Background Report Reference

AP-42 Section Number: 12.20

Background Chapter: 4

Reference Number: 35

Title: Emissions Stack Testing at McDonnell Douglas, Torrance, CA. Source Tested: Etching Tank Scrubbr (Tank 193, Bldg. 2) Anodizing Tank Scrubber (Tank 195, Bldg 2). Date Tested: October 1 and 3, 1986

November 1986

ELECTROPLATING
K. REF. 4-35
3/
1.

COPY TO: RANDY P. STRAIT, MIDWEST RESEARCH INSTITUTE
(RALEIGH, NORTH CAROLINA) - sent 3/24/87

FILE COPY

CHROMIUM EMISSIONS TESTS FOR TANK 193 AND TANK 195 AT DOUGLAS AIRCRAFT COMPANY (DAC)

The chromium emission test conditions and results for Tank 193 and Tank 195 are shown in Appendix A. An analysis of the results is presented below.

- "Total Cr" and "Cr^{+6}" emissions are lower for etching than for anodizing mainly because a batch of parts are etched for only 5 minutes but anodized for 40-45 minutes and because much less H_2 and other gases are generated at the solution-metal parts interface for etching than for anodizing.
- "Cr^{+6}" emissions are a much lower per cent of "Total Cr" emissions for etching than for anodizing primarily due to differences in the reactions occurring at the solution-metal parts interface.
  - Etching
    Aluminum metal (Al°) etched by nitric acid (HNO_3) and hydrofluoric acid (HF) is oxidized to trivalent aluminum (Al^{+3}). Hexavalent chromium (Cr^{+6}) picks up the 3 electrons freed by $Al^{0} \rightarrow Al^{+3}$ and reduces to trivalent chromium (Cr^{+3}). This leads to a gradual buildup of Cr^{+3} in the solution as more batches of parts are processed. The chromic acid (CrO_3) concentration is maintained within a specified range by periodic addition of CrO_3 to the solution. These factors cause the Cr^{+3} to Cr^{+6} ratio to increase over time.
  - Anodizing
    Electric current is passed through the solution when parts are being anodized. Aluminum metal (Al°) is oxidized to form a thin aluminum (as Al^{+3}) oxide film on the parts surface. At the same time, some complex compounds containing hexavalent chromium (Cr^{+6}) and trivalent aluminum (Al^{+3}) form in the solution and a small portion of the Cr^{+6} is reduced to trivalent chromium (Cr^{+3}). This along with periodic addition of chromic acid (CrO_3) to the solution leads to a gradual buildup of Cr^{+6} in the solution. These factors cause the Cr^{+3} to Cr^{+6} ratio to decrease over time. (The Tank 195 test with the sparge air off had a much higher Cr^{+3} to Cr^{+6} ratio than the Tank 195 tests with the sparge air on did. This indicates that the heavy Cr^{+6} compounds, i.e., complex Cr^{+6}-Al^{+3} compounds, were not being entrained as readily as the other Cr^{+6} compounds and the Cr^{+3} compounds with the sparge air off.)

CHROMIUM EMISSIONS TESTS FOR TANK 193 AND TANK 195 AT DOUGLAS AIRCRAFT COMPANY (DAC) (cont'd.)

- "Cr^{+6}" emissions on a lb/hr/ft² basis are lower for either etching or anodizing than for hard chrome plating.
  - Tank 193 (tri-acid etch), solution surface area = 93 ft²
    Highest measured Cr^{+6} emission on 10/1/86 = 0.0039 lb/hr
    lb/hr/ft² basis = (0.0039 lb/hr) / (93 ft²)
    = 0.042×10^{-4} lb/hr/ft² as Cr^{+6} at control equipment inlet
  - Tank 195 (anodize), solution surface area = 114 ft²
    Highest measured Cr^{+6} emission on 10/1/86 or 10/3/86 = 0.00624 lb/hr
    lb/hr/ft² basis = (0.00624 lb/hr) / (114 ft²)
    = 0.55×10^{-4} lb/hr/ft² as Cr^{+6} at control equipment inlet
  - Hard chrome plating tank data from "Report to the Scientific Review Panel on Chromium," California Air Resources Board and Department of Health Services, September 1985, page I-5
    Cr^{+6} emission range = 1.5×10^{-4} to 620×10^{-4} lb/hr/ft² as Cr^{+6} at control equipment inlet

APPENDIX A

Chromium Emissions Tests for
Tank 193 and Tank 195 at C6

K. J. SVOBODA
11/13/86

CHROMIUM EMISSIONS TESTS

(C6, BLDG. 2, TANKS 193 & 195)

C6 = Douglas Aircraft Company (DAC) Torrance Plant

Sampling on 10/1/86:

① 10 45 AM - 1 45 PM

Tank 193 (tri-acid etch) - sparge air on; scrubber water pump on; tank ventilation air blower on; parts in tank for 5 minutes (normal time period)

Tank 195 (anodize) - sparge air on; scrubber water pump on; tank ventilation air blower on; electric current for anodizing on at 1.5 kiloamps & 21 volts and parts in tank for 40 minutes (normal time period) *

② 1 45 PM - 4 30 PM

Tank 193 - sparge air off; scrubber water pump on; tank ventilation air blower on; parts in tank for 5 minutes

Tank 195 - sparge air off; scrubber water pump on; tank ventilation air blower on; electric current for anodizing on at 1.5 kiloamps & 21 volts and parts in tank for 10-15 minutes at start of sampling *

Tank 193 data - solution temp. = 70°F; CrO_3 conc. = 6.1 - 7.8 oz./gal.; solution volume = 4,754 gal.; solution surface area = 93 ft^2

Tank 195 data - solution temp. = 100°F; CrO_3 conc. = 7-8 oz./gal.; solution volume = 4,638 gal.; solution surface area = 114 ft^2

Per telecon with Rollie Rosario, Engineering Science on 11/11/86, scrubber inlet sampling results are:

	Tank 193		Tank 195	
Time Period	Total Cr	Cr^{+6}	Total Cr	Cr^{+6}
10 45 AM - 1 45 PM	0.00229 lb/hr	0.00035 lb/hr	0.00492 lb/hr	0.0036 lb/hr
1 45 PM - 4 30 PM	0.00237 lb/hr	0.00039 lb/hr	0.00441 lb/hr	0.00076 lb/hr

Tank 193 ventilation air flow = 13,187 cfm (10 45 AM - 1 45 PM) & 13,218 cfm (1 45 PM - 4 30 PM)

Tank 195 ventilation air flow = 23,279 cfm (10 45 AM - 1 45 PM) & 23,302 cfm (1 45 PM - 4 30 PM)

* Electric current on only when parts in tank

K.J. SVOBODA
11/13/86

CHROMIUM EMISSIONS TESTS (cont'd.)
(C6, BLDG. 2, TANKS 193 & 195)

Sampling on 10/3/86:
① 10 52 AM - 11 30 AM, 12 30 PM - 1 15 PM, & 1 30 PM - 2 18 PM
Tank 195 (anodize) - sparge air on ; scrubber water pump on ; tank ventilation air blower on ; electric current for anodizing on at 1.5-2.0 Kiloamps & 21 volts and parts in tank for entire sampling period — 3 batches of parts @ 40-45 minutes each were processed and sampling was only done when parts were in tank *

