Background Report Reference

AP-42 Section Number: 12.20

Background Chapter: 4

Reference Number: 36

Title: September 1984 (Naval Energy and Environmental Support Activity, Port Huenana, CA) Source Emission Testing and Industrial Ventilation Survey of Bldg. 210 Plating Shop

June 1984

ELECTROPLATING
REF. 4-36

SOURCE EMISSION TESTING AND INDUSTRIAL VENTILATION SURVEY
OF BUILDING 210 PLATING SHOP
Long Beach Naval Shipyard
Long Beach, California
7 May - 2 June 1984

ACCEPTABLE

SOURCE EMISSION TESTING OF THE BUILDING 195 PLATING SHOP
Norfolk Naval Shipyard
Portsmouth, Virginia
11-18 March 1985

ACCEPTABLE

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Office of Air Quality Planning and Standards
Research Triangle Park, North Carolina 27711

122 ...

MEMORANDUM

SUBJECT: Acceptability of Test Reports for Use as a Data Base for Chromium NESHAP

FROM: Frank R. Clay FRC
Field Testing Section, EMB, TSD (MD-14)

TO: Andrew Smith
Industrial Studies Branch, ESD (MD-13)

I have reviewed the test reports that are attached. Some of the reports are acceptable while others are not. The reports are listed below, and unacceptable reports are described in detail as to why they should not be used. I will continue to review the other reports that you have given to me and will send another group of reports as soon as the review has been completed.

TRUESDAIL LABORATORIES, INC.
Test of Dames and Moore
222 E. Annapamu
Santa Barbara, California 93101

UNACCEPTABLE

In reviewing the data, the outlet location gives the moisture content at the outlet as 2.50 percent. At 66°F, saturation moisture content at the absolute stack pressure and this temperature is 2.16 percent.

There are no meter box calibration sheets present, and consequently, no meter box correction factor.

There are no delta p values on the field data sheets to determine the point velocities during sampling.

The nozzles do not appear to have been measured with a micrometer.

TRUESDAIL LABORATORIES, INC.
Source Test of Intermetro Industries
9393 Arrow Highway
Cucamonga, California 91730

UNACCEPTABLE

Page 1 of the report describes cyclonic flow that was found at the outlet. The page also mentions that sampling was done at the angle of maximum velocity head which was 45 degrees. When testing for cyclonic flow, the angle of maximum delta p is not the angle of flow. The angle of flow is 90 degrees from the null reading on the pitot tube which is not the same as the angle of maximum delta p. When cyclonic flow is present, the sampling time per point must also be adjusted based on the angle. If all the angles are the same, the time adjustment is not necessary, however, in this case, it is not possible to know what the true angles were.

EMBEE PLATING TEST
2136 South Hathaway
Santa Ana, California 92705

UNACCEPTABLE

This report should not be used. First, there are not enough data sheets and related forms/sheets to tell how precisely the test was performed. On System 1, the moisture content was given at 3.7 percent. Saturation moisture content at 70 degrees F is 2.47 percent Emission data based on 3.7 percent are incorrect. The text also mentions that a piece of 3/8 inch Teflon tubing was used to collect the sample. There is no mention of a nozzle so it must be assumed that the tubing is also the nozzle. To sample isokinetically, the sample size should have been around 90 cubic feet an hour. The sample volume was about half that so the sampling was not within the acceptable isokinetic limits. For System 2, the runs are not within the isokinetic limits that the Agency requires.

CHEVROLET LIVONIA BUMPER PLANT
No. 4 Heil Evaporator
Tested by the Chevrolet Central Office of Environmental Engineering Department
Tested September 24, 1979

UNACCEPTABLE

This report is unacceptable for the following reasons: First, the necessary field data sheets to determine the correctness of the values in the report are not available. Second, all points at the inlet were not sampled (see further comments). Third, this test effort was made to gather data to correct emission problems, not to sample the control device in normal operating conditions. Fourth, there appears to be a large discrepancy between the volumetric flow rates found by the EMB test and this test.

This facility has been tested by EMB, but only at the inlet location. EMB testing performed in the normal production mode. The test done by the Chevrolet environmental group was done in an effort to maximize collection efficiency, and two parameters of the evaporator operation were monitored and/or altered to simulate conditions which could exist within the system, possibly causing an upset in the collection efficiency of the unit. Thus data generated on this test may not be typical of normal operating conditions.

The Chevrolet test sampled the inlet location at only two ports and chose sampling points of average velocity. While the points may be of average velocity, it does not necessarily follow that the distribution of chromium in the duct is uniform. Furthermore, the outlet volumetric flow rate was also used to determine emissions at the inlet. If leakage occurs between the inlet and outlet, the mass emission rates at the inlet will be biased high and the control device efficiency will also be biased high. When comparing the inlet volumetric flow rates, the EMB flows are about 28 percent lower than company flows.

In checking the outlet data, there are no field data sheets or other associated data sheets that were generated at the site; only typewritten data are provided. It appears that the calculations were done based on 70 degrees as standard temperature rather than 68.

It appears that the outlet data might be usable if the data sheets from the test could be provided. One item to consider, however, is whether or not this test represents process conditions that could be used in determining chromium emission standards.

accept

NEESA 2-119 September 1984

SOURCE EMISSION TESTING
AND
INDUSTRIAL VENTILATION SURVEY
OF BUILDING 210 PLATING SHOP

at

Long Beach Naval Shipyard
Long Beach, California
7 May-2 June 1984

By:

Susan Suzuki
William Powers
Robert Wood

Naval Energy and Environmental Support Activity
Port Hueneme, California 93043-5014

EXECUTIVE SUMMARY

Emission testing was performed on five wet scrubbers at the Electronics Weapons Precision Facility Plating Shop, Building 210, Long Beach Naval Shipyard, from 7 May to 2 June 1984. An industrial ventilation survey of the plating shop was performed concurrently with the emission testing program.

A. Emission Testing

Emission tests show that four of the scrubbers operating at the plating shop are unnecessary due to the negligible pollutant concentrations entering the scrubbers. Recommend that scrubbers on exhaust lines 101, 102, 105, and 106 be taken out of service and that the internal gas cleaning components be removed from these scrubbers to reduce the static pressure load on the exhaust fans. A reduction in exhaust fan static pressure load will reduce fan power requirements and result in significant energy savings.

Pollutant concentrations in exhaust lines 103 and 104 are high and the use of scrubbers on these exhaust lines is appropriate. The efficiency of the scrubber on Line 103 (chrome plating tank exhaust) is greater than 90%, adequate to control the chromic acid mist emissions. The scrubber on Line 104 (hydrochloric acid tank exhaust) was not operational during the test period and efficiency testing was not performed on Scrubber 104. Extensive acid attack of metal surfaces in the vicinity of the Scrubber 104 outlet indicates inadequate scrubber efficiency. Efficiency testing of the scrubber on Line 104 is recommended. It is also recommended that feedwater flowmeters be installed on the scrubbers on lines 103 and 104 to ensure scrubbers are operating at feedwater flowrates required for maximum scrubber efficiency.

B. Ventilation

Existing mechanical supply air equipment provides 94,000 standard cubic feet per minute (SCFM) less than is required to provide a balance with exhausted air. This condition causes turbulent cross-drafts which reduce local exhaust hood capture efficiencies. Recommend the installation of additional supply air equipment to correct the 94,000 SCFM imbalance. Sealing the three 8-foot by 8-foot wall-mounted air grills and providing tank baffles are also recommended to improve capture efficiency.

Recommend sealing the sump trench connecting exhaust lines 101, 102, and 103 to prevent cross-contamination. Installation of indicating devices to monitor supply air and exhaust air fans is also recommended to ensure proper fan operation.

