Background Report Reference

AP-42 Section Number: 12.20

Background Chapter: 4

Reference Number: 65

Title: Report of Air Pollution Source Testing at Douglas Aircraft Company Tank No. 195 and Tank No. 245

Engineering Science

June 1989

Enclosure 4
Reference 4

ELECTROPLATING
REF. 4-65

Used teflon line supported by metal rod
0.02 N $NaHCO_3$ - Trem drawing gives 0.1 N
Used fiberglass filter - does fiberglass need to be
blank corrected. - Tank 195 has Right inlet Acton
outlet. Table 3, tank 195

No tank or rinse H_2O sample mg
~~Tank sample~~ Sample blank was < .003 for
hex chrome and < .02 mg for total chrome. The
blank appears to be below detection limit. Tank 195
Outlet was the same as blank. Do not use
tank 195 data & do not use hex chrome number.
No indication of rinse length - points wrong
location

Tank 245 had enough Cr^{+6} & Cr^{T} to use with ≠
Tank 195 is below detection limit

Hex chrom as a % of total chromium ranged from a
low of 15.2 % to a high of 86.1 %

No

ENCLOSURE 4
REFERENCE D

WAO99.01

REPORT OF AIR POLLUTION SOURCE TESTING AT DOUGLAS AIRCRAFT COMPANY TANK NO. 195 AND TANK NO. 245

Prepared for:

DOUGLAS AIRCRAFT COMPANY
19503 S. NORMANDIE AVE.
TORRANCE, CALIFORNIA 90502

Submitted on:

June 28, 1989

Prepared by:

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Pasadena, California 91109

SUMMARY INFORMATION
REPORT OF AIR POLLUTION SOURCE TESTING
AT DOUGLAS AIRCRAFT COMPANY

Source Owner:	Douglas Aircraft Company 19503 S. Normandie Ave. Torrance, CA. 90502
Source Location:	Douglas Aircraft Company 19503 S. Normandie Ave. Torrance, CA 90502
Contact:	Mr. Jerry Topp Douglas Aircraft Company Telephone: 213-533-6755
Source Description:	Tank 195 and Tank 245 Scrubber Inlet and Outlet
Source Testing Contractor:	Engineering-Science, Inc. 75 N. Fair Oaks Ave. Pasadena, CA 91103
Contact:	Mr. Bryan Lee Telephone: 818-440-6040or Mr. Larry Cottone Telephone: 818-440-6030

REPORT OF AIR POLLUTION SOURCE TESTING AT THE DOUGLAS AIRCRAFT COMPANY TORRANCE, CALIFORNIA

INTRODUCTION

Engineering-Science (ES), Pasadena, California, conducted air pollution Source testing on scrubbers serving for chromium emissions control at tank 195 (anodizing tank), and tank 245 (chrome plating tank) operated by Douglas Aircraft Company (DAC), Torrance, California. The tests were conducted on April 12 and 13. The purpose of the testing was to determine chromium emissions from the two tanks and the chromium removal efficiency of the scrubber in accordance with SCAQMD Rule 1169. The tests were conducted simultaneously at inlet and outlet of the scrubber for the determination of the scrubber efficiency.

The compliance conditions require that measurements must be made to determine the emission rates of total chromium, and hexavalent chromium in mg/hr and mg/ampere.hr. The location of the sampling ports were in accordance with SCAQMD Reference Method 1 and SCAQMD Rule 217, where feasible. The testing program was coordinated by Mr. Jerry Topp of DAC. The ES testing team was comprised of Mssrs. Bryan Lee (Team Leader), Alex Pasimio, and Greg Burke.

TEST METHODOLOGY

Exhaust Gas velocity, Moisture Determination and Molecular Weight

Stack gas flow rates were determined using SCAQMD Reference Methods 1.1, 2.1 and 3.1. An S-Type pitot tube and an inclined oil manometer were used for the velocity measurements, and a type-K thermocouple (chromel-alumel) connected to an Omega model 601 digital temperature readout were used for determining the stack temperature. Carbon dioxide (CO_2) and oxygen (O_2) were estimated same as ambient air. Moisture content of the stack gases was determined gravimetrically by the weight gain in the impingers and the silica gel of the chromium impinger train. This procedure is in accordance with SCAQMD Method 4.1.

TOTAL CHROMIUM AND HEXAVALENT CHROMIUM

The samples for total chromium and hexavalent chromium were collected in accordance with modified SCAQMD Method 5.1. During the testing the chromium sampling probe was traversed in accordance with SCAQMD Method 3.1 as shown in Figure 1 (Tank 195), and Figure 2 (Tank 245). The sample train was comprised of one continuous line composed of 0.25" ID teflon tubing liner connected to a wet impingement train followed by a vacuum pump and dry gas meter. The portion of the teflon line in the stack was supported by stainless steel probe and nozzle. The wet impingement train ~~was~~ consisted of four impingers connected in series with ground glass leak-free fittings. The first two impingers were charged with 100 ml of 0.02 N $NaHCO_3$ (sodium bicarbonate). The third impinger was left empty, and the fourth contained weighted indicating silica gel to collect moisture. The filter was located between the third and fourth impingers. The filter was protected by the filter holder constructed of borosilicate glass with a glass frit. Teflon filters with a 0.30 micron pore size was used. The schematic diagram of the sampling system is presented in Figure 3.

The collected samples for the total chromium and hexavalent chromium were sent to Thermo Analytical, Inc., Monrovia, California for the analysis. Hexavalent chromium was determined on samples extracted in an alkaline solution, and analyzed by colormetric method. Total chromium was determined on samples that was extracted to convert all organic forms of chromium to inorganic forms. The samples were digested in an acidic solution and analyzed by Atomic Absorption.

QUALITY ASSURANCE

Field Testing Quality Assurance

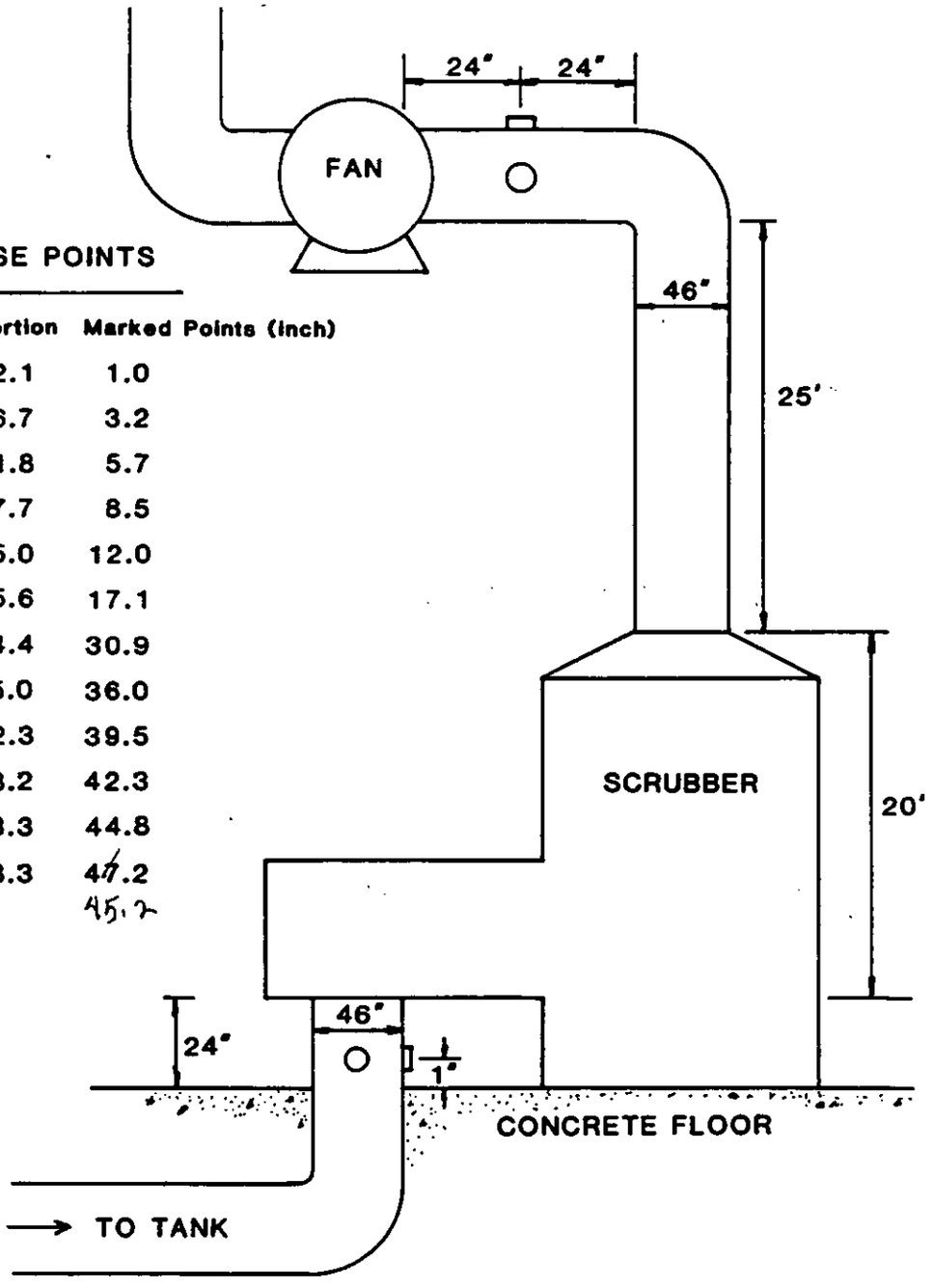
Prior to and at the conclusion of the field sampling, the meter box, dry gas meter, and orifice were calibrated against a wet test meter. The results of the orifice calibration are expressed as the H@, which is the pressure drop (in inches of water) at various flow rates through the dry gas meter as specified in EPA publication APTD-0576. The dry gas meter accuracy is expressed as gamma (Y) and was determined as the ratio of the sampling train dry gas meter volume to the wet test meter volume. One pretest and three post-test field checks for the Y factor were performed to verify meter accuracy. In all cases, the field testing equipment was within the acceptable range.