Tank 195 data - solution temp. = 100°F ; CrO_3 conc. = 7-8 oz./gal. ; solution volume = 4,638 gal. ; solution surface area = 114 ft^2

Per telecon with Rollie Rosario of Engineering Science on 11/11/86, scrubber inlet & outlet sampling results are:
Tank 195 scrubber inlet = 0.00925 lb/hr total Cr & 0.00624 lb/hr Cr^{+6}
Tank 195 scrubber outlet = 0.00052 lb/hr total Cr & 0.00030 lb/hr Cr^{+6}
Tank 195 ventilation air flow = 23,319 cfm to scrubber

Per pump data: Tank 195 scrubber water flow = 54 gpm
Per scrubber data**: Packing depth = 1 ft.
Mist eliminator depth = 6 in.
(chevron blade type)

* Electric current on only when parts in tank
** Duall F-101 — horizontal wet packed scrubber

WA01602

EMISSIONS STACK TESTING
AT McDONNELL DOUGLAS,
TORRANCE, CALIFORNIA

Source Tested:

Etching Tank Scrubber (Tank 193, Bldg. 2)
Anodizing Tank Scrubber (Tank 195, Bldg. 2)

Date Tested:

October 1 and 3, 1986

Prepared for

LATHAM AND WATKINS
ATTORNEYS AT LAW
555 South Flower Street
Los Angeles, California 90071

Revised

November 12, 1986

Prepared by

ENGINEERING-SCIENCE
75 N. Fair Oaks Avenue
P.O. Box 7107
Pasadena, California 91109

REPORT OF STACK TESTING
AT McDONNELL DOUGLAS

INTRODUCTION

On October 1 and 3, 1986, personnel from Engineering-Science (ES), Pasadena, California, conducted air pollution testing at the McDonnell Douglas facility in Torrance, California. The purpose of the tests was to determine the chromium emissions from etching tank 193 and anodizing tank 195 scrubbers (Bldg. 2). The testing program was coordinated by Mr. Ken Svoboda of McDonnell Douglas.

On October 1, the inlet to the Etching and Anodizing Tank Scrubbers was tested with the air sparger both on and off. On October 3, the inlet and outlet to the Anodizing Tank Scrubber were tested simultaneously. The ES testing team was comprised of Messrs. Rolando Rosario (team leader), Ron Diaz, Paul Farmanian, and Ms. Cammie Mok.

TEST METHODS

The chromium runs were conducted proportionally. The sampling train consisted of a Teflon probe connected to four impingers in series. The first two impingers were each charged with 100 milliliters of deionized water, the third impinger was dry, and the fourth contained about 400 grams of indicating silica gel. The first, third, and fourth impingers were straight tube Greenburg-Smith impingers and the second was an orifice tip Greenburg-Smith impinger.

RESULTS

The results of the testing program are summarized in Tables 1 through 4. Additional supporting data are presented in the Appendix. Additionally, a discussion of the determination of hexavalent chromium emissions is included in the Appendix.

ABLE 1

SUMMARY OF VOLUMETRIC FLOW DATA
ETCHING TANK SCRUBBER (Tank 193, Bldg. 2)
ANODIZING TANK SCRUBBER (Tank 195, Bldg. 2)

McDonnell Douglas

October 1, 1986

Parameter	Etching Tank Scrubber Inlet Sparger On	Etching Tank Scrubber Inlet Sparger Off	Anodizing Tank Scrubber Inlet Sparger On	Anodizing Tank Scrubber Inlet Sparger Off
Velocity (FPS)	30.19	30.26	41.10	41.14
Volumetric Flow				
ACFM	13,187	13,218	23,279	23,302
DSCFM	12,546	12,531	22,024	22,026
Stack Temperature (°F)	70	73	72	73
Moisture Content (%)	1.65	1.44	1.83	1.73

TABLE 2

SUMMARY OF VOLUMETRIC FLOW DATA
ANODIZING TANK SCRUBBER (Tank 195, Bldg. 2)

McDonnell Douglas

October 3, 1986

Parameter	Anodizing Tank Scrubber Inlet	Anodizing Tank Scrubber Outlet
Velocity (FPS)	41.17	50.32
Volumetric Flow		
ACFM	23,319	24,576
DSCFM	22,052	23,231
Stack Temperature (°F)	71	71
Moisture Content (%)	1.39	1.43

TABLE 3

SUMMARY OF EMISSIONS DATA
ETCHING TANK SCRUBBER (Tank 193, Bldg. 2)
ANODIZING TANK SCRUBBER (Tank 195, Bldg. 2)

McDonnell Douglas

October 1, 1986

Parameter	Etching Tank Scrubber Inlet Sparger On	Etching Tank Scrubber Inlet Sparger Off	Anodizing Tank Scrubber Inlet Sparger On	Anodizing Tank Scrubber Inlet Sparger Off
Total Chromium				
ppm	22.2×10^{-3}	23.0×10^{-3}	27.19×10^{-3}	24.7×10^{-3}
lbs/hr	2.29×10^{-3}	2.37×10^{-3}	4.92×10^{-3}	4.47×10^{-3}
Chromium +6				
ppm	3.38×10^{-3}	3.78×10^{-3}	19.91×10^{-3}	4.19×10^{-3}
lbs/hr	0.35×10^{-3}	0.39×10^{-3}	3.6×10^{-3}	0.76×10^{-3}

TABLE 4

SUMMARY OF VOLUMETRIC FLOW DATA
ANODIZING TANK SCRUBBER (Tank 195, Bldg. 2)

McDonnell Douglas

October 3, 1986

Parameter	Anodizing Tank Scrubber Inlet	Anodizing Tank Scrubber Outlet
Total Chromium		
ppm	51.06×10^{-3}	2.71×10^{-3}
lbs/hr	9.25×10^{-3}	0.52×10^{-3}
Chromium +6		
ppm	34.43×10^{-3}	1.55×10^{-3}
lbs/hr	6.24×10^{-3}	0.30×10^{-3}

APPENDIX

ENGINEERING-SCIENCE, ARCADIA, CALIFORNIA

PLANT: MCDONNEL DOUGLASS
SOURCE: SCRUBBER #1 INLET
DATE: 10-1-86
RUN #: SPARGER ON

FLOW DATA

STACK LENGTH (INCHES)	32.875
STACK WIDTH (INCHES)	31.875
STACK CROSS-SECTIONAL AREA (SQUARE FT)	7.28
BAROMETRIC PRESSURE (INCHES MERCURY)	29.5
OXYGEN CONTENT (%)	20.8
CARBON DIOXIDE (%)	0
MOISTURE CONTENT (%)	1.65
STACK TEMPERATURE (DEG F)	70
STACK STATIC PRESSURE (INCHES WATER)	-1.3
VELOCITY PRESSURE (SQ RT INCHES WATER DELTA P)	.53
PITOT TUBE CORRECTION FACTOR	.84
VELOCITY (FEET PER SEC)	30.19
EXHAUST GAS FLOW RATE (ACFM)	13187
EXHAUST GAS FLOW RATE (DSCFM)	12546

POLLUTANT DATA

PARAMETER: TOTAL CHROMIUM
MOLECULAR WEIGHT=52

CONCENTRATION (PPM)	22.2 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	2.29 $\times 10^{-3}$

PARAMETER: CHROMIUM +6
MOLECULAR WEIGHT=52

CONCENTRATION (PPM)	3.38 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	.35 $\times 10^{-3}$