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NOMENCLATURE

Symbol	Unit	Description
A_s	in^2	Stack cross sectional area
	CF	Cubic feet
	CFM	Cubic feet per minute
	BHP	Brake horsepower
CO_2	%	Measured carbon dioxide content
CO_{2m}	SCFM	Carbon dioxide measured flow rate = $(CO_2)(Qs)/100$
Cp		Pitot tube calibration factor
Dn	inches	Nozzle diameter
Dp	microns	Particle diameter
	DSCF	Dry standard cubic feet
	DSCFM	Dry standard cubic feet per minute.
D_{p50}	microns	Mass mean particle diameter
	fpm	Feet per minute
G	32.1725 ft/sec	Acceleration due to gravity
	g	Gram
	gr	Grain, 1/7000th of a pound
	hp	Horsepower
	hr	Hour
%I	%	Isokinetic
	lb	Pound
	kW	Kilowatt
%M	%	Percent moisture in stack gas by volume
ME	%	Mechanical efficiency
M_d		Mole fraction dry gas

Symbol	Unit	Description
	μ	Micron, 1×10^{-6} meters
	mg	Milligram, 1×10^{-3} grams
M_f	g	Particulate weight collected on probe and filter
M_t	g	Particulate weight—total
M_w	g	Mass of water in particulate train
MW	lb/lb-mole	Molecular weight of stack gas
MW_{air}	28.9641 lb/lb-mole	Molecular weight of air at standard conditions
MW_d	lb/lb-mole	Molecular weight of dry stack gas
MW_{H_2O}	18.0153 lb/lb mole	Molecular weight of water
O_2	%	Measured oxygen content
Pb	"Hg absolute	Barometric pressure
Ps	"Hg absolute	Stack pressure
ΔP	"H_2O	Velocity head of stack gas
P_{std}	29.92125 "Hg	Standard barometric pressure
$\dot{Q}s$	DSCFM	Stack gas dry flow rate
R	21.85 "Hg-ft^3/lb-mole-R°	Universal gas constant
	RPM	Revolutions per minute
	SCF	Standard cubic feet
SP	"H_2O	Static pressure
t_{amb}	°F	Ambient temperature
t_m	°F	Control box meter temperature
T_t	min	Net time of test
t_s	°F	Stack gas temperature
T_{std}	528°R	Standard temperature

Symbol	Unit	Description
V_m	ft^3	Volume of dry gas sampled @ meter conditions
$V_{m_{std}}$	DSCF	Volume of dry gas sampled @ standard conditions
V_s	fpm	Stack velocity @ stack conditions
V_w	ml	Total water collected in impingers and desiccant
$V_{w_{gas}}$	ft^3	Volume of water vapor collected @ standard conditions
$\Delta H@$	"H_2O	Orifice pressure drop across meter
ρ_{air}	0.075224 lbs/ft^3	Density of air at standard conditions
ρ_{H_2O}	62.31639 lbs/ft^3	Density of water at standard conditions
ρ_{H_2O}	0.99824 g/ml	Density of water at standard conditions

Standard conditions are 68°F, 29.92126 "Hg

Symbol	Description
Ag^{+}	Silver ion
AgCN	Silver Cyanide
Al^{+++}	Aluminum ion
Cd^{++}	Cadmium ion
Cl^{-}	Chloride ion
CN^{-}	Cyanide ion
$CO_3^{=}$	Carbonate ion
Cr^{+3}	Trivalent Chromium ion
Cr^{+6}	Hexavalent Chromium ion
Cr_{tot}	Total Chromium ion
CrO_3	Chromic Acid
Cu^{++}	Copper ion
CuCN	Copper Cyanide
F^{-}	Fluoride ion
HCL	Hydrochloric Acid/Muriatic Acid
K^{+}	Potassium ion
K_2CO_3	Potassium Carbonate
KCN	Potassium Cyanide
KOH	Potassium Hydroxide
Na^{+}	Sodium ion
Na_2CO_3	Sodium Carbonate
NaCN	Sodium Cyanide
NaOH	Sodium Hydroxide
Ni^{++}	Nickel ion
$NiCl_26H_2O$	Nickel Chloride
NiSO4	Nickel Sulfate
PO_4^{-3}	Phosphate ion
$SO_4^{=}$	Sulfate ion

LONG BEACH NAVAL SHIPYARD PLATING SHOP

I. INTRODUCTION

In response to a request[1] from Western Division, Naval Facilities Engineering Command (WESTNAVFACENGCOM), San Bruno, California, the Naval Energy and Environmental Support Activity (NAVENENVSA) Source Emission Test (SET) team tested emissions from five wet scrubbers at the Electronic Weapons Precision Facility Plating Shop, Building 210, Long Beach Naval Shipyard (NAVSHIPYD), from 7 May to 2 June 1984. An industrial ventilation survey was also performed during the emission test period.

II. TECHNICAL BACKGROUND

A. General

Lack of adequate emissions data has made it difficult to determine the level of emission control necessary on cleaning and plating processes in Navy plating shops. Commander, Naval Facilities Engineering Command (COMNAVFACENGCOM) tasked NAVENENVSA to evaluate emissions from selected Navy plating shops to determine the level of air pollution control needed for various plating shop processes. Building 210 plating shop, Long Beach NAVSHIPYD is one of two Navy plating shops being tested by the NAVENENVSA SET team. Long Beach NAVSHIPYD requested NAVENENVSA test the plating shop ventilation system during air emissions testing. Results from ventilation system testing are reported concurrently with the air emissions test results.

B. Facility Description

1. General. The plating shop ventilation system consists of six separate local exhaust systems (figures 1-7) and four roof-mounted heating and ventilating (HV) units supplying air through sixteen concentric cone diffusers mounted in the ceiling (Figure 8). The local exhaust systems ventilate thirty-three tanks, with push-pull exhaust hoods on eighteen tanks and lateral exhaust hoods on fifteen tanks.

2. Exhaust System. The plating shop exhaust system consists of six subsystems: Chrome line, acid line, heavy metal line, chromate line, and two alkaline lines. Two scrubbers (101 and 102), each designed to operate at 35,000 cfm, serve the alkaline tanks. The chrome line has one scrubber (103) designed to operate at 25,000 cfm. The acid line has one scrubber (104) designed to operate at 39,000 cfm. The heavy metal line (105) and the chromate line (106) each have scrubbers designed to operate at 50,000 cfm. See figures 1-7.

The scrubbers are thin-bed packed tower units designed for the control of aerosols. These units consist of a spray chamber with media pads located below a network of spray nozzles. The chamber is followed by mist eliminator pads. The scrubber body is mated to the fan by a reducing transition.