FIGURE 2

SAMPLING TRAVERSE POINTS AT TANK 245

DOGLAS AIRCRAFT COMPANY

Torrance, California



TRAVERSE POINTS

Points	%Portion	Marked Points (inch)
1	2.1	1.0
2	6.7	3.2
3	11.8	5.7
4	17.7	8.5
5	25.0	12.0
6	35.6	17.1
7	64.4	30.9
8	75.0	36.0
9	82.3	39.5
10	88.2	42.3
11	93.3	44.8
12	98.3	47.2 45.2

XROM "METH 1"

DIA INCHES?
46.000000 RUN
NIPPLE INCH ?
RUN
POINTS ONE TRV?
12.000000 RUN
POINT 1. 1.0
POINT 2. 3.1
POINT 3. 5.4
POINT 4. 8.2
POINT 5. 11.5
POINT 6. 16.4
POINT 7. 29.6
POINT 8. 34.5
POINT 9. 37.8
POINT 10. 40.6
POINT 11. 42.9
POINT 12. 45.0

SAMPLING TRAVERSE POINTS AT TANK 195

DOGLAS AIRCRAFT COMPANY
Torrance, California

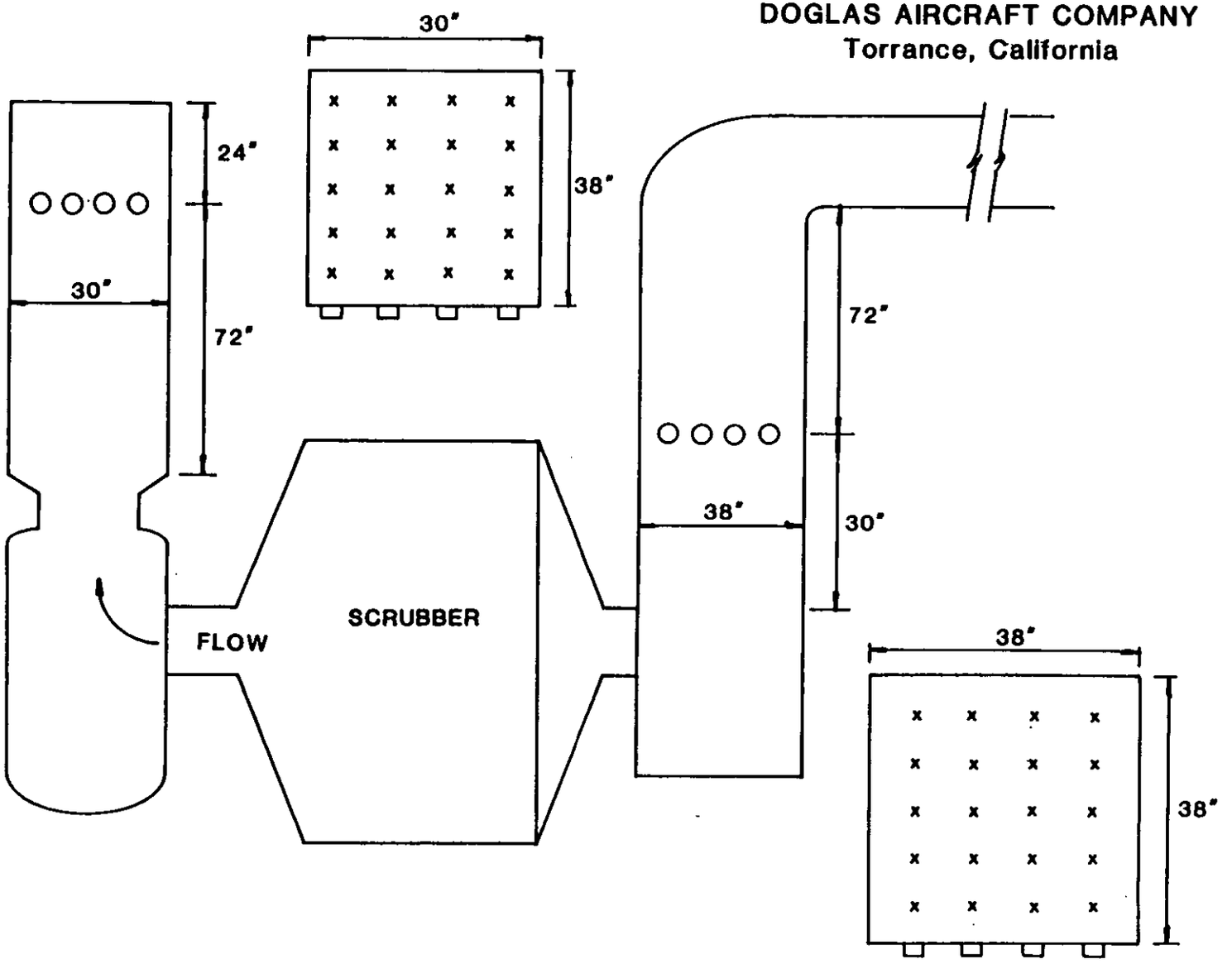
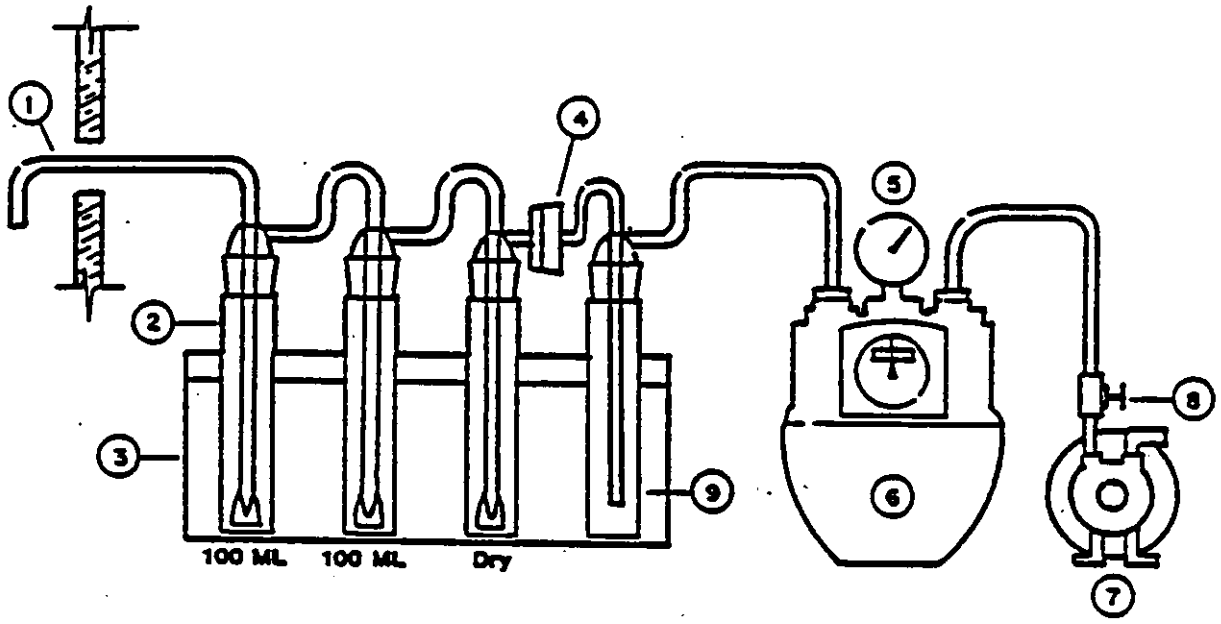


FIGURE 1

ENGINEERING-SCIENCE

WET IMPINGEMENT SAMPLING TRAIN FOR CHROMIUM



1. Sampling Probe
2. Impinger (Dust Concentration Sampler)
3. Ice Bath Container
4. Dry Filter Teflon backed by glass fiber
5. Vacuum Gage (0–25 in. Hg)
6. Dry Gas Meter (temperature–compensated)
7. Vacuum Pump
8. Valve to Control Gas Flow Rate
9. 400g Silica Gel

Impinger Solutions: 0.1N sodium hydroxide

Exhaust gas, filter,dry gas meter, and impinger temperatures were monitored using a type-K thermocouple connected to an Omega Model 601 digital readout. The temperature measuring equipment was calibrated with an NBS traceable mercury in glass thermometer.

Stack velocity was determined using an S-type pitot tube attached to the probe as specified in EPA Reference Method 2. The pitot tube was measured for adherence to the dimensions as specified in Reference Method 2. A pitot tube correction factor of 0.84 was used for determining volumetric flow through the exhaust gas stack.

At the conclusion of each test run the sampling train was leak checked at a vacuum equal to the highest vacuum observed during the test runs. The sampling train was considered to be leak free with a leak rate less than 0.02 CFM.