ENGINEERING-SCIENCE, ARCADIA, CALIFORNIA

PLANT: MCDONNEL DOUGLASS
SOURCE: SCRUBBER #1 INLET
DATE: 10-1-86
RUN #: SPARGER OFF

FLOW DATA

STACK LENGTH (INCHES)	32.875
STACK WIDTH (INCHES)	31.875
STACK CROSS-SECTIONAL AREA (SQUARE FT)	7.28
BAROMETRIC PRESSURE (INCHES MERCURY)	29.5
OXYGEN CONTENT (%)	20.8
CARBON DIOXIDE (%)	0
MOISTURE CONTENT (%)	1.44
STACK TEMPERATURE (DEG F)	73
STACK STATIC PRESSURE (INCHES WATER)	-1.3
VELOCITY PRESSURE (SQ RT INCHES WATER DELTA P)	.53
PITOT TUBE CORRECTION FACTOR	.84
VELOCITY (FEET PER SEC)	30.26
EXHAUST GAS FLOW RATE (ACFM)	13218
EXHAUST GAS FLOW RATE (DSCFM)	12531

POLLUTANT DATA

PARAMETER: TOTAL CHROMIUM
MOLECULAR WEIGHT=52

CONCENTRATION (PPM)	23 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	2.37 $\times 10^{-3}$

PARAMETER: CHROMUIM +6
MOLECULAR WEIGHT=52

CONCENTRATION (PPM)	3.78 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	.39 $\times 10^{-3}$

ENGINEERING-SCIENCE, ARCADIA, CALIFORNIA

PLANT: MCDONNEL DOUGLASS
SOURCE: SCRUBBER #2 INLET
DATE: 10-1-86
RUN #: SPARGER ON

FLOW DATA

STACK LENGTH (INCHES)	37.875
STACK WIDTH (INCHES)	35.875
STACK CROSS-SECTIONAL AREA (SQUARE FT)	9.44
BAROMETRIC PRESSURE (INCHES MERCURY)	29.5
OXYGEN CONTENT (%)	20.9
CARBON DIOXIDE (%)	0
MOISTURE CONTENT (%)	1.83
STACK TEMPERATURE (DEG F)	72
STACK STATIC PRESSURE (INCHES WATER)	-1.4
VELOCITY PRESSURE (SQ RT INCHES WATER DELTA P)	.72
PITOT TUBE CORRECTION FACTOR	.84
VELOCITY (FEET PER SEC)	41.1
EXHAUST GAS FLOW RATE (ACFM)	23279
EXHAUST GAS FLOW RATE (DSCFM)	22024

POLLUTANT DATA

PARAMETER: TOTAL CHROMIUM
MOLECULAR WEIGHT=52

CONCENTRATION (PPM)	27.19 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	4.92 $\times 10^{-3}$

PARAMETER: CHROMIUM +6
MOLECULAR WEIGHT=52

CONCENTRATION (PPM)	19.91 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	3.6 $\times 10^{-3}$

ENGINEERING-SCIENCE, ARCADIA, CALIFORNIA

PLANT:	MCDONNEL DOUGLASS
SOURCE:	SCRUBBER #2 INLET
DATE:	10-1-86
RUN #:	SPARGER OFF

FLOW DATA

STACK LENGTH (INCHES)	37.875
STACK WIDTH (INCHES)	35.875
STACK CROSS-SECTIONAL AREA (SQUARE FT)	9.44
BAROMETRIC PRESSURE (INCHES MERCURY)	29.5
OXYGEN CONTENT (%)	20.8
CARBON DIOXIDE (%)	0
MOISTURE CONTENT (%)	1.73
STACK TEMPERATURE (DEG F)	73
STACK STATIC PRESSURE (INCHES WATER)	-1.4
VELOCITY PRESSURE (SQ RT INCHES WATER DELTA P)	.72
PITOT TUBE CORRECTION FACTOR	.84
VELOCITY (FEET PER SEC)	41.14
EXHAUST GAS FLOW RATE (ACFM)	23302
EXHAUST GAS FLOW RATE (DSCFM)	22026

POLLUTANT DATA

PARAMETER: TOTAL CHROMIUM

MOLECULAR WEIGHT=52	
CONCENTRATION (PPM)	24.7 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	4.47 $\times 10^{-3}$

PARAMETER: CHROMIUM +6

MOLECULAR WEIGHT=52	
CONCENTRATION (PPM)	4.19 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	.76 $\times 10^{-3}$

ENGINEERING-SCIENCE, ARCADIA, CALIFORNIA

PLANT: MCDONNEL DOUGLASS
SOURCE: SCRUBBER #2 INLET
DATE: 10-3-86
RUN #: INLET

FLOW DATA

STACK LENGTH (INCHES)	37.875
STACK WIDTH (INCHES)	35.875
STACK CROSS-SECTIONAL AREA (SQUARE FT)	9.44
BAROMETRIC PRESSURE (INCHES MERCURY)	29.3
OXYGEN CONTENT (%)	20.8
CARBON DIOXIDE (%)	0
MOISTURE CONTENT (%)	1.39
STACK TEMPERATURE (DEG F)	71
STACK STATIC PRESSURE (INCHES WATER)	-1.3
VELOCITY PRESSURE (SQ RT INCHES WATER DELTA P)	.72
PITOT TUBE CORRECTION FACTOR	.84
VELOCITY (FEET PER SEC)	41.17
EXHAUST GAS FLOW RATE (ACFM)	23319
EXHAUST GAS FLOW RATE (DSCFM)	22052

POLLUTANT DATA

PARAMETER: TOTAL CHROMIUM
MOLECULAR WEIGHT=52

CONCENTRATION (PPM)	51.06 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	9.25 $\times 10^{-3}$

PARAMETER: CHROMIUM +6
MOLECULAR WEIGHT=52

CONCENTRATION (PPM)	34.43 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	6.24 $\times 10^{-3}$

ENGINEERING-SCIENCE, ARCADIA, CALIFORNIA

PLANT: MCDONNEL DOUGLASS
SOURCE: SCRUBBER #2 OUTLET
DATE: 10-3-86
RUN #: OUTLET

FLOW DATA

STACK LENGTH (INCHES)	38.75
STACK WIDTH (INCHES)	30.25
STACK CROSS-SECTIONAL AREA (SQUARE FT)	8.14
BAROMETRIC PRESSURE (INCHES MERCURY)	29.3
OXYGEN CONTENT (%)	20.8
CARBON DIOXIDE (%)	0
MOISTURE CONTENT (%)	1.43
STACK TEMPERATURE (DEG F)	71
STACK STATIC PRESSURE (INCHES WATER)	-1.3
VELOCITY PRESSURE (SQ RT INCHES WATER DELTA P)	.88
PITOT TUBE CORRECTION FACTOR	.84
VELOCITY (FEET PER SEC)	50.32
EXHAUST GAS FLOW RATE (ACFM)	24576
EXHAUST GAS FLOW RATE (DSCFM)	23231

POLLUTANT DATA

PARAMETER: TOTAL CHROMIUM
MOLECULAR WEIGHT=52

CONCENTRATION (PPM)	2.71 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	.52 $\times 10^{-3}$