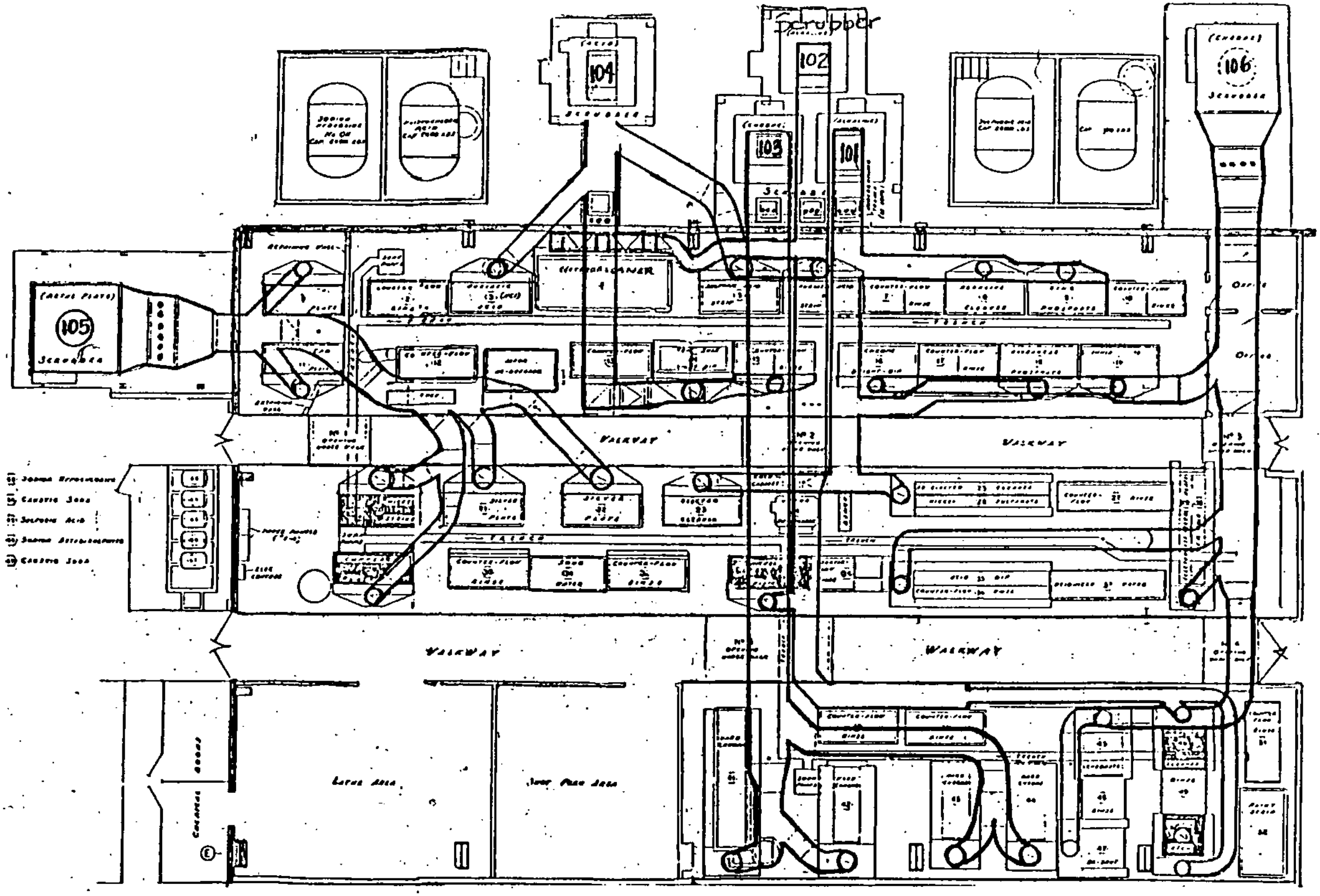
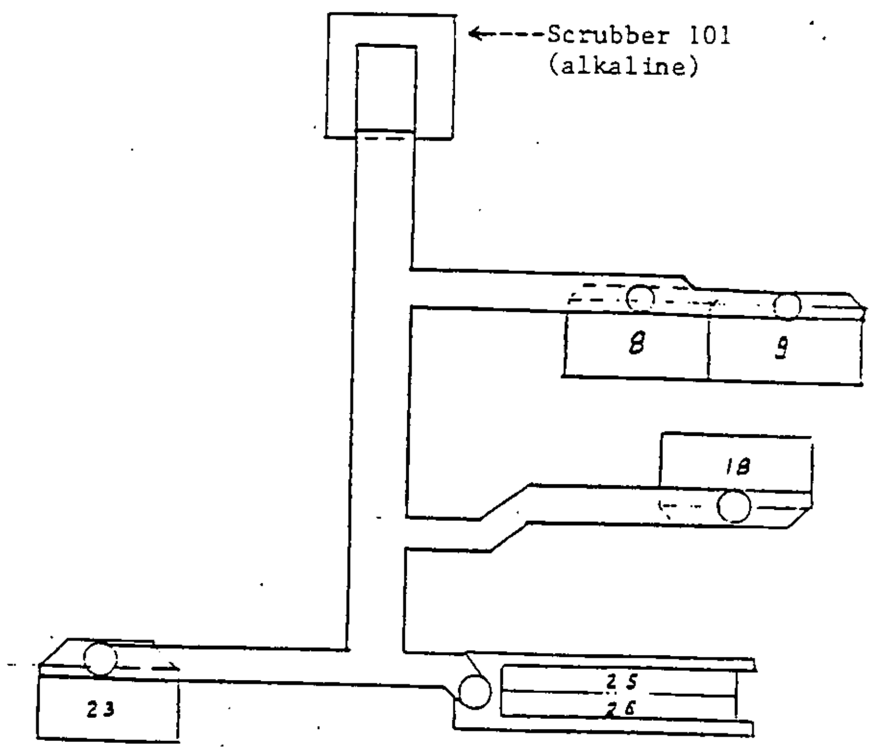
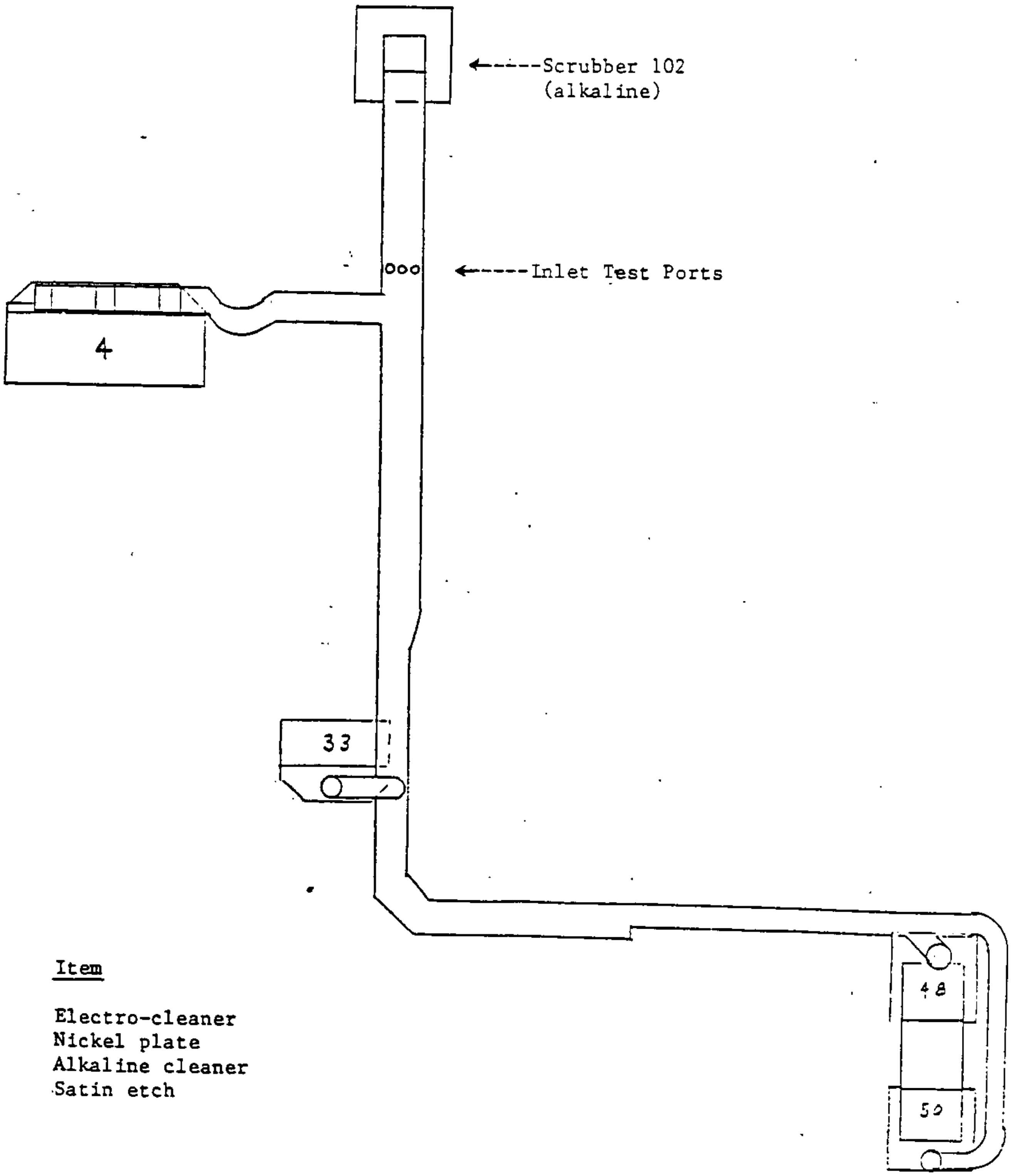