Laboratory Quality Assurance

The filter drydown weights were obtained using a Sar-torius Model 2003 digital analytical balance. Prior to conducting any weighings the accuracy of the balance was verified with a 100 gram Class S weight. All weighings were conducted in an environmentally controlled balance room maintained at 70 degrees F with a relative humidity of $\leq$50%. All dry down and filter samples were conditioned and desiccated before weighing and a constant weight was defined as $\pm$0.5 mg between consecutive weighings with an elapsed time between weighings greater than 6 hours. All weight data were recorded in a permanently bound notebook maintained in the balance room. The filters used for the sampling trains were fiberglass and manufactured by Schleicher & Schuell, Catalog #30, and were EPA approved filters for particulate source sampling.

All reagents for charging the sampling train and sample recovery were ACS reagent grade materials.

Sample Custody

A specific Chain-of-Custody procedure was used for this project. The elements of this procedure include:

- o Train component identification
- o Sample identification
- o Sample labels
- o Documentation
- o Chain of custody forms

The sequence of activities concerned with sample custody together with identification and tracking procedures are described below:

1. Sample train preparation by laboratory including filter holders, impingers, and other sampling equipment identified by tags and codes.

2. Sample train issued to test team and master log filled out. Sample I.D. number stickers issued according to test identification code

3. Train returned to recovery area when a valid sample is obtained. Sample train accompanied by all field data sheets.

4. Recovery team recovers samples using appropriate containers, affixes sample I.D. labels to sample containers, to master log, to field data sheet, and to train recovery sheet.

5. All samples returned to ES Pasadena laboratory with Chain-of-Custody form.

6. Samples transferred or shipped to appropriate laboratory with Chain-of-Custody form

7. Samples examined at each transfer point for integrity (broken containers, loss in liquid, or seal integrity).

Upon completing the required analysis, the analyst returns the Chain-of Custody form along with results to the ES project manager. All samples are accounted for by the ES laboratory supervisor and Project Manager. Each laboratory identifies samples in its own laboratory notebooks by the ES I.D. number as well as any internal identification. Notebooks are retained by each laboratory according to usual laboratory practices.

RESULTS

The results of the testing program are summarized in Tables 1 through 3. Additional supporting data are located in the Appendix.

Table 1 summarizes the flow data from the inlet and the outlet of all tested scrubbers. Table 2 shows the ampere-hr rate for the process.

Table 3 summarizes the chromium emissions from the tank 195 and tank 245, and Table 4 shows the scrubber removal efficiency at each tank.

TABLE 1

SUMMARY OF SCRUBBER EXHAUST FLOW DATA
AT TANK NO. 195 AND TANK NO. 245

Douglas Aircraft Company
Torrance, California

April 12 and 13, 1989

Parameters	Tank 195		Tank 245	
	Inlet	Outlet	Inlet	Outlet
Stack Temp (deg F)	72	68	69	65
Stack Diameter (in)	36"x38"	38"x30"	46	46
Moisture (%)	1.5	1.8	1.5	2.0
Molecular Wt.	28.8	28.8	28.8	28.8
Velocity (ft/sec)	39.2	43.4	37.8	39.2
Flow				
ACFM	22,327	20,614	26,165	27,168
DSCFM	21,174	19,886	25,018	25,641

TABLE 2

SUMMARY OF PROCESS DATA
TANK 195 AND TANK 245

Douglas Aircraft Company
Torrance, California

April 12 and 13, 1989

Parameter	Test Date	Start Time	End Time	Net Run Time	Average Process Loading Rate (Amp-hr)
Tank 195					
Inlet	4/12/89	1124	1431	180	700
Outlet	4/12/89	1122	1430	180	700
Tank 245					
Inlet	4/13/89	0930	1246	180	1,000
Outlet	4/13/89	0932	1248	180	1,000

SUMMARY OF EMISSIONS

PLANT Douglas Aircraft Company LOCATION Torrance, Calif.

SAMPLED SOURCE Tank 245 only

RUN	DATE	(1) V_m Std.	(2) DSCFM	FRONT HALF MILLIGRAMS PROBE	CYCLONE	FILTER	Hex (3) ~~TOTAL~~	Total (4) ~~BACK HALF~~	5 FRONT + BACK TOTAL
IN Tank 245	13 Apr 89	146,743	25018				399	491.72	
OUT Tank 245	13 Apr 89	135,309	25641				.0864	.1008	

Hex Total CONCENTRATIONS

RUN	FRONT HALF Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	~~BACK HALF~~ Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr	TOTAL Gr/DSCF	Mg/M³	Lb/Hr	Kg/Hr
IN T245	96.0202	~~.0226~~	8.9980			118.3334	11.0890					
OUT T245	.02255	~~.0261~~	.002166			.00253	.02631					
	6	7	8	9	10	17	18	19	20	21	22	23

Remarks: Tank 245 Only

SAMPLING SUMMARY SHEET

PLANT _____ LOCATION _____

SAMPLED SOURCE _____

Run	Date	N_p	(3) Y_m	(4) ΔH	(5) P Bar.	(6) V_m	(7) T_m	(8) V_m Std.	(9) %	(10) P_{st}	17 P_s	(18) T_s	(19) VP	(20) V_w	21 $V_{w_{gas}}$	22 %M	23 M_d

Run	(24) CO_2	(25) O_2	26 N_2	(27) CO	(28) —	29 MW_d	30 MW	(31) C_p	(32) $\sqrt{\Delta P_s (T_s + 460)}$	(33) T_t	(34) D_n	35 V_s	(36) D_s	(37) Area	38 ACFM	(39) DSCFM	40 %I

$$V_{m\ Std.} = Y_m \frac{17.64 \times V_m \left(P\ Bar. + \frac{\Delta H}{13.6}\right)}{(T_m + 460)}$$

$$V_{w_{gas}} = 0.0471\ V_w$$

$$MW_d = \%CO_2 \times .44 + (\%O_2 \times .32) + (\%CO + \%N_2) \times .28 + \left(\%Other \times \frac{Mol.\ wt.}{100}\right)$$

$$MW = MW_d \times M_d + 18(1 - M_d)$$

$$V_s = 85.49 \times C_p \sqrt{\Delta P_s (T_s + 460)} \left[\frac{1}{P_s \times MW}\right]^{1/2}$$

$$\%I = \frac{0.09450 \times (T_s + 460) \times V_{m\ Std.}}{V_s \times T_t \times P_s \times M_d \times A_n}$$

$$\%M = \frac{100 \times V_{w_{gas}}}{V_{m\ Std.} + V_{w_{gas}}}$$

$$M_d = \frac{100 - \%M}{100}$$

$$P_s = P\ Bar. \pm \frac{P_{st}}{13.6}$$

N_p = Total No. of Sampling points

Y_m = Meter Box Correction Factor

ΔH = Average Orfice Pressure Drop, inches H_2O

P Bar. = Barometric Pressure, Inches Hg, Absolute

V_m = Volume of Dry Gas at Meter Conditions, DCF

T_m = Average Meter Temperature, °F.

$V_{m\ Std.}$ = Volume of Dry Gas at STP, DSCF[a]

% = Per Cent other gas removed before Dry Gas Meter

P_{st} = Static Pressure of Stack Gas, inches H_2O

P_s = Stack Gas Pressure, inches Hg.

T_s = Average Stack Temperature, °F

VP = Vapor Pressure of H_2O At Stack Temperature

V_w = Total H_2O Collected in Impingers and Silica Gel

$V_{w_{gas}}$ = Volume of water vapor collected at STP, SCF[b]

%M = Per Cent Moisture by volume

M_d = Mole Fraction of Dry Gas

$\%CO_2$ = Volume % Dry

$\%O_2$ = Volume % Dry

$\%N_2$ = Volume % Dry

%CO = Volume % Dry

MW_d = Molecular Weight of Stack Gas Dry Basis

MW = Molecular Weight of Stack Gas, Wet Basis

C_p = Pitot Tube Coefficient

$\sqrt{\Delta P (T_s + 460)}$ Is determined by averaging the square root of the product of the velocity head (P) and the absolute stack temperature from each sampling point.

T_t = Net time of test in minutes

D_n = Sampling Nozzle Diameter, inches

A_n = Area of Nozzle opening, ft^2.

V_s = Stack Gas Velocity at Stack Conditions, Feet per second.

D_s = Diameter of Stack, inches

Area = Area of duct in ft^2

ACFM = Actual Cubic Feet per minute

DSCFM = Dry Standard Cubic Feet per minute

%I = Per Cent Isokinetic

[a] Dry Standard Cubic Feet @ 68°F, 29.92 in. Hg.

[b] Standard Conditions @ 68°F. 29.92 in. Hg.