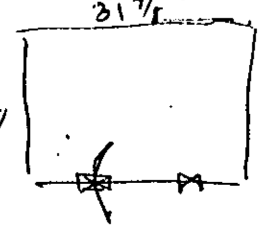
PARAMETER: CHROMIUM +6
MOLECULAR WEIGHT=52

CONCENTRATION (PPM)	1.55 $\times 10^{-3}$
EMISSION RATE (LBS/HR)	.3 $\times 10^{-3}$

FIELD DATA

PLANT Mc 17
DATE 10-1-86
SAMPLING LOCATION SCRUBBER #1
SAMPLE TYPE
RUN NUMBER 1
OPERATOR
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, (P_s)
FILTER NUMBER (s)

31 ½
32 ⅞



SCHEMATIC OF TRAVERSE POINT LAYOUT

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

CONDITION W/ SPARGER ON

READ AND RECORD ALL DATA EVERY 10 MINUTES FIX! 180 only

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft³	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
	0	1045	124.049	.272	.75	.75	63	80		2"		
	10	1055	130.6			.75		80		2"		
	20	1105	137.0			.75		82		2"		
	30	1115	140.3	.272		.75	72	82		2"		
	40	1125	146.0			.75		87				
	50	1135	151.7			.75		90		2"		
	60	1145	156.2	.273		.75	73	90				
	70	1155	162.6			.75		90		2"		
	80	1205	168.5			.75		90		2"		
	90	1215	172.9			.75		90		2"		
	100	1225	178.1			.75		90		2"		
	110	1235	184.4	.272		.75		90				
	120	1245	188.5			.75		90		2"		
	130	1255	194.2			.75		90		2"		
	140	1305	201.0			.75		90		2"		
	150	1315	204.8	.272		.75		90		2"		
	160	1325	210.4			.75		90		2"		
	170	1335	215.6					90		2"		
	180	1345	220.931	END				90		2"		
							70					
			96.882	√.522				90			~~238~~ ml 33.2	

COMMENTS:

FIELD DATA

PLANT McD TORRANCE
DATE 10-1-86
SAMPLING LOCATION SC # 1
SAMPLE TYPE
RUN NUMBER 2
OPERATOR KL
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, (P_s) -1.0
FILTER NUMBER (s) —

31 7/8"

30 7/8"

SCHEMATIC OF TRAVERSE POINT LAYOUT

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER 3
METER $\Delta H_@$ 1.93 1.0V
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

CONDITION: "SPARGER OFF"

READ AND RECORD ALL DATA EVERY 10 MINUTES

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET $(T_{m\,in})$, °F	DRY GAS METER TEMPERATURE OUTLET $(T_{m\,out})$, °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
	0	1355	221.095	.27	.75	.75	73	86		2		
	10	1405	226.1			.75		86		2		
	20	1415	231.8			.75	73	86		2"		
	30	1425	238.3			.75						
	40	1435	242.4			.75	73	86		2"		
	50	1445	247.3			.75		88				
	60	1455	253.2			.75	73					
	70	1505	258.5			.75		86		2"		
	80	1515	264.0			.75	73					
	90	1525	269.8			.75		88		2"		
	100	1535	274.1			.75						
	110	1545										
	120	1555	285.6			.75	73	88		2"		
	130	1605	291.1			.75		88		2"		
	140	1615	296.2			.75				2"		
	150	1625	301.7			.75		86		2"		
	160	1635	307.0			.75				2"		
161	~~170~~	~~1645~~ 1646	307.158	END RUN								
	~~180~~	~~1655~~				END	RUN				85.8	
			86.063 ft^3	$\sqrt{\ }$=.52		.75	73	87			85.V	
											75.8	

COMMENTS:

1 O_2 = 10.8%

2 O_2 = 10.8%

FIELD DATA

PLANT McD
DATE 10-1-86
SAMPLING LOCATION SCRUBBER #2 INLET
SAMPLE TYPE
RUN NUMBER
OPERATOR
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, (P_s)
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER
METER $\Delta H_@$
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 10 MINUTES

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
	0	10:45	746.769	.55	.75	.75	~~80~~ 72	81		3		
	10	10:55	751.5		.75	.75	73	83				
	20	11:05	756.1		.75	.75	70	86		3		
	30	11:15	760.8		.75	.75		81				
	40	1125	766.0			.75		88				
	50	1135	770.1			.75	72	88				
	60	1145	775.2			.75	73	88				
	70	1155	780.6			.75	73	88		3		
	80	1205	784.6			.75						
	90	1215	789.3			.75						
	100	1225	794.1			.75						
	110	1235	798.9			.75				3		
	120	1245	803.6			.75						
	130	1255	808.4			.75	73			3		
	140	1305	812.1			.75						
	150	1315	817.9			.75						
	160	1325	822.7			.75						
	170	1335	827.4			.75						
	180	1345	832.249			.75						
			85.46	.55		.75	72	84			23.7	
				$\sqrt{}$ = .74								

COMMENTS:

FIELD DATA

PLANT McD
DATE 10-1-86
SAMPLING LOCATION Scrubber #2 INLET
SAMPLE TYPE
RUN NUMBER V
OPERATOR
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, (P_s)
FILTER NUMBER (s)

PROBE LENGTH AND TYPE
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER 2A
METER BOX NUMBER 2
METER $\Delta H_@$ 1.99 1.03
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 10 MINUTES

TRAVERSE POINT NUMBER	SAMPLING TIME, min / CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\,in}$), °F	DRY GAS METER TEMPERATURE OUTLET ($T_{m\,out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
	1355 0	832.351		.75	.75	74	83		2		
	1405 10	837.9			.75	72					
	1415 20	842.1			.75	72			2		
	1425 30	846.9			.75	72					
	1435 40	851.6			.75	73			2		
	1445 50	856.4			.75	73	83				
	1455 60	861.2			.75	76	84		2		
	70 1505	866.0			.75	73	84		2		
	80 1515	870.9			.75	73	83				
	90 1525	875.6			.75	73	82		2		
	100 1535	880.4			.75	73	82				
	110 1545	885.3			.75	73	82		2		
	120 1555	890.1			.75	73	82				
	130 1605	894.8			.75	73	82				
	140 1615	899.6			.75	73	82		2		
	150 1625	904.5			.75	72	82				
	160 1635	909.355									
	170 1645										
	180 1655										
		77.004	√=.74		.75	73	83			78.7	

COMMENTS:

FIELD DATA

PLANT McDONNELL DOUGLAS
DATE 10-3-86
SAMPLING LOCATION SCRUBBER #2 INLET
SAMPLE TYPE METHOD 5
RUN NUMBER 1
OPERATOR C. MOK
AMBIENT TEMPERATURE 75
BAROMETRIC PRESSURE 29.5
STATIC PRESSURE, (P_s) –
FILTER NUMBER (s) NONE

PROBE LENGTH AND TYPE NONE / TEFLON TUBING
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER 2A
METER $\Delta H_@$ 1.99 / 8 = 1.03
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp
STACK DIAMETER = 35 7/8" x 37 3/4"

SCHEMATIC OF TRAVERSE POINT LAYOUT

READ AND RECORD ALL DATA EVERY 10 MINUTES

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O DESIRED	ACTUAL	STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE INLET ($T_{m\ in}$), °F	OUTLET ($T_{m\ out}$), °F	PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
	0	11:00	41.425		0.75	0.75	71		63			
	10	11:10	46.12		0.75	0.75	74		81			
	20	11:20	51.13		0.75	0.75	73		83			
★	30	11:30	56.07		0.75	0.75	73		83	9		
	40	12:40	61.1		0.75	0.75	78		90	9		
	50	12:50	65.69		0.75	0.75	76		92	9		
	60	13:00	70.4		0.75	0.75				9		
	70	13:10	75.55		0.75	0.75	73		94	9		
	80	13:20	80.64		0.75	0.75				9		
	90	13:30	84.72		0.75	0.75	78		93	9		
	100	13:40	89.34		0.75	0.75				9		
	110	13:50	94.12		0.75	0.75	71		94	9		
	120	14:00	98.933		0.75	0.75				9		
	TT = 120min		V_m= 57.508	$\sqrt{\Delta p}$ = .72	ΔH=	0.75	T_s= 74	T_m=	86	9"	16.8 ml	

COMMENTS: ★ pump shut off at 11:31 (V_m=56.705) per request of client. Pump turned back on at 12:31.