Figure 1. Scrubber and Tank Locations, Bldg. 210 Plating Shop



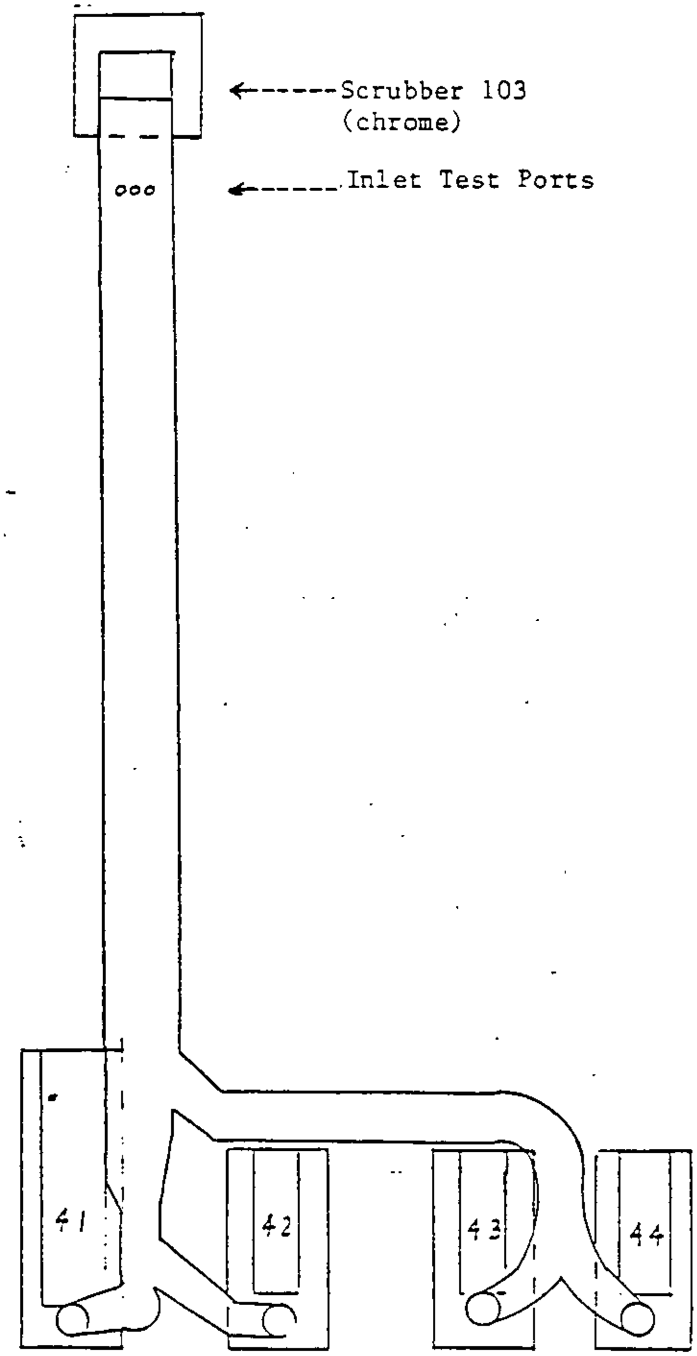
Tank No.	Item
8	Alkaline cleaner
9	Zinc Phosphate
18	Manganese phosphate
23	Electro cleaner
25	Electro cleaner
26	Nickel sulfamate

Figure 2. Line 101



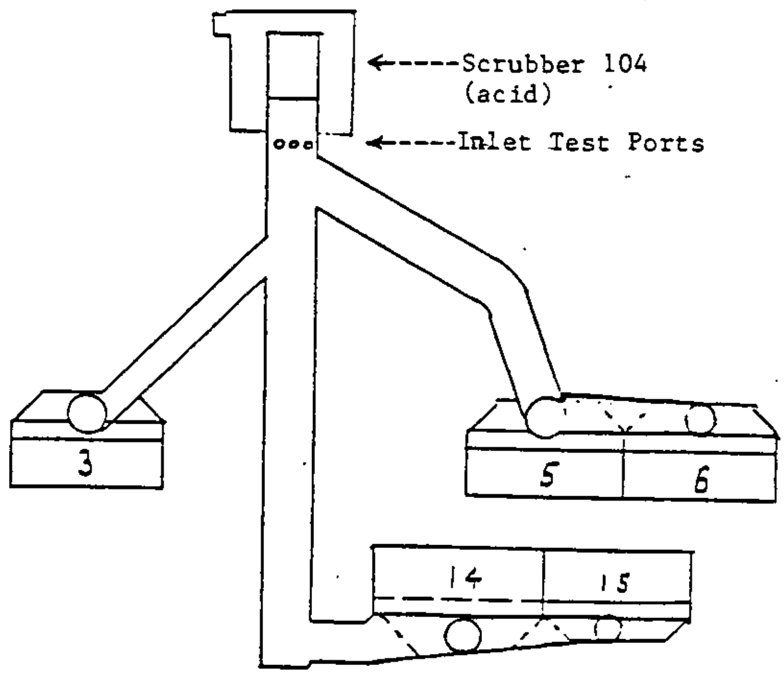
Tank No.	Item
4	Electro-cleaner
33	Nickel plate
48	Alkaline cleaner
50	Satin etch

Figure 3. Line 102



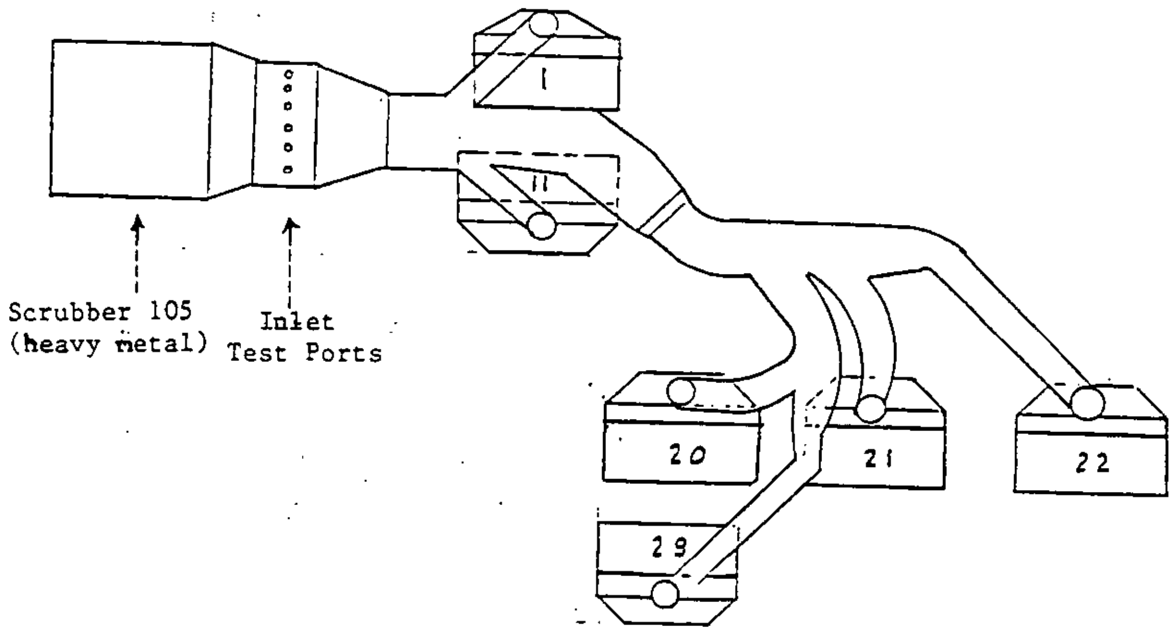
Tank No.	Item
41	Hard chrome
42	Hard chrome
43	Hard chrome
44	Decorative chrome