TABLE 3

SUMMARY OF TOTAL AND HEXAVALENT CHROMIUM EMISSIONS DATA FROM TANK 195 AND 245

Douglas Aircraft Company
Torrance, California

April 12 and 13, 1989

Parameters	Tank 195 Inlet	Tank 195 Outlet	Tank 245 Inlet	Tank 245 Outlet
Hexavalent chromium				
mg/hr	2,286	<17	3,864,647	1,038
mg/amp.hr	3.26	<0.024	3,864	1.0
Total chromium				
mg/hr	4,282	<112	4,766,198	1,206
mg/amp.hr	6.1	<0.16	4,766	1.2
	53.4% HEX	15.2% HEX	81.1% HEX	86.1% HEX

ABS
SES
FIX 6
XROM "MASSFLO-

RUN NUMBER Tank 245 Inlet RUN

VOL MTR STD ?
146.743000 RUN
STACK DSCFM ?
25,018.000000 RUN
FRONT 1/2 MG ?
399.0000000 RUN
BACK 1/2 MG ?
1.0000000 CLX
491.7200000 RUN

F GR/DSCF = 0.041960
F MG/MMM = 96.020153
F LB/HR = 8.999006
F KG/HR = 4.081496

B GR/DSCF = 0.051711
B MG/MMM = 118.333413
B LB/HR = 11.088972
B KG/HR = 5.029952

TABLE 4

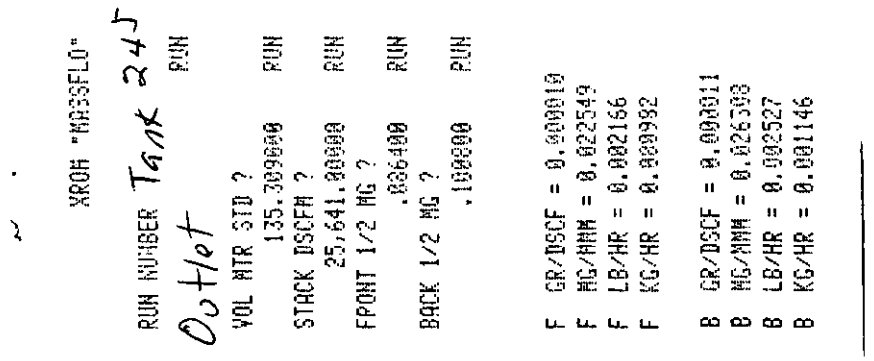
SUMMARY OF SCRUBBER REMOVAL EFFICIENCY OF TOTAL AND HEXAVALENT CHROMIUM EMISSIONS

TANK NO.195 AND TANK NO.245

Douglas Aircraft Conmpany
Torrance, Califonia

April 12 and 13, 1989

Parameter	Tank 195	Tank 245
Hexavalent Chromium (%)	99.3	99.9
Total Chromium(%)	97.4	99.9



APPENDIX

APPENDIX A

COMPUTER PRINTOUT FOR DETAIL DATA

Engineering-Science, Pasadena, California

Plant: DOUGLAS AIRCRAFT COMPANY
Source: TANK 195 SCRUBBER INLET
Date: 4-12-89
Run: 1
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK LENGTH (inches)	36.00
STACK WIDTH (inches)	38.00
STACK CROSS-SECTIONAL AREA (sq feet)	9.50
BAROMETRIC PRESSURE (inches Hg)	29.62
OXYGEN CONTENT (%)	20.9
CARBON DIOXIDE CONTENT (%)	0.0
MOISTURE CONTENT (%)	1.5
STACK TEMPERATURE (deg F)	72
STACK STATIC PRESSURE (inches water)	-2.10
DRY STACK GAS MOLECULAR WEIGHT	28.84
VELOCITY PRESSURE (sq rt inches water)	0.69
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	39.17
EXHAUST GAS FLOW RATE (ACFM)	22,327
EXHAUST GAS FLOW RATE (DSCFM)	21,174

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	139.989
DRY GAS VOLUME SAMPLED (DSCF)	124.443
DRY GAS METER TEMPERATURE (deg F)	101
DRY GAS METER GAMMA	0.97
AVERAGE ORIFICE PRESSURE (inches water)	1.71
TOTAL RUN TIME (min)	180
NOZZLE DIAMETER (inches)	0.250
ISOKINETIC (%)	91.0

LABORATORY DATA

MOISTURE RECOVERED (mls)	40.20
PARTIC. FROM NOZ., PROBE & WASHES (mg)	1.00
PARTICULATE FROM FILTER (mg)	1.00

PARTICULATE DATA

FRONT HALF	(gr/DSCF)	0.0002
	(gr/ACF)	0.0002
	(lb/hr)	0.05
TOTAL	(gr/DSCF)	0.0002
	(gr/ACF)	0.0002
	(lb/hr)	0.05

Engineering-Science, Pasadena, California

Plant: DOUGLAS AIRCRAFT COMPANY
Source: TANK 195 SCRUBBER OUTLET
Date: 4-12-89
Run: 1
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK LENGTH (inches)	38.00
STACK WIDTH (inches)	30.00
STACK CROSS-SECTIONAL AREA (sq feet)	7.92
BAROMETRIC PRESSURE (inches Hg)	29.62
OXYGEN CONTENT (%)	20.9
CARBON DIOXIDE CONTENT (%)	0.0
MOISTURE CONTENT (%)	1.8
STACK TEMPERATURE (deg F)	68
STACK STATIC PRESSURE (inches water)	3.20
DRY STACK GAS MOLECULAR WEIGHT	28.84
VELOCITY PRESSURE (sq rt inches water)	0.77
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	43.40
EXHAUST GAS FLOW RATE (ACFM)	20,614
EXHAUST GAS FLOW RATE (DSCFM)	19,886

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	152.002
DRY GAS VOLUME SAMPLED (DSCF)	153.390
DRY GAS METER TEMPERATURE (deg F)	99
DRY GAS METER GAMMA	1.09
AVERAGE ORIFICE PRESSURE (inches water)	2.29
TOTAL RUN TIME (min)	180
NOZZLE DIAMETER (inches)	0.250
ISOKINETIC (%)	99.5

LABORATORY DATA

MOISTURE RECOVERED (mls)	60.40
PARTIC. FROM NOZ., PROBE & WASHES (mg)	1.00
PARTICULATE FROM FILTER (mg)	1.00

PARTICULATE DATA

FRONT HALF	(gr/DSCF)	0.0002
	(gr/ACF)	0.0002
	(lb/hr)	0.03
TOTAL	(gr/DSCF)	0.0002
	(gr/ACF)	0.0002
	(lb/hr)	0.03

Engineering-Science, Pasadena, California

Plant: DOGLAS AIRCRAFT COMPANY
Source: TANK 244/245 INLET
Date: 4-13-89
Run: 1
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	46.00
STACK CROSS-SECTIONAL AREA (sq feet)	11.54
BAROMETRIC PRESSURE (inches Hg)	29.47
OXYGEN CONTENT (%)	20.9
CARBON DIOXIDE CONTENT (%)	0.0
MOISTURE CONTENT (%)	1.5
STACK TEMPERATURE (deg F)	69
STACK STATIC PRESSURE (inches water)	1.10
DRY STACK GAS MOLECULAR WEIGHT	28.84
VELOCITY PRESSURE (sq rt inches water)	0.67
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	37.79
EXHAUST GAS FLOW RATE (ACFM)	26,165
EXHAUST GAS FLOW RATE (DSCFM)	25,018

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	146.306
DRY GAS VOLUME SAMPLED (DSCF)	146.743 ✓
DRY GAS METER TEMPERATURE (deg F)	89
DRY GAS METER GAMMA	1.07
AVERAGE ORIFICE PRESSURE (inches water)	1.76
TOTAL RUN TIME (min)	180
NOZZLE DIAMETER (inches)	0.252
ISOKINETIC (%)	108.6

LABORATORY DATA

MOISTURE RECOVERED (mls)	48.50
PARTIC. FROM NOZ., PROBE & WASHES (mg)	1.00
PARTICULATE FROM FILTER (mg)	1.00

PARTICULATE DATA

FRONT HALF	(gr/DSCF)	0.0002
	(gr/ACF)	0.0002
	(lb/hr)	0.05
TOTAL	(gr/DSCF)	0.0002
	(gr/ACF)	0.0002
	(lb/hr)	0.05

Engineering-Science, Pasadena, California

Plant: DOUGLAS AIRCRAFT COMPANY
Source: TANK 244/245 SCRUBBER OUTLET
Date: 4-13-89
Run: 1
Standard Temp = 60 deg F Standard Press = 29.92 in Hg

FLOW DATA

STACK DIAMETER (inches)	46.00
STACK CROSS-SECTIONAL AREA (sq feet)	11.54
BAROMETRIC PRESSURE (inches Hg)	29.47
OXYGEN CONTENT (%)	20.9
CARBON DIOXIDE CONTENT (%)	0.0
MOISTURE CONTENT (%)	2.0
STACK TEMPERATURE (deg F)	65
STACK STATIC PRESSURE (inches water)	-5.00
DRY STACK GAS MOLECULAR WEIGHT	28.84
VELOCITY PRESSURE (sq rt inches water)	0.69
PITOT TUBE CORRECTION FACTOR	0.84
VELOCITY (ft per sec)	39.24
EXHAUST GAS FLOW RATE (ACFM)	27,168
EXHAUST GAS FLOW RATE (DSCFM)	25,641

SAMPLING DATA

DRY GAS VOLUME SAMPLED (DCF)	149.594
DRY GAS VOLUME SAMPLED (DSCF)	135.309
DRY GAS METER TEMPERATURE (deg F)	89
DRY GAS METER GAMMA	0.97
AVERAGE ORIFICE PRESSURE (inches water)	1.73
TOTAL RUN TIME (min)	180
NOZZLE DIAMETER (inches)	0.250
ISOKINETIC (%)	99.3