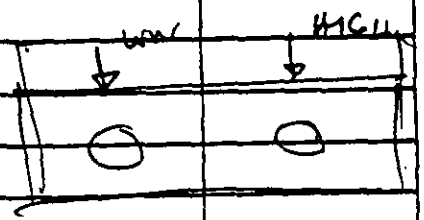
PRELIMINARY VELOCITY TRAVERSE

PLANT TURRMAN
DATE 10-5-86
LOCATION
STACK I.D.
BAROMETRIC PRESSURE, in. Hg
STACK GAUGE PRESSURE, in. H_2O 1.3
OPERATORS

1.
ANODIZE TANK
SCHEMATIC OF TRAVERSE POINT LAYOUT

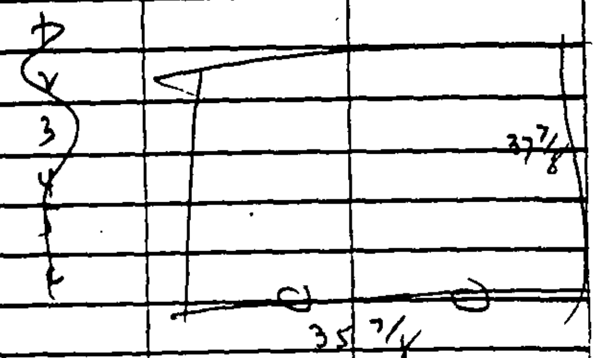
TRI-ACID
#1 37 7/8 x 31 7/8
STD

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.15	63
2	.12	
3	.15	
4	.15	
5	.12	
6	.18	
1	.4	63
2	.3	
3	.25	
4	.22	
5	.3	
6	.35	
	$\Sigma\sqrt{\Delta p}$ = .46	63
AVERAGE		



Scrubber #2 35 7/8" x 37 7/8"

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.55	63
2	.56	65
3	.56	70
4	.57	70
5		
6		
1	.45	70
2	.45	70
3	.40	70
4	.30	70
5	.35	70
6		
$\sqrt{\Delta p}$'s = .874	CAN'T READ W/ STD.	
1.3 PS		
AVERAGE		



EPA (Dur) 233
4/72

FIELD DATA

PLANT McD + D
DATE 10-3-86
SAMPLING LOCATION scrubber #2 outlet
SAMPLE TYPE
RUN NUMBER 1
OPERATOR RON DIAZ
AMBIENT TEMPERATURE
BAROMETRIC PRESSURE
STATIC PRESSURE, (P_s) –
FILTER NUMBER (s) NONE

PROBE LENGTH AND TYPE TEFLON TUBING
NOZZLE I.D.
ASSUMED MOISTURE, %
SAMPLE BOX NUMBER
METER BOX NUMBER 3
METER $\Delta H_@$ 1.93 / 8 = 1.02
C FACTOR
PROBE HEATER SETTING
HEATER BOX SETTING
REFERENCE Δp

SCHEMATIC OF TRAVERSE POINT LAYOUT

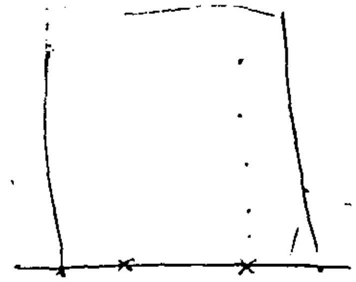
READ AND RECORD ALL DATA EVERY ______ MINUTES

TRAVERSE POINT NUMBER	SAMPLING TIME, min	CLOCK TIME (24-hr CLOCK)	GAS METER READING (V_m), ft^3	VELOCITY HEAD (Δp_s), in. H_2O	ORIFICE PRESSURE DIFFERENTIAL (ΔH), in. H_2O		STACK TEMPERATURE (T_s), °F	DRY GAS METER TEMPERATURE		PUMP VACUUM, in. Hg	SAMPLE BOX TEMPERATURE, °F	IMPINGER TEMPERATURE, °F
					DESIRED	ACTUAL		INLET ($T_{m\,in}$), °F	OUTLET ($T_{m\,out}$), °F			
	0	10:55	309.491	.77	1.0	1.0	68		78	1"		
	10	1105	314.9		1.0	1.0	68		82			
	20	1115	320.4		1.0	1.0				1"		
	30	1125	325.9		1.0	1.0	68		82			
	40	1131 stop	329.691 start 12:30									
	50	1240	334.9		1.0	1.0	71		82	1"		
	60	1250	340.4		1.0	1.0	71		82	1"		
	70	1300	345.9		1.0	1.0						
	80	1310	351.8		1.0	1.0	74		83	1"		
	90	1320	356.9		1.0	1.0			84	1		
	100	1330	362.4		1.0	1.0	73		84	1		
	120	1340	367.9		1.0	1.0						
	130	1350	373.7		1.0	1.0	73		84	1"		
	140	1400	378.936									
	TT = 120min		Vm = 69.445	√p = .44	ΔH =	1.0	Ts = 71		Tm = 82		W.g.	

COMMENTS:

PRELIMINARY VELOCITY TRAVERSE

PLANT: Mc Donnel Douglas
DATE: 10-1-86
LOCATION: SCRUBBER # 1 (TRI-BEND) INLET
STACK I.D.: 31 7/8 × 32 7/8
BAROMETRIC PRESSURE, in. Hg:
STACK GAUGE PRESSURE, in. H_2O: -1.3
OPERATORS: RR / RD



SCHEMATIC OF TRAVERSE POINT LAYOUT

1140

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.28	70
2	.30	70
3	.27	70
4	.23	70
5	.30	70
6	.32	70
$\sqrt{\Delta p_s}$	.534	
AVERAGE		

$$V_s = 85.49\, C_p \sqrt{\frac{T_s}{M_s P_s}}\, \sqrt{\Delta p_s}$$

$$= 85.49 \cdot .84 \sqrt{\frac{530}{29 \cdot 29}}\ .534$$

$$= 30.4 \text{ fps}$$

$$\text{Dscfm} = V_s\, A \times 60 \frac{\text{sec}}{\text{min}}$$

$$= 30.4\ \frac{\cancel{31.875}}{12} \times \frac{\cancel{31.875}}{12} \times 60$$

$$= 13{,}273 \text{ acfm}$$

$$= 12\,551 \text{ dscfm}$$

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.27	70
2	.30	
3	.27	70
4	.21	
5	.25	70
6	.34	
AVERAGE		