Figure 4. Line 103



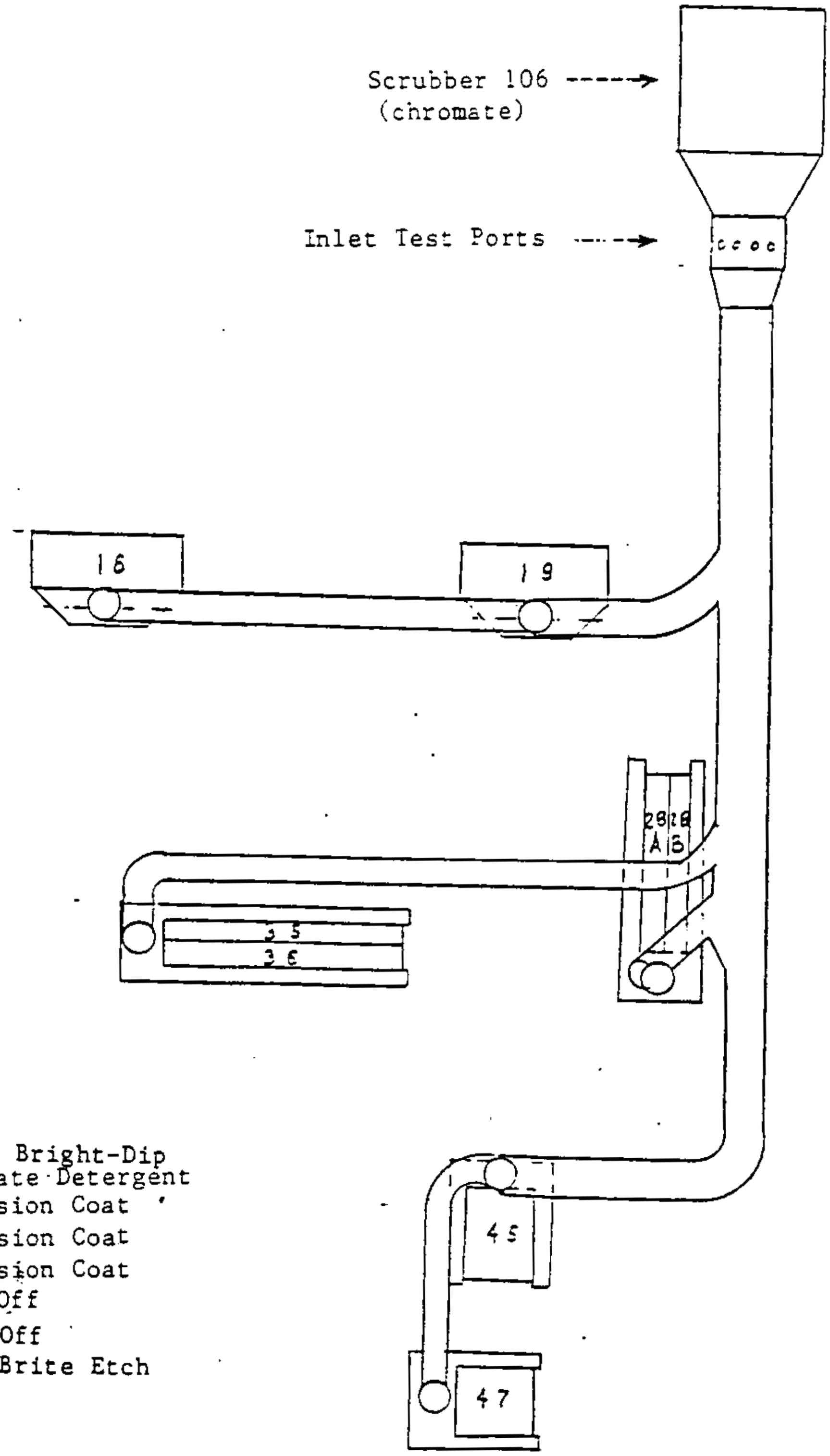
Tank No.	Item
3	Muriatic (HCL) acid
5	Sulfuric acid strip
6	Sulfuric acid strip
15	Counter-flow rinse
14	Iradite

Figure 5. Line 104



Tank No.	Item
1	Cad plate
11	Cad plate
20	Nickel strike
21	Silver plate
22	Silver plate
29	Copper plate

Figure 6. Line 105



Tank No.	Item
16	Chrome Bright-Dip
19	Phosphate Detergent
35	Conversion Coat
36	Conversion Coat
45	Conversion Coat
47	Smutt-Off
28A	Smutt-Off
28B	Micro Brite Etch

Figure 7. Line 106

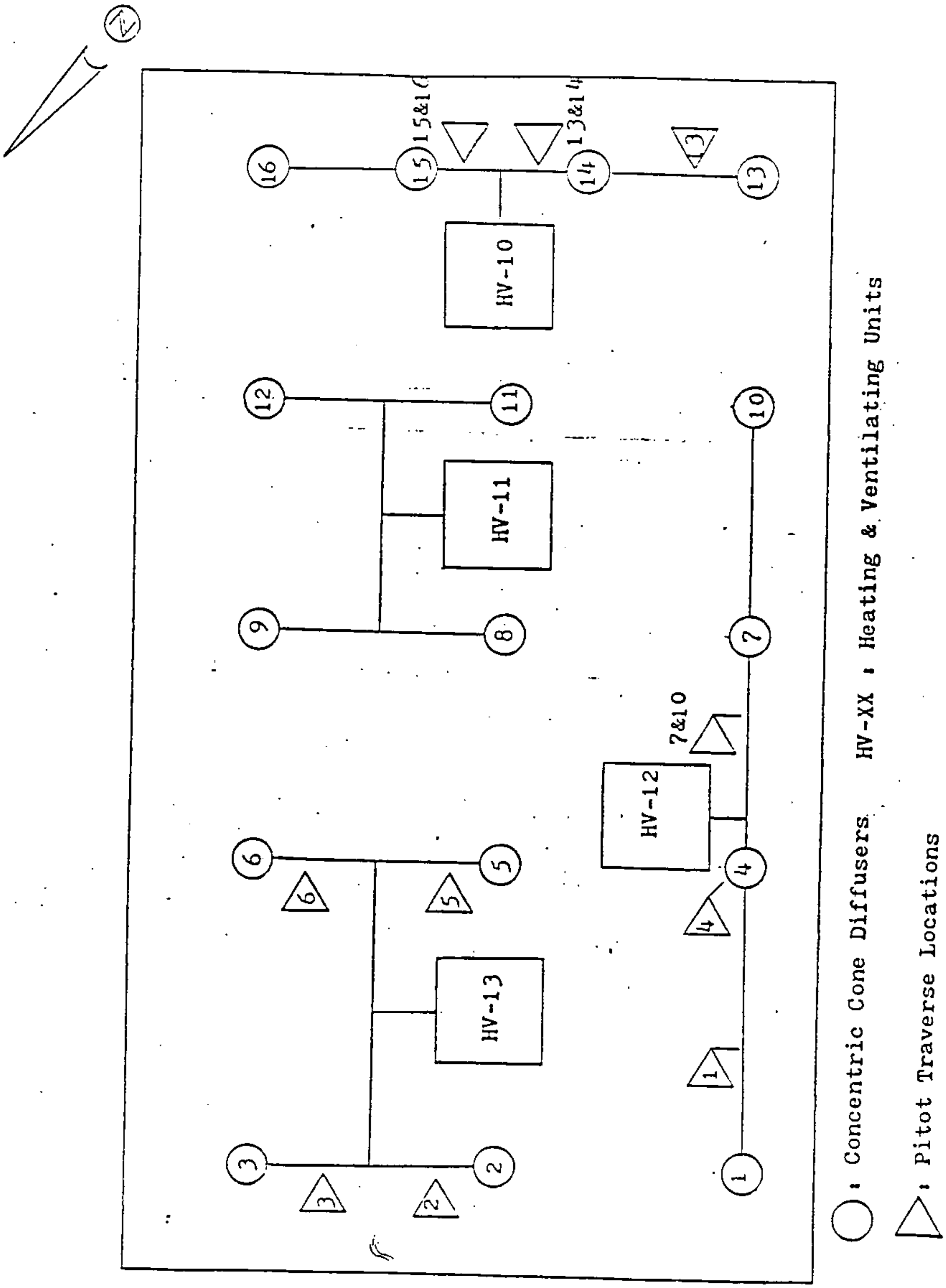


Figure 8. Supply Air Schematic

Thin-bed packed towers collect liquid aerosols by particle size growth in the spray chamber section. Removal is accomplished by impingement in the media pads.

Table 1 identifies the plating tanks and tank chemical solutions served by each line.