LABORATORY DATA

MOISTURE RECOVERED (mls)	60.50
PARTIC. FROM NOZ., PROBE & WASHES (mg)	1.00
PARTICULATE FROM FILTER (mg)	1.00

PARTICULATE DATA

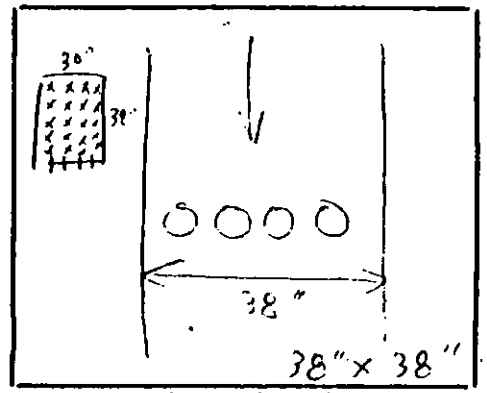
FRONT HALF	(gr/DSCF)	0.0002
	(gr/ACF)	0.0002
	(lb/hr)	0.05
TOTAL	(gr/DSCF)	0.0002
	(gr/ACF)	0.0002
	(lb/hr)	0.05

APPENDIX B

FIELD DATA

FIELD DATA

Plant DAC Torrance
Date 4-12-89
Sampling Location Tank #175 Inlet
Sample Type Chrome
Run Number #1
Operator BL / AP
Ambient Temperature 70° F
Barometric Pressure 29.62
Static Pressure (P_s) +2.1
Filter Number(s)
Pretest Leak Rate = 0.0 cfm @ 15 in. Hg
Pretest Pitot Leak Check
Pretest Orsat Leak Check
Read and Record all Data Every ___ Minutes



Schematic of Traverse Point Layout

Probe Length and Type 6'
Pitot Tube I.D. No.
Nozzle I.D. 1/4"
Assumed Moisture, % 6
Temp. Readout S/N
Meter Box Number RED #2 (#79)
Meter $\Delta H_@$ 1.63
C Factor 0.84
Meter Gamma 0.965
Heater Box Setting
Reference Δp N/A
Post Test Leak Rate = ___ cfm @ ___ in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

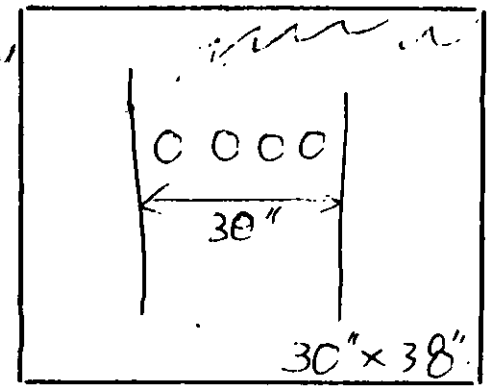
K = 3.57 180 Mins / 9 mins points

Traverse Point Number	Sampling / Clock Time, (min) / (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
1	1124	266.541	0.61	2.18	2.2	72	81		1	NA	66
2	1133	276.51	0.65	2.32	2.3	72	94		1		66
3	1142	282.38	0.57	2.03	2.0	70	99		1		66
4	1151	290.29	0.60	2.14	2.1	72	102		5		66
5	1200	297.96	0.49	1.75	1.8	72	103		4		66
	1209	305.534	Port	change							
1	1211	305.534	0.60	2.09	2.1	72	101		2		66
2	1220	313.15	0.58	2.07	2.1	72	104		4		66
3	1229	320.91	0.59	2.10	2.1	72	105		4		66
4	1238	328.39	0.56	1.99	2.0	71	105		4		67
5	1241	336.22	0.46	1.57	1.6	71	105		4		67
	1256	343.235	Port	change							
1	1258	343.238	0.50	1.78	1.8	70	102		4		67
2	1307	351.12	0.37	1.32	1.3	71	104		3		67
3	1316	357.34	0.35	1.24	1.2	72	103		3		67
4	1325	364.12	0.40	1.43	1.4	73	103		3		67
5	1334	369.68	0.42	1.49	1.5	72	103		2		67
	1343	376.370	Port	change							
1	1346	376.370	0.41	1.46	1.5	72	100		3		67
2	1355	383.12	0.28	0.99	1.0	73	103		3		67
3	1404	389.11									
4	1413	394.22	0.38	1.36	1.4	75	103		3		67
5	1422	400.45	0.31	1.10	1.1	74	103		2		67
	1431	406.530	End	Run							
	180 min	139.989	0.6815		1.71	72	101.2				

Moisture = 40.2

FIELD DATA

Plant MAC Douglas Terminal
Date 8-12-87
Sampling Location Tank #193 Southern Outlet
Sample Type Trace Metal Chrome
Run Number #1
Operator BI / AF
Ambient Temperature 90
Barometric Pressure 29.62
Static Pressure (P_s) +3.2
Filter Number(s)
Pretest Leak Rate = 0 cfm @ 15 in. Hg
Pretest Pitot Leak Check
Pretest Orsat Leak Check
Read and Record all Data Every 9 Minutes



Schematic of Traverse Point Layout

Probe Length and Type 7'
Pitot Tube I.D. No. 0.84
Nozzle I.D. 1/4"
Assumed Moisture, % 5
Temp. Readout S/N
Meter Box Number RED #1 (#26)
Meter $\Delta H_@$ 1.72 / 1.09
C Factor 0.84
Meter Gamma 1.09
Heater Box Setting NA
Reference Δp
Post Test Leak Rate = ___ cfm @ ___ in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

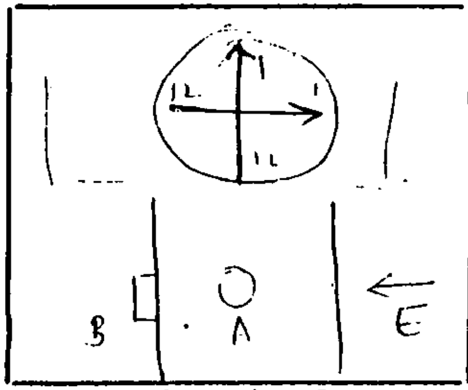
K = 3.17. 180 mins / 9 mins port.

Traverse Point Number	Sampling Time, (min) / Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
1	/ 1122	479.035	0.6	2.26	2.3	69	96		2	NA	66
2	/ 1131	486.89	0.71	2.68	2.7	69	90		5		66
3	/ 1140	495.24	0.78	2.94	2.9	68	98		6		66
4	/ 1149	504.08	0.80	3.01	3.0	69	100		6		66
5	/ 1158	512.77	0.78	2.94	2.9	68	101		6		66
	/ 1207	461.45	Port	change			F				
1	/ 1209	461.47	0.45	1.69	1.7	68	110		6		66
2	/ 1218	468.31	0.38	1.44	1.4	68	100		4		66
3	/ 1227	476.42	0.46	1.72	1.7	68	100		4		66
4	/ 1236	480.56	0.53	2.07	2.1	68	100		5		66
5	/ 1245	488.31	0.98	3.69	3.7	68	100		7		69
	/ 1254	497.671	Port	change							
1	/ 1256	497.671	0.35	1.32	1.3	68	106		4		67
2	/ 1305	503.73	0.56	1.88	1.9	68	105		4		67
3	/ 1314	510.88	0.46	1.73	1.7	68	101		5		67
4	/ 1323	518.71	0.68	2.79	2.2	68	102		5		67
5	/ 1332	525.52	0.95	3.58	3.6	68	102		7		68
	/ 1341	535.230	Port	change							
1	/ 1345	535.230	0.21	0.79	0.77	68	100		3		68
2	/ 1354	542.23	0.63	2.38	2.4	68	100		5		68
3	/ 1403	547.22	0.62	2.31	2.3	68	100		4		68
4	/ 1412	554.62	0.64	2.41	2.4	68	102		6		68
5	/ 1421	560.12	0.73	2.75	2.8	68	102		6		66
	/ 1430	571.037	End	Run							
	180 mins.	152.	0.769.		2.29	68.2.	99.2.				

Moisture = 60.1

FIELD DATA

Plant: DAC Torrance
Date: 4-13-81
Sampling Location: Tank 24V 1 243 Inlet
Sample Type: Chrome
Run Number: #1
Operator: RL/DP
Ambient Temperature: 70 F
Barometric Pressure: 29.47
Static Pressure (P_s):
Filter Number(s): 1.1
Pretest Leak Rate = .06 cfm @ 15 in. Hg
Pretest Pitot Leak Check
Pretest Orsat Leak Check
Read and Record all Data Every ___ Minutes



Schematic of Traverse Point Layout

Probe Length and Type: 6'
Pitot Tube I.D. No.:
Nozzle I.D.: 1/4"
Assumed Moisture, %: 5
Temp. Readout S/N
Meter Box Number: RDA#1 (#76)
Meter $\Delta H_@$: 1.72
C Factor: 0.84
Meter Gamma: 1.09
Heater Box Setting: N/A
Reference Δp
Post Test Leak Rate = ___ cfm @ ___ in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

$K = 845.8\ \Delta H\ C_p^2\ (1-B_{wo})^2\ D_n^4\ \frac{T_m}{T_s} = 3.77$ Run = ~~180 mins / 7.5 mins~~ 192 min / 8 mins