EPA (Dur) 233
4/72

PLANT McDonnel Douglas
DATE 10-1-8?
LOCATION Scrubber # 2 (Anodize) Inlet
STACK I.D. 37 7/8"
BAROMETRIC PRESSURE, in. Hg 29.5
STACK GAUGE PRESSURE, in. H_2O
OPERATORS

35 7/8
37 7/8

SCHEMATIC OF TRAVERSE POINT LAYOUT

12:30

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.55	73
2	.55	
3	.56	73
4	.52	
5	.49	
6	.45	72
AVERAGE		

$\sqrt{\Delta p}$ = .721

$V_s = 85.49\ C_p \sqrt{\frac{T_s}{M_s P_s}} \sqrt{\Delta p_s}$

$= 85.49 (.84) \sqrt{\frac{533}{29.24}}\ .721$

= 41.2 fps

Q acfm = V_s A × 60

$= 41.2 \times \frac{35.875 \times 35.875}{144} \times 60$

= 41.2 × 9.436 × 60

= 23 325 acfm

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	.56	72
2	.55	
3	.55	
4	.53	
5	.48	
6	.45	
AVERAGE		

EPA (Dur) 233
4/72

Dscfm $= 23325 \left(\frac{530}{533}\right)\left(\frac{29.}{29.92}\right)$

= 22 057 dscfm

PRELIMINARY VELOCITY TRAVERSE

PLANT McDonnel Douglas
DATE 10-3-86
LOCATION Scrubber 2 outlet
STACK I.D.
BAROMETRIC PRESSURE, in. Hg
STACK GAUGE PRESSURE, in. H_2O
OPERATORS CM/RD

Width 38 6/8" 38.75
30 1/4" 30.25

SCHEMATIC OF TRAVERSE POINT LAYOUT

O_2 21% CO_2 0%

x x
A B

A

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	0.60	70
2	0.90	69
3	1.0	70
4	1.0	63
5	1.4	63
6	1.2	63
1	0.65	63
2	0.92	70
3	1.0	70
4	1.1	70
5	1.6	70
6	1.1	70
AVERAGE		

B

TRAVERSE POINT NUMBER	VELOCITY HEAD (Δp_s), in. H_2O	STACK TEMPERATURE (T_s), °F
1	0.25	70
2	0.36	63
3	0.60	70
4	0.66	70
5	0.68	70
6	0.84	70
	$\sqrt{\Delta p_s}$ =	.87
		68°F
1	0.27	70
2	0.37	63
3	0.62	70
4	0.65	70
5	0.65	70
6	0.80	70
	$\sqrt{\Delta p_s}$ =	.88
		69°F
AVERAGE		

EPA (Dur) 233
4/72

The Determination of Hexavalent Chromium Emissions using a Diphenylcarbazide Colorimetric Method

SAMPLE ANALYSIS

The EPA Method 5 sampling trains were recovered in the laboratory. The probe wash and impinger solutions were combined, diluted to 500 mls and stored at room temperature. These samples were analyzed for hexavalent chromium ~~within 24 hours~~ after sampling following the procedure below.

The analytical procedure consisted of three steps. The initial step consisted of digesting the samples with an alkaline solution of sodium hydroxide and anhydrous sodium carbonate. The digested samples were then filtered. The second step involved reacting the digested and filtered samples with the diphenylcarbazide solution to produce the characteristic red-violet color which allowed the colorimetric determination of hexavalent chromium. The third step consisted of analyzing the reacted samples spectrophotometrically.

The samples were prepared for analysis by an initial digestion and filtration step. A 50 ml aliquot of each sample was taken and combined with approximately 40 mls of the digesting solution. This mixture was heated to near boiling with constant stirring for thirty minutes and then allowed to cool. After the solution had cooled, it was filtered through a 47-mm diameter, 3.0-μm pore size Zefluor filter. The filtered solution was then transferred quantitatively into a 100 ml volumetric flask and diluted to the mark. A deionized water blank was prepared for analysis in the same manner.

Then the samples were reacted with a diphenylcarbazide solution. A 50 ml aliquot of the digested and filtered sample was transferred to another 100 ml volumetric flask and diluted with approximately 70 mls of deionized water. The pH of each sample was adjusted to 2±0.5 with the dropwise addition of 10% (v/v) H_2SO_4 [redacted]. Two mls of the diphenylcarbazide solution were added to each volumetric flask which was then diluted to the mark. This step was also carried out for seven calibration standards prepared from a standard potassium dichromate stock solution. The seven calibration standard solutions, ranging in concentration from 0 ug Cr^{+6} to 100 ug Cr^{+6}, were used to obtain the spectrophotometric calibration factor, Kc. The samples and calibration standard solutions were allowed to stand for 15 minutes to allow full color development.

After full color development, the samples and calibration standard solutions were analyzed spectrophotometrically at the predetermined optimum wavelength.

EMISSION CALCULATIONS

~~The seven calibration~~

The spectrophotometric calibration factor, Kc, was calculated from the absorbance values obtained by the spectrophotometer measurement of the seven calibration standard solutions. The spectrophotometer calibration factor, Kc, was calculated using the following equation:

$$K_c = 25 \frac{A_1 + 2A_2 + 5A_3 + 10A_4 + 15A_5 + 20A_6}{A_1^2 + A_2^2 + A_3^2 + A_4^2 + A_5^2 + A_6^2}$$

Where:

K_c = calibration factor
A_1 = absorbance of the 5 ug Cr^{+6} standard
A_2 = " " " 10 ug Cr^{+6} "
A_3 = " " " 25 ug Cr^{+6} "
A_4 = " " " 50 ug Cr^{+6} "
A_5 = " " " 75 ug Cr^{+6} "
A_6 " " " 100 ug Cr^{+6} "

The total ug Cr^{+6} in each sample, m, was calculated using the following equation:

$$m = \frac{500\ K_c\ AF}{V_a}$$

Where
500 = volume in ml of total sample
A = absorbance of sample
F = dilution factor (if required)
V_A = volume in ml of aliquot analyzed (50)

Douglas Aircraft Test Data

12/1/87 RKS

A.) Test Run No. 1

- tested for 3 hours but anodized for only 40 min. of 3h
- averaged 1.5 kiloamperes or 1,500 amps during 40 min of Cr^{+6} anodizing = 1,000 amp-hours
- "uncontrolled" emission rate (sparge air on) = 3.6×10^{-3} lbs/h
- Tank surface area = 114 ft^2 = 10.6 m^2
- calculation of uncontrolled emissions (mg/Ah)

$$\frac{3.6 \times 10^{-3}\ \text{lb}}{\text{h}} \left| \frac{0.4536\ \text{kg}}{\text{lb}} \right. = \cancel{1.633 \times 10^{-3}\ \frac{\text{kg}}{\text{h}}} \text{ or } 1.633 \times 10^{3}\ \frac{\text{mg}}{\text{h}}$$

$$\frac{1.633 \times 10^{3}\ \text{mg}}{\text{h}} \left| 0.67\text{h} \right| \frac{}{1{,}000\ \text{Ah}} = 1.1\ \text{mg/Ah}$$

- $(1.633 \times 10^{-3}\ \text{kg/h}) \div 10.6\ m^2 = 1.54 \times 10^{-4}\ \frac{\text{kg/h}}{m^2}$