3. Supply Air System. Air exhausted from the plating shop is partially supplied by four mechanical heating and ventilating units on the roof. Infiltration through three 8-foot by 8-foot wall grills, two 6-foot by 9-foot double doors, and two 6-foot by 7-foot double doors accounts for the additional supply air. The three grills and two 6-foot by 9-foot doors are located in the northwest wall. The two doors remained open 24 hours a day during the survey.

C. Air Emission Sources[3]

Air pollution is associated with two processes in the plating operation, cleaning and electroplating. In the cleaning process, work pieces are cleaned to remove oil, grease, dirt, scale, and old plating. Cleaning involves the following major steps:

1. Mechanical cleaning to remove loose dirt and scale is usually done using a wire brush or wire wheel. Some particulate air pollution is produced, though the particles are large and their effect is limited to the work area.

2. Precleaning by solvent-soaking or vapor-degreasing is used to clean heavily soiled or painted items. Hydrocarbon gases can be generated by the process, but usually are not a major source of pollution unless the precleaning operation is large. The Long Beach NAVSHIPYD plating shop has three tanks for this purpose. Potentially hazardous gases are emitted from these tanks, which have no exhaust ventilation.

3. Intermediate cleaning in a strong alkaline bath is used to further remove greases. Aerosols are formed by the intermittent dipping of items into these solutions. Aerosols can also be formed by agitation or splashing during the cleaning process. The amount of aerosol formed is usually small and represents a localized nuisance in the shop rather than an air pollution source. Intermediate alkaline cleaning in the Long Beach NAVSHIPYD plating shop is not an air pollution problem, but it is responsible for localized corrosion around the cleaning tanks.

4. Electrocleaning, one of the two final cleaning steps, is accomplished by passing a current through a strong alkaline bath. Chemical action from the caustic solution dissolves and loosens remaining dirt. Mechanical action from electrolysis (gassing) lifts off the loosened dirt. Gassing can form an aerosol mist at the liquid surface and contribute small amounts of airborne emissions.

5. Pickling is also used in the cleaning process. Pickling is achieved by soaking items in an acid bath with or without an induced current. The cleaning process is similar to electrocleaning but usually produces more

TABLE 1
Tank Data

Location: LBNSY, Plating Shop
Building: 210

Date: ____________

Scrubber No.	Tank No.	Dimensions LxWxD (ft)	Capacity (gallons)	Temp (°F)	Name	Constituents (oz/gal)
101	8	9x3.5x6	1300	140	Cleaner soak A-54	Cee-Bee A-54 (8-16, sodium orthosilicate 10-20%)
101	9	9x3.5x6	1300	150	Phosphate Acid	
101	18	9x3.5x6	1300	120	Phosphate Seal	
101	23	9x3.5x6	1300	150	Electro Cleaner PD #77	Cee-Bee PC-77 (2-3, sodium orthosilicate 30-50%, NaOH 40-60%) pH 12.5
101	25	16x1.5x5	900	150	Caustic Cleaner Soak #107	Micel soak #107 (8-16, NaOH 20%
101	26	16x1.5x5	900	150	Al Etch #3	Omega Al Etch #3 (2-12, NaOH 95%) pH 13
102	4	16x6x8	5400	180	Caustic Cleaner #180	Cleaner 180 (4)
102	33	9x3.5x6	1300	150	Nickel Plate	Ni (10-14) + $NiCh_2 6H_2O$ (6-12) + $NiSO_4$ (36-48) + Boric Acid (6-7) pH 4-4.6
102	48	5x5x5	700	Room	Caustic Cleaner, Soak	
102	50	5x5x5	700	180	Al Etch #3	Omega Al Etch #3 (2-12, NaOH 95%) pH 13

TANK DATA

Location: LBNSY, Plating Shop
Building: 210

Date: ____________

Scrubber No.	Tank No.	Dimensions LxWxD (ft)	Capacity (gallons)	Temp (F)	Name	Constituents (oz/gal)
103	41	16x3.5x6	2500	132	Hard Chrome	CrO_3 (33) + SO_4 (0.17)
103	42	9x3.5x16	3650	132	Hard Chrome	Same as above
103	43	9x3.5x6	1300	132	Hard Chrome	Same as above
103	44	9x3.5x6	1300	115	Decorative Chrome	CrO_3 (24) + SO_4 (0.13)
104	3	9x3.5x6	1300	Room	Muratic Acid	HCL
104	5	9x3.5x6	1300	Room	Electro Strip	
104	6	9x3.5x6	1300	Room	Muratic Acid	HCL
104	14	9x3.5x6	1300	Room	Iridite	
104	15	9x3.5x6	1300	Room	Water Rinse/ Paint Stripper	
105	1	9x3.5x6	1300	Room	Cadmium	Cd (2.6-3.3) + NaCN (16-18) + Na_2CO_3 (2-8) + NaOH (2.5)
105	11	9x3.5x6	1300	Room	Cadmium Cyanide	Same as above
105	20	9x3.5x6	1300	Room	Nickel Strike	$NiCh_2$ 6 H_2O (16-32) + HCL (8-16)

TANK DATA

Location: LBNSY, Plating Shop
Building: 210

Date: ____________

Scrubber No.	Tank No.	Dimensions LxWxD (ft)	Capacity (gallons)	Temp (F)	Name	Constituents (oz/gal)
105	21	9x3.5x6	1300	Room	Silver Plate	AgCN (6) + KCN (12-14) + K_2CO_3 (2-12)
105	22	9x3.5x6	1300	Room	Silver Strike	AgCN (0.3-0.5) + KCN (12)
105	29	9x3.5x6	1300	140	Copper Plate	CuCN (7.5-8) + KCN (2.5-3) + KOH (1.75-2)
106	16	9x3.5x6	1300	Room	Copper Brite 320	Micel Copper Brite 320 (B-32, Acidic)
106	19	9x3.5x6	1300	160-170	Phosphate Detergent	
106	28A	16x1.5x5	700	Room	Smutt-off "A"	Omega smutt-off A (8-16, CrO_3 10%, Fluoride salts 1%) Acidic
106	35	16x1.5x5	900	Room	Aurous #19	Omega Aurous #19 (2, CrO_3 45-55%, Barium Nitrate 15-25%, Sodium silicofluoride 10-20%, Potassium Nitrate 5-15%) pH 1.5
106	36	16x1.5x5	900	Room	Micro Brite Seal	Micel micro brite seal (1.3) + CrO_3 (2.6)

TANK DATA

Location: LBNSY, Plating Shop
Building: 210

Date: ____________

Scrubber No.	Tank No.	Dimensions LxWxD (ft)	Capacity (gallons)	Temp (F)	Name	Constituents (oz/gal)
106	28B	16x1.5x5	700	Room	Micro Brite Etch	Micel Mirco brite (10.3) + HCL (.34% Vol)
106	45	5x7x5	700	Room	Aurous #19	Omega Aurous #19 (3/4-2 1/4, CrO_3 45-55%, Barium Nitrate 15-25%, Sodium Silicofluoride 10-20%, Potassium Nitrate 5-15%)
106	47	5x5x5	700	Room	Smutt-off "A"	Omega smutt-off A (8-16, CrO_3 10%, Fluoride Salts 1%)
N/A	31	9x3.5x6	1300	Room	Sour Water	HCL (10% - Triacid Salts #303)
N/A	52	5x10x5	1400	Room	Paint Strip	Magnaflux Omega 31321X stripper (full strength, ChlHC's 82%, Phenol 9%, Formic Acid 5%)
N/A	24	N/A	N/A	N/A	Nonexistent	
N/A	2				Water Rinse	
N/A	7				Water Rinse	
N/A	10				Water Rinse	

TANK DATA

Location: LBNSY, Plating Shop
Building: 210

Date: ______________

Scrubber No.	Tank No.	Dimensions LxWxD (ft)	Capacity (gallons)	Temp (F)	Name	Constituents (oz/gal)
N/A	12				Water Rinse	
N/A	13				Water Rinse	
N/A	15				Water Rinse	
N/A	17				Water Rinse	
N/A	27				Water Rinse	
N/A	30				Water Rinse	
N/A	32				Water Rinse	
N/A	34				Water Rinse	
N/A	37				Water Rinse	
N/A	39				Water Rinse	
N/A	46				Water Rinse	
N/A	49				Water Rinse	
N/A	51				Water Rinse	

gassing. In addition, electro-pickling creates more gases than ordinary pickling. The electroprocesses, however, are both faster and more thorough. Significant amounts of air pollutants can be generated during this process.