Traverse Point Number	Sampling Time, (min)	/Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
(A) 1		0930	571.374	0.82	3.09	3.1	70	72		18	N/A	
2		0938	578.97	0.92	3.47	3.3	69	84		18		
3		0946	586.72	0.87	3.23	3.2	69	92		18		
4		0954	593.82	0.82	3.09	3.1	69	91		16		
5		1002	601.92	0.52	1.96	2.0	69	92		11		
6		1010	609.27	0.55	2.07	2.1	69	92		11		
7		1018	615.12	0.39	1.47	1.5	69	92		10		
8		1026	622.32	0.36	1.36	1.4	69	93		8		
9		1034	629.29	0.29	1.09	1.1	68	92		8		
10		1042	633.96	0.29	1.09	1.1	68	92		7		
11		1050	637.58	0.25	0.89	0.9	68	92		7		
12		1058	640.31	0.25	0.89	0.9	69	91		7		
		1106	647.700	End	Run							
(B) 1		1110	647.700	0.31	1.16	1.2	69	88		6		
2		1118	652.71	0.32	1.3	1.3	68	88		5		
3		1126	658.21	0.31	1.16	1.2	68	86		6		
4		1134	663.01	0.31	1.16	1.2	69	88		6		
5		1142	667.21	0.21	0.79	0.8	68	88		6		
6		1150	673.55	0.25	0.89	0.9	69	88		6		
7		1158	677.85	0.52	1.96	2.0	69	86		6		
8		1206	684.41	0.57	2.13	2.2	69	89		14		
9		1214	691.51	0.52	1.96	2.0	69	89		12		
10		1222	698.49	0.48	1.81	1.8	69	90		11		
11		1230	705.03	0.51	1.92	1.9	69	90		12		

Moisture = 48.5

FIELD DATA

Plant DAC [illegible]
Date 4-13-89
Sampling Location [illegible]
Sample Type
Run Number
Operator
Ambient Temperature [illegible]
Barometric Pressure
Static Pressure (P_s)
Filter Number(s)
Pretest Leak Rate = ___ cfm @ ___ in. Hg
Pretest Pitot Leak Check
Pretest Orsat Leak Check
Read and Record all Data Every ___ Minutes

Schematic of Traverse Point Layout

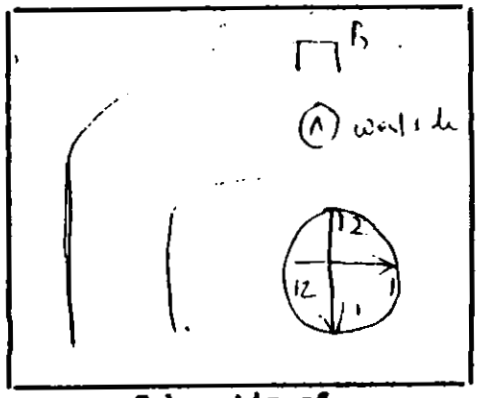
Probe Length and Type
Pitot Tube I.D. No.
Nozzle I.D.
Assumed Moisture, %
Temp. Readout S/N
Meter Box Number
Meter $\Delta H_@$
C Factor
Meter Gamma
Heater Box Setting
Reference Δp
Post Test Leak Rate = ___ cfm @ ___ in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft^3	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
12		1238	711.25	0.52	1.96	2.0		90		14	NA	
		1246	717.680	End	Run							
		180 mins	846.306	0.666		1.96	69	88.8				

1 of 2

FIELD DATA

Plant DAC Torrance
Date 4-13-99
Sampling Location Tank 344/345 outlet
Sample Type Chrome
Run Number #1
Operator BL / AF
Ambient Temperature 70's
Barometric Pressure 27.47
Static Pressure (P_s) >-5
Filter Number(s)
Pretest Leak Rate = 0.0 cfm @ 15 in. Hg
Pretest Pitot Leak Check
Pretest Orsat Leak Check
Read and Record all Data Every ___ Minutes



Schematic of Traverse Point Layout

Probe Length and Type 6'
Pitot Tube I.D. No.
Nozzle I.D. 1/4"
Assumed Moisture, % 5
Temp. Readout S/N
Meter Box Number RED #2 (#79)
Meter $\Delta H_@$ 1.63
C Factor 0.84
Meter Gamma 0.965
Heater Box Setting N/A
Reference Δp
Post Test Leak Rate = ___ cfm @ ___ in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

Stack Dia = 46" | K = 3.57 Run = ~~180 mins~~ / 7.5 mins. 192 min / 8 mins

Traverse Point Number	Sampling Time, (min)	Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
A 1	/	0932	401.721	0.45	1.6	1.6	65	77		2	NA	
2	/	0940	411.28	0.45	1.6	1.6	65	82		2		
3	/	0948	420.23	0.45	1.6	1.6	67	87		2		
4	/	0956	426.03	0.49	1.75	1.8	64	87		2		
5	/	1004	432.24	0.51	1.82	1.8	65	90		2		
6	/	1012	440.31	0.54	1.93	1.9	64	90		2		
7	/	1020	446.52	0.53	1.89	1.9	65	91		2		
8	/	1028	453.54	0.48	1.81	1.8	65	91		2		
9	/	1036	459.25	0.48	1.8	1.8	65	93		2		
10	/	1044	466.41	0.44	1.57	1.6	65	93		2		
11	/	1052	472.2	0.26	0.93	0.93	65	93		2		
12	/	1100	477.92	0.76	2.78	2.8	63	91		2		
	/	1108	483.252	End	Run							
1	/	1112	483.452	0.75	2.67	2.7	64	80		2		
2	/	1120	490.33	0.28	0.99	1.0	65	92		3		
3	/	1128	496.21	0.46	1.64	1.6	65	89		2		
4	/	1136	500.26	0.43	1.54	1.5	65	88		2		
5	/	1144	506.21	0.51	1.82	1.8	65	88		3		
6	/	1152	512.41	0.53	1.89	1.9	66	88		4		
7	/	1200	519.41	0.53	1.89	1.9	65	88		4		
8	/	1208	525.42	0.55	1.96	2.0	65	88		4		
9	/	1216	532.51	0.47	1.68	1.7	66	89		2		
10	/	1224	538.97	0.44	1.57	1.6	66	89		3		
11	/	1232	545.02	0.37	1.32	1.3	66	88		3		

Moisture = 60.5

...ELD ...A

Plant DAC Torrance
Date 4-13-89
Sampling Location Tank 3155/3161 outlet
Sample Type Chrome
Run Number
Operator
Ambient Temperature See P1
Barometric Pressure
Static Pressure (P_s)
Filter Number(s)
Pretest Leak Rate = ____ cfm @ ____ in. Hg
Pretest Pitot Leak Check
Pretest Orsat Leak Check
Read and Record all Data Every ____ Minutes

Schematic of Traverse Point Layout

Probe Length and Type
Pitot Tube I.D. No.
Nozzle I.D.
Assumed Moisture, %
Temp. Readout S/N
Meter Box Number
Meter $\Delta H_@$
C Factor
Meter Gamma
Heater Box Setting
Reference Δp
Post Test Leak Rate = ____ cfm @ ____ in. Hg
Post Test Pitot Leak Check
Post Test Orsat Leak Check

Traverse Point Number	Sampling Time, (min) / Clock Time (24-hour clock)	Gas Meter Reading (V_m) ft³	Velocity Head (ΔP_s) in. H_2O	Orifice Pres. Differential (ΔH) in. H_2O Desired	Orifice Pres. Differential (ΔH) in. H_2O Actual	Stack Temp. (T_s) °F	Dry Gas Meter Temp. Inlet ($T_{m_{in}}$) °F	Dry Gas Meter Temp. Outlet ($T_{m_{out}}$) °F	Pump Vacuum in. Hg	Sample Box Temp. Filter Temp. °F	Impinger Temp. °F
12	/ 1240	~~[illegible]~~	0.37	1.32	1.3	67	88		3	NA	
	/ 1248	557.315	Gnd Run								
	/										
	/ 180 min.	149.594	0.6882		1.73	65	88.79				
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APPENDIX C

ES LABORATORY DATA

ENGINEERING-SCIENCE, INC.

TRAIN RECOVERY SHEET

DATE 4-13-89 RUN# 1 METHOD 405.1

FACILITY DOUGLAS AIRCRAFT TORRANCE TANK 245 INLET TYPE CHROME HEXCHROME

TECHNICIAN R.M IMP. SOLUTION 0.02 N NAHCO3

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			
UMBILICAL RINSE			

		FINAL (g)	INITIAL(g)	NET(g)
IMPINGER # 1		635.8	616.3	19.5
IMPINGER # 2		633.5	633.5	0
IMPINGER # 3		519.5	519.3	0.2
IMPINGER #				
DESCRIPTION				
IMPINGER RINSE				

		FINAL (g)	INITIAL(g)	
SILICA GEL (DESCRIPTION)	2/3 USED	840.8	812.0	28.8
FILTER# (DESCRIPTION)		TOTAL MOISTURE		48.5 (g)

FIELD BLANKS

DISPOSITION/COMMENTS

VERY DIRTY SOURCE deep yellow color in SAMPLE (1st imp, probe WASH)

ENGINEERING-SCIENCE, INC.

TRAIN RECOVERY SHEET

DATE 4-13-89 RUN# 1 METHOD 405.1

FACILITY DOUGLAS AIRCRAFT TORRANCE TANK 245 OUTLET TYPE HEXCHROME/CHROME

TECHNICIAN R.M IMP. SOLUTION 0.02 N NAHCO3

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			
UMBILICAL RINSE			

		FINAL (g)	INITIAL (g)	NET (g)
IMPINGER # 1	BICARBONATE	583.1	563.3	19.8
IMPINGER # 2	BICARBONATE	570.1	567.4	2.7
IMPINGER # 3	MT	499.2	497.7	1.5
IMPINGER #				
DESCRIPTION				
IMPINGER RINSE				

		FINAL (g)	INITIAL (g)	
SILICA GEL (DESCRIPTION)	2/3 USED	868.3	831.8	36.5
FILTER# (DESCRIPTION)		TOTAL MOISTURE		60.5 (g)

FIELD BLANKS _____

_____

_____

DISPOSITION/COMMENTS

_____

_____

_____

ENGINEERING-SCIENCE, INC.