B.) Test Run No. 2

- tested for 3 h and anodized during all 3 h (testing was stopped to change parts).
- averaged 1.5 kiloamperes or 1,500 amps during anodizing = 4,500 Ah
- Cr^{+6} uncontrolled emission rate (sparge air on) = 6.24×10^{-3} lbs/h
- calculation of uncontrolled emissions (mg/Ah)

$$\frac{6.24 \times 10^{-3}\ \text{lb}}{\text{h}} \left| \frac{0.4536\ \text{kg}}{\text{lb}} \right. = \cancel{2.83 \times 10^{-3}\ \frac{\text{kg}}{\text{h}}} \text{ or } 2.83 \times 10^{3}\ \frac{\text{mg}}{\text{h}}$$

$$\frac{2.83 \times 10^{3}\ \text{mg}}{\text{h}} \left| 3\ \text{h} \right| \frac{}{4{,}500\ \text{Ah}} = 1.9\ \frac{\text{mg}}{\text{Ah}}$$

- $(2.83 \times 10^{-3}\ \text{kg/h}) \div (10.6\ m^2) = 2.67 \times 10^{-4}\ \frac{\text{kg/h}}{m^2}$

Reliable Plating

Tank dimensions = $\underbrace{11.5, \overbrace{2.0}^{23\ ft^2}}$, 3.0 ft
$= \underbrace{3.5, 0.61}_{2.13\ m^2}, 0.91\ m$

A) Run No. 1

- $1.9 \times 10^{-3} \frac{kg}{h} = \frac{1.9 \times 10^{3}\ mg}{h} \left| \frac{1\ h}{86.5\ Ah} \right. = 22 \frac{mg}{Ah}$

- $(1.9 \times 10^{-3}\ kg/h) \div (2.13\ m^2) = 8.92 \times 10^{-4} \frac{kg/h}{m^2}$

B) Run No. 2

- $0.39 \times 10^{-3} \frac{kg}{h} = \frac{0.39 \times 10^{3}\ mg}{h} \left| \frac{1\ h}{25.8\ Ah} \right. = 15 \frac{mg}{Ah}$

- $(0.39 \times 10^{-3}\ kg/h) \div (2.13\ m^2) = 1.83 \times 10^{-4} \frac{kg/h}{m^2}$

C) Run No. 3

- $0.15 \times 10^{-3} \frac{kg}{h} = \frac{0.15 \times 10^{3}\ mg}{h} \left| \frac{1\ h}{20\ Ah} \right. = 7.5 \frac{mg}{Ah}$

- $(0.15 \times 10^{-3}\ kg/h) \div (2.13\ m^2) = 7.04 \times 10^{-5} \frac{kg/h}{m^2}$

D) Run No. 4

- $2.5 \times 10^{-3} \frac{kg}{h} = \frac{2.5 \times 10^{3}\ mg}{Ah} \left| \frac{1\ h}{100\ Ah} \right. = 25 \frac{mg}{Ah}$

- $(2.5 \times 10^{-3}\ kg/h) \div (2.13\ m^2) = 1.17 \times 10^{-3} \frac{kg/h}{m^2}$

Avg
- $1.2 \times 10^{-3} \frac{kg}{h}$
- $5.79 \times 10^{-4} \frac{kg/h}{m^2} \Rightarrow 6 \times 10^{-4} \frac{kg/h}{m^2}$

11/17/86

~~McDonnell~~ Douglas Aircraft Co.

~~Ken Svoboda~~

Ken Svoboda
3855 Lakewood Blvd.
Long Beach, Ca 90846
Mail Code 73-40
(Dept. C1-711)

Kent Adams
Sen. Env. Eng.
Env. Compliance

~~K~~ Env. Compliance Dept.

Aluminum Aircraft Parts.
80% of Commercial + Defense /
70% of Parts into Plane

1. Alkaline Cleaner
Sodium Phosphate
" Borate

2. Water Rinse

Raw Imp.

3. Spray Rinse
DI. Water

4. Nitric Acid
CrO_3
Hydrofluoric Acid

Catch Tank

5. Rinse
Tank

6. CrO_3
Anodizing

7. Rinse
DI + water

Chromating
Anodic Seal
Potassium
dichromate

CrO_3 Anodizing Tank

95-100°F

Vol. ≈ 5,000 gal

[CrO_3]

3-5% by wt.

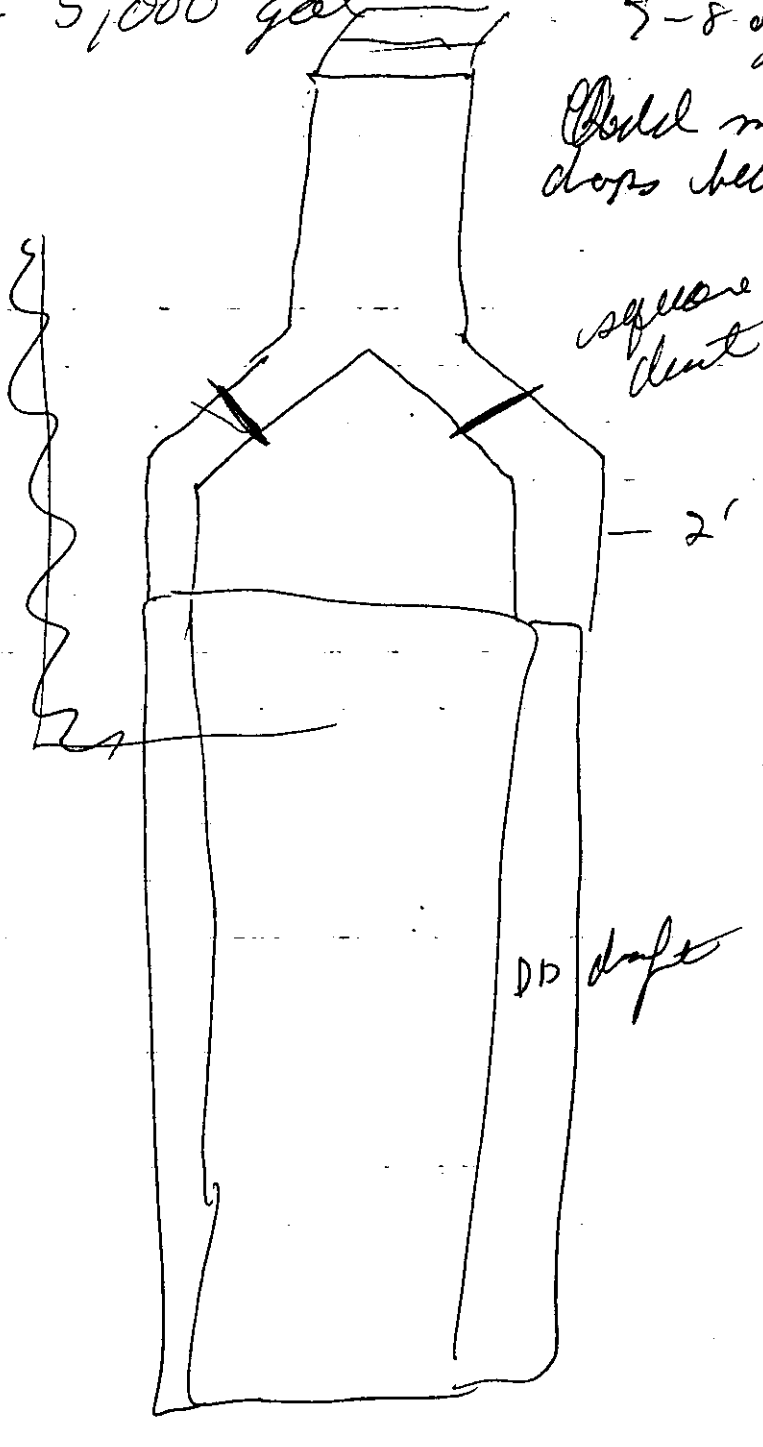
7-8 oz/gal.