The second and greatest source of air emissions is the plating process itself. Emissions are generated by two sources: electrolytic processes, and tank loading and unloading.

A portion of the electrical power applied to the plating solution is consumed by the electrolysis of water in the solution. Hydrogen and oxygen are produced and bubble to the surface, causing a condition known as "gassing." The vigorous hydrogen gassing at the cathode tends to remove any contaminants left from the cleaning process. It is this mechanical action that makes electroplating feasible.

Most electroplating and cleaning operations have little impact from an air pollution standpoint. When emissions are non-offensive and small in volume due to low gassing rates, air pollution control equipment is not required. Building ventilation is required, however, for worker safety and corrosion prevention.

Exhaust gases from chrome plating tanks do require air pollution control equipment. Large volumes of both hydrogen and oxygen are liberated during chrome plating. The bubbles break the surface and produce a chromic acid aerosol. The aerosol is then carried into the shop ambient air and is eventually discharged to the environment. Since chromic acid is both toxic and corrosive, its discharge requires control. The emission of chromic acid mists will often result in nuisance complaints and property damage. Especially susceptible are automobile paint finishes which can be spotted by even small amounts of the mist.

Hard chrome plating produces an extremely hard, corrosion-resistant coating. It is used in rebuilding and repairing operations to build up worn parts, especially shafts. Hard chrome plating requires a current density of approximately 250 amperes per square foot of workpiece area. This high current density produces large quantities of hydrogen and oxygen and a dense chromic acid mist. The plating facility at Long Beach NAVSHIPYD has three large hard chrome plating tanks which are vented through a scrubber to the atmosphere.

Decorative chrome plating is typically used on small items such as plaques and name plates. Decorative chrome plating requires a current density of approximately 100 amperes per square foot of workpiece area, and, therefore, evolves less gas than hard chrome plating. There is one decorative chrome tank at the Long Beach NAVSHIPYD plating shop.

Splash fill of piece work into and out of tanks, and splash fill of liquid into tanks, generates aerosol mists containing large liquid droplets (>15 um diameter) of plating solution. Aerosol mists generated by splash filling tend to deposit on interior exhaust line surfaces and are not a significant source of air pollution.

D. Emission Removal Mechanisms

Contaminants generated from open surface tanks used in plating are controlled by local exhaust hoods. Typically, the exhaust ductwork from several tanks containing similar chemical solutions are combined and vented to the atmosphere through one exhaust fan. Local exhaust hoods used at the plating shop contain slots across the length of the hood (slot hood) to evenly distribute the exhaust suction. Slot hoods require a face velocity of 2000 feet per minute (fpm) and a plenum velocity not greater than one-half the face velocity.[2] These hood design criteria are given in Appendix H. The 2000 fpm face velocity is recommended so that uniform suction is maintained at the slot. Slot hoods should not be greater than 10 feet in length. Splitters or multiple take-offs are used to reduce the effective slot length in hoods greater than 10 feet in length.

Cross drafts are controlled by using side and hood baffles. Side baffles increase effective tank height and help contain aerosols in the tank area.

The quantity of exhaust air used to control a given tank must be adequate to effectively remove contaminants from the tank surface area and exhaust them outside the building. Exhaust rates based on exhaust hood type, tank contents and process conditions are provided in American National Standards Institute (ANSI) Z9.1--1977, "Practices for Ventilation and Operation of Open-Surface Tanks." Plating shop exhaust system design should comply with this standard.

Aerosol emissions can be reduced by floating one or more layers of plastic spheres, cylinders, or ellipsoids on the liquid surface. Tests indicate that aerosol emissions and evaporation can be reduced by as much as 90%, and that heat losses from open tanks can be reduced by as much as 80% by using floating layers. Both hollow and solid balls are used. They are usually made of high density polyethylene (HDPE) or polypropylene (PP). Solid PP or hollow HDPE balls are normally used for hard chrome plating solutions. Some success has been achieved using solid PP balls on nitric/sulfuric acid bright-dip tanks. It is important to understand that gassing is not affected by the floating ball covers. The chief advantage is limitation of aerosol formation by gassing and reduction of process heat losses.

Several disadvantages can arise from using floating ball covers on plating tanks. First, floats are sometimes dragged out of the tanks with the work. Once out of the tanks, they may inadvertently enter drain systems. Drains and liquid effluent handling equipment have been plugged and damaged in this manner. Second, at elevated temperatures, hollow floats may burst and spray liquid into the work area. Third, hollow floats sometimes leak and sink to the bottom of the tank.

III. PROCEDURE

A. Air Emissions

Scrubbers on lines 102, 103, 104, 105, and 106 were tested. Scrubber 101 emissions were not tested, as tanks contain similar solutions existed on lines 102 and 106. The two types of tests performed on each scrubber were mass emissions and particle size distribution. Mass emission tests were performed simultaneously on the inlet and outlet of each scrubber.+ Three separate two-hour sampling runs comprised one mass emissions test. Mass emission test data was used to provide information on the total quantity of a pollutant in the exhaust gas. Particle size distribution tests were also performed simultaneously on the inlet and outlet of each scrubber.+ Two separate sampling runs comprised one particle size distribution test. Particle size distribution test data was used to aid in determining the appropriate air pollution control device for a particular gas stream.

Each tank connected to a scrubber undergoing testing was loaded with actual work pieces or with scrap metal to simulate tank loads at or above the maximum load encountered during normal shop operation. Tank loads and electrical readings were monitored during each test, and are included in tables 1, 2, 3, and 4 and Appendix A.

1. Mass Emissions Test.

a. Sampling procedures and equipment coincided with the following U.S. Environmental Protection Agency (EPA) test methods described in the Federal Register, Volume 42, No. 160, Part II of 18 August 1977[4], except as noted in the following paragraphs.

(1) Method I--Sample and Velocity Traverse

(2) Method II--Determination of Stack Gas Velocity and Volumetric Flow Rate

(3) Method III (modified)--Gas Analysis for O_2, CO_2

(4) Method IV--Determination of Moisture Content of Stack Gases

(5) Method VIII (modified)--Determination of Sulfuric Acid Mist and Sulfur Dioxide

b. Location of sampling sites (figures 1-7) and number of sampling points (figures 9 and 10) were determined from Method I of the Federal Register cited above.

c. Sampling trains are shown in figures 11 and 12. Type "S" pitot tubes were used. Gold-plated, button-hook nozzles and quartz-glass probe-liners were used to prevent any chemical reactions between the exhaust gas and internal sampling train surfaces. Sampling at each scrubber inlet was performed with a probe mounted vertically and connected to the impinger box by 25 feet of 0.5 in. diameter teflon tubing. Sampling at each scrubber outlet was performed with the probe mounted horizontally and connected to the impinger box with borosilicate glassware.

+The outlet of Scrubber 104 was not tested. Scrubber 104 was not operational during the test period.