TRAIN RECOVERY SHEET

DATE 4-12-89 RUN# 1 METHOD SCAQMD 405.1

FACILITY DOUGLAS AIRCRAFT TORRANCE TANK #95 INLET TYPE HEXCHROME/CHROME

TECHNICIAN B.M IMP. SOLUTION 0.02N NAHCO3

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			
UMBILICAL RINSE			

		FINAL (g)	INITIAL(g)	NET(g)
IMPINGER # 1	BICARBONATE	564.5	555.0	9.5
IMPINGER # 2	BICARBONATE	584.9	582.6	2.3
IMPINGER # 3	MT	478.8	478.6	0.2
IMPINGER #				
DESCRIPTION				
IMPINGER RINSE				

		FINAL (g)	INITIAL(g)	
SILICA GEL (DESCRIPTION)	1/2 USED	865.9	837.7	28.2
FILTER# (DESCRIPTION)		TOTAL MOISTURE		40.2 (g)

FIELD BLANKS _____

_____

_____

DISPOSITION/COMMENTS

_____

_____

_____

ENGINEERING-SCIENCE, INC.

TRAIN RECOVERY SHEET

DATE 4-12-89 RUN# 1 METHOD SCAQM 504.1

FACILITY DOUGLAS AIRCRAFT TORRANCE TANK 195 OUTLET TYPE HEXCHROME/CHROME

TECHNICIAN R.M IMP. SOLUTION 0.02N $NaHCO_3$

	SOLUTION	VOL. (ml)	DESCRIPTION
NOZZLE-PROBE RINSE			
UMBILICAL RINSE			

		FINAL (g)	INITIAL(g)	NET(g)
IMPINGER # 1	BICARBONATE	589.3	585.0	4.3
IMPINGER # 2	BICARBONATE	581.7	558.6	23.1
IMPINGER # 3	MT	482.6	480.6	2.0
IMPINGER #				
DESCRIPTION				
IMPINGER RINSE				

		FINAL (g)	INITIAL(g)	
SILICA GEL (DESCRIPTION)	1/2 USED	871.4	840.4	31.
FILTER# (DESCRIPTION)		TOTAL MOISTURE		60.4 (g)

FIELD BLANKS

DISPOSITION/COMMENTS

FILTER, NOZZLE PROBE RINSE COMBINED INTO ONE SAMPLE BOTTLE

APPENDIX D

TOTAL AND HEXCHROME DATA FROM TMA INC. LABORATORY

Received: 04/17/89 04/27/89 08:58:36

REPORT TO: Engineering Science
75 N. Fair Oaks Ave.
P.O. Box 7107
Pasadena, CA 91109
ATTEN: Mr. Robert Mazurek

CLIENT: ENGINEER SCI SAMPLES: 5
COMPANY: Engineering Science
FACILITY:

WORK ID: WA099 Douglas Air. Torrance
TAKEN: By Engineering Science Staff
TRANS: By Engineering Science Staff
TYPE: Liquids
P.O. #: WA 099
INVOICE: under separate cover

PREPARED BY: Thermo Analytical Inc.
160 Taylor Street
Monrovia, CA 91016
ATTEN:
PHONE: 818-357-3247

T. Shultz
CERTIFIED BY

CONTACT: TWS

This report is for the sole and exclusive use of the client to whom it is addressed and represents only those samples herein described. Samples not destroyed in testing are retained a maximum of 30 days unless otherwise requested.

SAMPLE IDENTIFICATION

01 890466 Blank
02 890455 Tank #195 Outlet
03 890457 Tank #245 Outlet
04 890456 Tank #195 Inlet
05 890458 Tank #245 Inlet

TEST CODES and NAMES used on this report

CR HEX Hexavalent Chromium
CR L Chromium - Liquids

SAMPLE ID 890466 Blank SAMPLE # 01 FRACTIONS: A
Date & Time Collected 04/13/89 Category
020 µgm
CR_HEX < .003 mg/L CR_L < 0.02 mg/L

SAMPLE ID 890455 Tank #195 Outlet SAMPLE # 02 FRACTIONS: A
Date & Time Collected 04/12/89 Category
CR_HEX < .003 mg/L CR_L < 0.02 mg/L 20 µgm

SAMPLE ID 890457 Tank #245 Outlet SAMPLE # 03 FRACTIONS: A
120 µgm 140 µgm
Date & Time Collected 04/13/89 Category
CR_HEX .12 mg/L CR_L 0.14 mg/L
0.72 liters
Hex = .0864 mg - Total = .1008 mg

SAMPLE ID 890456 Tank #195 Inlet SAMPLE # 04 FRACTIONS: A
340 µgm 630 µgm
Date & Time Collected 04/12/89 Category
CR_HEX .34 mg/L CR_L 0.63 mg/L

SAMPLE ID 890458 Tank #245 Inlet SAMPLE # 05 FRACTIONS: A

525000 647000

Date & Time Collected 04/13/89 Category

CR_HEX	525 mg/L	CR_L	647. mg/L

0.76 liters

8/20

399 mg Hex 491.72mg Total

APPENDIX E

SAMPLE CALCULATIONS

• Project Name: Douglas Aircraft Company.

• Subject: Sample calculation for Chrome emissions.

Equation Needed.

1). To Find the Grain/DSCF. (C_{sd}).

$$C_{sd} = 0.01543\ (W_p) / (V_{mstd})$$

where: W_p = Concentration of chrome (mg).

V_{mstd} = Sampled volume in (DSCF).

2) To Find the lbs/hr. (E_p).

$$E_p = (C_{sd})(60)(Q_{sd}) / 7000$$

where: Q_{sd} = Flow rate of stack in (DSCFM)

3). To Find the mg/hr. (M_p)

$$M_p = (lbs/hr) \times \frac{1\ mg}{2.2046 \times 10^{-6}}$$

Project name : Douglas Aircraft Company.

Subject : Sample calculation for chrome emissions

1) Total Chromium

(A) Tank 195 Inlet. $V_{mstd} = 124.443$

Given = 0.63 mg/ℓ Initial solution = 0.66 ℓ

$$C_{sd} = 0.01543 (W_p)/(V_{mstd})$$

$$W_p = 0.63 \text{ mg/ℓ} \times 0.66 \text{ ℓ} = 0.4158$$

$$C_{sd} = 0.01543 (0.4158)/(124.443)$$
$$= 5.2 \times 10^{-5} \text{ gr/DSCF}$$

$$E_p = (5.2 \times 10^{-5})(60)(21,174)/7000$$
$$= 9.44 \times 10^{-3} \text{ lbs/hr}.$$

$$M_p = (9.44 \times 10^{-3} \text{ lbs/hr}) \left(\frac{1 \text{ mg}}{2.2046 \times 10^{-6} \text{ lb}}\right)$$
$$= 4,282 \text{ mg/hr}.$$

(13) Tank 195 Outlet

Given = < 0.02 mg/ℓ Initial Sol. = 0.72 ℓ.

$V_{mstd} = 153.39$ DSCF.

$$W_p = < 0.02 \text{ mg/ℓ} \times 0.72 \text{ ℓ} = < 0.0144$$
$$C_{sd} = 0.01543 (0.0144)/153.39$$
$$= 4.45 \times 10^{-6}$$
$$E_p = (1.45 \times 10^{-6})(60)(19,886)/7000$$
$$= < 2.47 \times 10^{-4} \text{ lbs/hr}.$$

$$M_p = (2.47 \times 10^{-4}) \left(\frac{1\,mg}{2.2046 \times 10^{-6}}\right)$$

$$= < 112\ mg/hr$$

© Tank 245 Inlet.

Given = 647 mg/l

Initial solution = 0.72

V_{mstd} = 146.743

$$W_p = 647\ mg/l \times 0.72\ l = 465.84$$

$$C_{sd} = 0.01543\,(465.84)/(146.743)$$
$$= 4.90 \times 10^{-2}$$
$$E_p = (4.9 \times 10^{-2})(60)(25,018)/7000$$
$$= 10.51\ lbs/hr.$$
$$M_p = (10.51\ lbs/hr)\left(\frac{1\,mg}{2.2046 \times 10^{-6}\,lbs}\right)$$
$$= 4,766,198\ mg/hr.$$

(D) Tank 245 outlet.

Given = 0.14 mg/l

V_{mstd} = 135.309

Initial Solution = 0.76 l

$$W_p = 0.14\ mg/l \times 0.76\ l = 0.1064\ mg.$$
$$C_{sd} = 0.01543\,(0.1064)/135.309$$
$$= 1.21 \times 10^{-5}$$
$$E_p = (1.21 \times 10^{-5})(60)(2564.1)/7000$$
$$= 2.66 \times 10^{-3}\ lbs/hr.$$
$$M_p = (2.66 \times 10^{-3}\ lbs/hr)\left(\frac{1\,mg}{2.2046 \times 10^{-6}\,lbs}\right) = 1,206\ mg/hr$$

2) HEX. Chromium.

(A) #195 Inlet.

Given = 0.34 mg/ℓ

W_p = 0.2244 mg

C_{sd} = 2.78×10^{-5} gr/DSCF

E_p = 5.04×10^{-3} lbs/hr.

M_p = 2,286 mg/hr.

(B) #195 Outlet.

Given = < 0.003 mg/ℓ

W_p = < 0.003 mg/ℓ × 0.72 ℓ = 0.00216 mg

C_{sd} = $< 2.2 \times 10^{-7}$

E_p = $< 3.75 \times 10^{-5}$ #

M_p = < 17 mg/hr.