Add more when drops below 7 oz/gal

Heating & cooled

1½ kiloamps

30-40 volts



Etch Tank

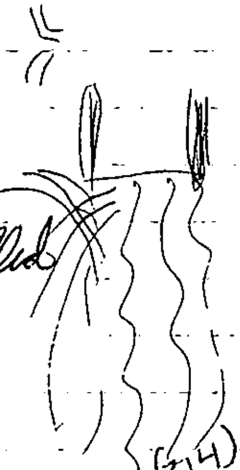
Duall F100 CFM = ~~21,000~~ 16,000
Serial No. ~~3742~~ 9331
2" SP
20 HP ~~blower~~
3 HP pump

Anodizing Tank

Duall F101 CFM = 21,000

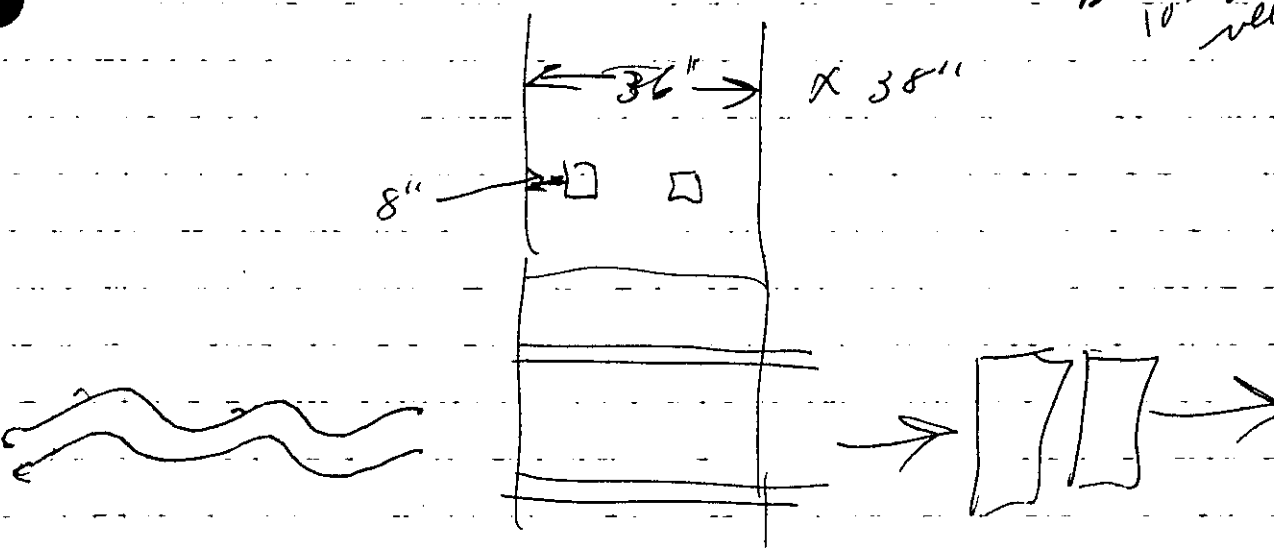
GPM = 54 SP = 2"
Ser No. 3742

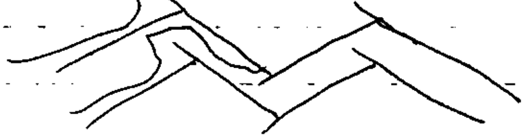
Installed ~~1980~~ 1979



~~(314) 230~~ (314) 694-1000 Envirochem Systems
Monsanto
- Brink Mist Eliminator
- St. Louis MO.
- Brownian motion
10-40 ft/min velocity

Anodizing Tank





Vortile packed-bed (2') scrubbers

Harrington Ind. Plastics, Inc.
Annaheim (714) 829-9030

Ceroform ME

$\boxed{11/30/87}$ Ken Svobda

Anodizing

Run No. 1.: 40 min. anodized
1.5 K amps for 40 min.
3 h of test

Run No. 2.: 3 h anodized
1.5 - 2 K amps on avg $\boxed{\text{use 1.5 k amps}}$
3 h test
3 batches at 40 min each

Etch tank No current parts etched for 5 min.
smooths surface

[redacted]

[redacted] Hydrofluoric acid

Seattle
Witichatau, KS

Boeing subcontracts anodizing to Northrup

Lockheed in Marietta, Georgia Headquarters in Burbank
C5A military transport planes

Houston Dallas are

General Dynamics
~~Ke [illegible]~~ Rohr, San Diego - subcontractor for Douglas
Rockwell ?
Grummond - East coast
McDonald Douglas
General Dyn

McDonald - Douglas
→ Rohr
→

Space equipment manufacturers
1.) Hughes
2.) Rockwell
3.) Martin Marietta

Test report & risk results
→ Will be totally public by middle of Jan.

April or May will be testing new baths
- scrubber + mist eliminators
- Herington - Single packed-bed w/ 2 ft. packing. Vertical flow unit
  - mist eliminator sign wave upstream & mesh pad downstream.
  - inlet + outlet
- got spikes over 1st 5 min. increase voltage.
- last 35-40 min. amps was constant.
- avg. 2-3 amp/ ft^2 over 40 min period time weighted average.

Long Beach, California - will be testing a new anodizing tank in March or April of 1988.

$$\left(3.6 \times 10^{-3} \frac{lb}{h}\right)\left(0.4536 \frac{kg}{lb}\right)\left(\right.$$

$$\left(1.633 \times 10^{-3} \frac{kg}{h}\right)\left(10^{6} \frac{mg}{kg}\right) = 1.633 \times 10^{3} \ mg/h$$

$$\left(1.633 \times 10^{3} \frac{mg}{h}\right)\left(3 h\right) = 4.9 \times 10^{3} \ mg$$

$$\frac{4.9 \times 10^{3} \ mg}{4,500 \ Ah} = 1.0 \ mg/Ah$$

Douglas Aircraft   Longbeach, Calif.

80,000 gal chromic anodizing tanks
South Coast Air Resource

29,000 gal

Eng. Science

(213) 496-6335

Ken Svorda - Knows a lot about Mist Eliminators
Have test data - 3 runs.
- Need to know what was tested
Where tested, how tested,
700,000 cfm

Coming up w/ proposal

Need 99% control

Cameron Francis
State of Calif. Air Resource Board

SCAMD

Address: Next to Long Beach Airport off
Freeway.

Best way to get ~~there~~?

12:15

Test inlet & outlet?
ie Uncontrolled Condition?

SCAMD

Test – 4,000 – 5,000 gal ~~tanks~~

South on ~~Long Beach~~ Harbor Freeway → S
405 Freeway (San Diego Freeway) → to
San Diego Freeway route on 405 → Past
Long Beach Freeway → W Lakewood Blvd.
→ to R on Spring Street →
R at first stoplight onto Airport Plaza
Drive → Second Bldg on Rt next to
Marriot → turn Rt by Marriot

4800 Airport Plaza Drive
Ken Srooda: X 66335