(C) #245 Inlet.

Given = 525 mg/ℓ

W_p = 525 mg/ℓ × 0.72 ℓ = 378 mg.

C_{sd} = 0.03975 gr/DSCF.

E_p = 8.52 lbs/hr.

M_p = $(8.52)\left(\frac{1}{2.2046 \times 10^{-6}}\right)$ = 3,864,647 mg/hr.

(d) Tank # 2X5 Outlet.

Given = 0.12 mg/ℓ

$W_p = 0.0912$

$C_p = 1.04 \times 10^{-5}$

$E_p = 2.29 \times 10^{-3}$ lbs/hr.

$M_p = 1,038$ mg/hr

DAC Torrance ..... WA099.
Process Load .....

< TANK 195 >

@ Data Was Given by Jerry Topp .

- Rule 1169.
- Typical Loading Rate ⇒ 4 loads / day. Average
- Loading Rate for Ampere during test :
  - 12:35 - 01:15 700 Amperes.

< TANK 245 >

Typical Run Volt = 3 ~ 5 Volts.

Amperes during Run = 1000 Amps.

Indeal Temp for plating = 125 °F.

DAC.
Velocity traverse
4-12-89

WA099
Bryan Lee.

(*) Tank 195.

Outlet Dimension = 38" x 30". $\Delta H = 1.72$

Inlet Dimension = 36" x 38". $\Delta H = 1.63$

	38"
1	3.8
2	11.4
3	19.0
4	26.6
5	34.2

$K = 849.8\ \Delta H\ C_p^2 (1-B_w)^2\ D_n^4\ \frac{T_m}{T_s}$

$T_m = 560$

$K = 1.6$

$= 3.57$ Inlet ($\Delta H = 1.63$)

$K = 3.77$ outlet ($\Delta H = 1.72$).

APPENDIX F

QUALITY ASSURANCE DATA

ENGINEERING SCIENCE
Pasadena, California

POST TEST METER BOX CALIBRATION FORM

Meter Box No. RED #1 Date 5-31-89

Barometric Pressure 29.44 Calibrated by M. Dorsey

Project No WA 103 (RETEST) Pre Test Y^i 1.01

Harbor Cogen

Orifice Manometer (in. H^2O) H	Gas Volume: Wet Test Meter (ft_3) V^w	Gas Volume: Dry Gas Meter (ft_3) V^d	Temperatures: Wet Test Meter (° F) Tw	Temperatures: Dry Gas Meter (° F) Td	Time (min) Ti	Y^i	H@i
2.0	11.784	12.445	73	84	14	0.96	—
2.0	10.944	11.788	73	91	13	0.96	—
2.0	12.583	13.701	73	96	15	0.96	—

Y^i AVG 0.96

@ 11.0" HG.

ENGINEERING SCIENCE
Pasadena, California

POST TEST METER BOX CALIBRATION WORK SHEET

Meter Box No.: Red #1 Meter Box Operator: D. Becker Date: 5-31-89

Barometric Pressure (P_b): 29.44 Ambient Temperature: 74 Calibrated by: M.

Project Name: Harbor Cogen Project No.: WA103 (Retest) ΔH@ Run: 2.0 "H_2O

Vacuum @: 11.0 "HG

Run		V_w (ft^3)	V_d (ft^3)	T_w (°F)	T_d (°F)	θ (min.)	Y_i (each)
0.5	Initial	210.200	574.600	73	80	15:20	
1	Final	221.984	587.245	73	88	15:34	0.96
2.0	Net	11.784	12.645	73	84	14	
1.0	Initial	221.984	587.245	73	88	15:35	
2	Final	232.930	599.033	73	94	15:48	0.96
3.0	Net	10.946	11.788	73	91	13	
1.5	Initial	232.930	599.033	73	94	15:50	
3	Final	245.513	612.734	73	98	16:05	0.96
4.0	Net	12.583	13.701	73	96	15	

Leak Check: 15 "HG @ 1 MIN. Leakage: 0.004

Final Meter Reading: 612.744

Y_i AVG 0.96

Meter Box Calibration History

Date Last Calibration 2/3/89 Calibrated by M.

ΔH of Calibration @ 1.80 Y_i of Calibration 1.04

$$Y_i = \frac{(V_w)(P_b)(T_d + 460)}{(V_d)(P_b + \Delta H/13.6)(T_w + 460)}$$

ENGINEERING SCIENCE
Pasadena, California

POST TEST METER BOX CALIBRATION FORM

Meter Box No. Rad #2 Date 4-27-89

Barometric Pressure 29.52 Calibrated by M. [illegible]

Project No WA 130 Pre Test Y^i 0.97

BP1 Argus

Orifice Manometer (in. H^2O) H	Gas Volume: Wet Test Meter (ft_3) V^w	Gas Volume: Dry Gas Meter (ft_3) V^d	Temperatures: Wet Test Meter ($_o$ F) Tw	Temperatures: Dry Gas Meter ($_o$ F) Td	Time (min) Ti	Y^i	H@i
1.0	11.315	11.790	60	66	20	0.97	—
1.0	12379	13.142	60	77	22	0.97	—
1.0	46.021	50.184	62	91	82	0.97	—
						Y^i AVG	0.97

@ 1.0 " HG.

ENGINEERING SCIENCE
Pasadena, California

POST TEST METER BOX CALIBRATION WORK SHEET

Meter Box No.: Rot #2 Meter Box Operator: M. Atwa Date: 4-27-89

Barometric Pressure (P_b): 29.52 Ambient Temperature: 61 Calibrated by: M.

Project Name: BPI-Agnew Project No.: WA 130 ΔH Run: 1.0 "H_2O

Vacuum @: 1.0 "Hg

Run		V_w (ft^3)	V_d (ft^3)	T_w (°F)	T_d (°F)	θ (min.)	Y_i (each)
0.5	Initial	351.790	842.800	60	60	11:15	
(1)	Final	363.105	854.590	60	70	11:35	0.97
2.0	Net	11.315	11.790	60	65	20	(0.967)
1.0	Initial	363.105	854.590	60	70	11:36	
(2)	Final	375.484	867.732	60	84	11:58	0.97
3.0	Net	12.379	13.142	60	74	22	(0.970)
1.5	Initial	375.484	867.732	60	84	11:59	
(3)	Final	421.505	917.916	64	98	13:21	0.97
4.0	Net	46.021	50.184	62	91	82	(0.946)

Leak Check: 15" Hg @ 1 min. Leakage: 0.000

Final Meter Reading: 918.050

Y_i Avg 0.97

METER BOX CALIBRATION HISTORY

Date Last Calibration 1/6/89 Calibrated by ~~BB~~

θ of Calibration 1.63 Y_i of Calibration 0.965

$$Y_i = \frac{(V_w)(P_b)(T_d + 460)}{(V_d)(P_b + \Delta H/13.6)(T_w + 460)}$$

ENGINEERING SCIENCE, INC.
Pasadena, California

CHAIN OF CUSTODY RECORD

Project No.	Project Name									TMS ARLI
WA099	DOUGLAS AIRCRAFT TORRANCE									REMARKS
Samplers: BRIAN LEE				TOTAL CHROME	HEX CHROME					
ES Lab No.	Test Date	Comp	[redacted] (ml)	Sampling Location						
890466	4-13-89		210	BLANK	✓	✓				
890455	4-12-89		720	COMBINED/TANK #195 OUTLET	✓	✓				
890457	4-13-89		760	COMBINED/TANK #245 OUTLET	✓	✓				
890456	4-12-89		660	COMBINED/TANK #195 INLET	✓	✓				
890458	4-13-89		720	COMBINED/TANK #245 INLET	✓	✓				

Relinquished by:	Date/Time	Received by:	Relinquished by:	Date/Time	Received by:
ROBERT MAZUREK Of: ES PASADENA	4:25pm	Of: Ramiro Ordonez	Of: Ramiro Ordonez	4-17-89 17:25	Of: TMA/ARLI
Relinquished by: Of:	Date/Time	Received by: Of:	Relinquished by: Of:	Date/Time	Received by: Of:
Relinquished by: Of:	Date/Time	Received by: Of:	Relinquished by: Of:	Date/Time	Received by: Of:

For more information call: ROBERT MAZUREK (818)440-601
~~Telephone No.:~~ BRYAN LEE X6040

ENGINEERING SCIENCE
SOURCE TEST WORK REQUEST

Project Number: WA099.

Team Leader: Bryan Lee

Client: Mc Donald Aircraft.

Address: 19503 South Normandie Ave.

City: Torrance State: CA Zip: 90502

Contact Person: Gerry Topp. Telephone: (213) 533-~~7291~~ 1675

Agency: Compliance Test: [~~yes~~] [no]

Applicable Rules/Regulations:

SOURCE DESCRIPTION Tank 245, Tank 445

Unit to be Tested: Tank 195, Tank 244 Diameter of Stack (in):

Height of Platform (ft): Number of Ports:

Stack Temp (deg F): Ambient. Moisture Content (%):

SAMPLING INFORMATION

Parameter:	Method:	No. of Runs:	Run Time:	Other:
Chromium		2	4	for 4/11/89
		2	4	for 4/12/89
		2	4	for 4/13/89.

SCHEDULE AND PERSONNEL

Scheduled Test Date: April 11, 12, 13. Actual Test Date:

Departure from ES: Arrival at Site:

Personnel: Bryan Lee, Larry Cottone, Greg Burke.

NOTES