TABLE 2
Tank Loading Summary

Scrubber No.	Tank No.	Voltage Load (V)	Current Load (Amp)	Workpiece Surface Area (Ft^2)	Lifting Interval (Min.)
102	4	7.0	1950	38	15
	33	5.0	150	4.5	15
	48	N.A.	N.A.	N.A.	N.A.
	50	N.A.	N.A.	22.5	15
103	41	8.0	1580	12	N.A.
	42	8.2	2000	13	N.A.
	43	6.4	1060	12	N.A.
	44	8.5	1060	21	N.A.
104	3	N.A.	N.A.	10	20
	5	5.0	1325	9	N.A.
	6	N.A.	N.A.	9	20
	14	N.A.	N.A.	N.A.	N.A.
	15	N.A.	N.A.	N.A.	N.A.
105	1	4.0	450	8	N.A.
	11	4.0	450	7	N.A.
	20	6.0	330	4	N.A.
	21	1.1	22	2	N.A.
	22	0	0	2	N.A.
	29	2.4	310	4	N.A.
106	16	N.A.	N.A.	3	30
	19	N.A.	N.A.	8	30
	28A	N.A.	N.A.	9	30
	28B	N.A.	N.A.	4	30
	35	N.A.	N.A.	6	30
	36	N.A.	N.A.	3	30
	45	N.A.	N.A.	15	30
	47	N.A.	N.A.	25	30

TABLE 3
Tank Loading

Scrubber 102

Test-Run	Lift Internal (Min.)	Tank 4			Tank 33*			Tank 48			Tank 50		
		V	A	Ft^2	V	A	Ft^2	V	A	Ft^2	V	A	Ft^2
2-1	--	4.8	--	26	--	--	--	--	--	--	--	--	--
2-2	15	6.9	2000	20.5	5	140	4.5	--	--	--	--	--	16
2-3	15	8.5	1980	32	5	150	4.5	--	--	--	--	--	16
2-4	15	8.5	1975	18	5	140	4.5	--	--	--	--	--	32
3-1	15	7.3	2000	64	5	150	4.5	--	--	--	--	--	24
3-2	15	6.4	1825	66	5	150	4.5	--	--	--	--	--	24
Average	15	7.0	1950	38	5	150	4.5	--	--	--	--	--	22.5

*Load in tank not lifted during test.

TABLE 3 (CONTD.)
Tank Loading

Scrubber 103*

Test-Run	Tank 41			Tank 42			Tank 43			Tank 44		
	V	A	Ft^2	V	A	Ft^2	V	A	Ft^2	V	A	Ft^2
4-1	7	400	2	8	2000	18	7.7	1100	1	7	840	28
4-2	7	450	2	8	2000	12	7.6	1100	14	9	1100	20
4-3	8.9	2075	17	8.5	2000	12	6.4	970	24	9.6	950	19.5
4-4	9	2200	17	8.5	2000	12	6.4	660	10.5	9.6	1275	19.5
5-1	8	2150	17	8.1	2000	12	9.3	1350	11	8	1100	19.5
5-2	8.4	2200	17	8	1800	12	8	1180	11	7.7	1100	19.5
Average	8	1580	12	8.2	2000	13	6.4	1060	12	8.5	1060	21

*Load in tanks not lifted during test.

TABLE 3 (CONTD.)
Tank Loading

Scrubber 104

Test -Run	Lift Internal (Min.)	Tank 3			Tank 5*			Tank 6			Tank 14*			Tank 15*		
		V	A	Ft^2	V	A	Ft^2	V	A	Ft^2	V	A	Ft^2	V	A	Ft^2
6-1	20	--	--	8	5	1300	9	--	--	8	--	--	--	--	--	--
6-2	25	--	--	10	5	1300	8	--	--	8	--	--	--	--	--	--
6-3	24	--	--	11	5	1350	9	--	--	11	--	--	--	--	--	--
7-1	23	--	--	11	5	1175	9	--	--	11	--	--	--	--	--	--
7-2	10	--	--	10	5	1450	10.5	--	--	8	--	--	--	--	--	--
Average	20	--	--	10	5	1325	9	--	--	9	--	--	--	--	--	--

*Load in tank not lifted during test.

TABLE 3 (CONTD.)
Tank Loading

Scrubber 105*

Test-Run	Tank 1			Tank 11			Tank 20			Tank 21			Tank 22			Tank 29		
	V	A	Ft^2	V	A	Ft^2	V	A	Ft^2	V	A	Ft^2	V	A	Ft^2	V	A	Ft^2
10-1	4	400	5	4	400	5	6	310	4	1	20	2	--	--	2	2.4	310	4
10-2	4	450	9	4	450	8	6	350	4	1	20	2	--	--	--	2.5	300	4
10-3	4	490	9	4	490	8	6	350	4	1.3	30	2	--	--	2	2.4	310	4
11-1	3.8	440	9	3.8	440	8	6	330	4	1.2	20	2	--	--	2	2.3	300	4
11-2	4	490	9	4	490	8	6	330	4	0.8	20	2	--	--	2	2.3	330	4
Average	4	450	8	4	450	7	6	330	4	1.1	22	2	--	--	2	2.4	310	4

*Load in tanks not lifted during test.

TABLE 3 (CONTD.)
Tank Loading

Scrubber 106*

Test-Run	Lift Internal (Min.)	Tank 16 Ft^2	Tank 19 Ft^2	Tank 28A Ft^2	Tank 28B Ft^2	Tank 35 Ft^2	Tank 36 Ft^2	Tank 45 Ft^2	Tank 47 Ft^2
8-1	--	3	8	9	4.5	6	3	18	24
8-2	30	3	8	9	4.5	6	3	18	24
8-3	25	3	8	9	4.5	6	3	18	24
9-1	40	3	8	9	3	6	3	8	30
1-1,2,3	--	--	--	--	--	--	--	--	--
Average	30	3	8	9	4	6	3	15	25

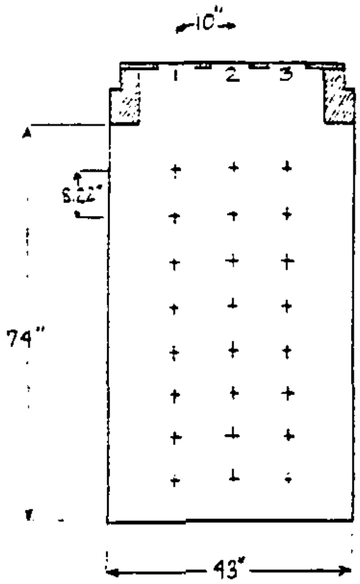
*No electrical load.

TABLE 4
Electrical Equipment Rating

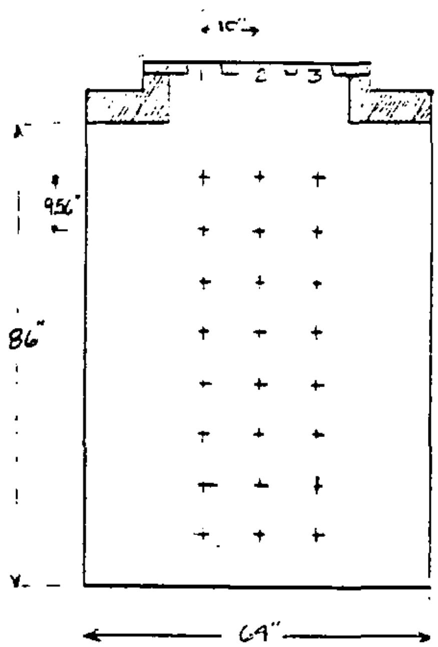
Tank	Scrubber	Rectifier Number	ID#	Voltage (V) Input	Voltage (V) Output	Current (Amps) Input	Current (Amps) Output
1/11	105	1	616692	480	0-15	69	3,000
4/5	102	7	616691	480	0-15	69	3,000
21/22	105	4	417726	480	0-12	19	1,000
23	101	5	417724	480	0-9	23	1,500
29/20	105	3	417723	480	0-9	23	1,500
33	102	6	616693	480	0-15	69	3,000
41	103	--	601627	480	0-12	95	5,000
42	103	--	601626	480	0-12	95	5,000
43	103	--	601623	480	0-12	210	10,000
44	103	--	601622	480	0-12	210	10,000

All are Clinton Plator Rectifiers, Clinton Supply Co., Chicago, Ill.

All are 3ϕ, 60 cycle



Scrubber 102



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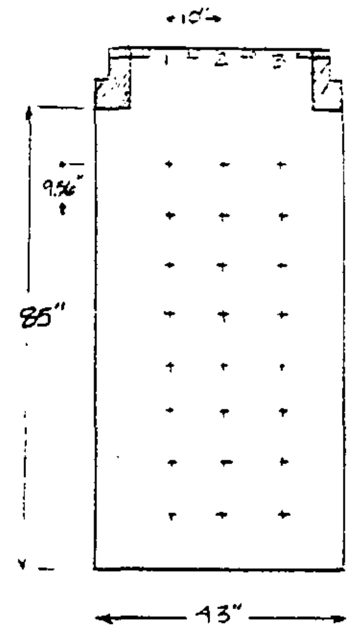

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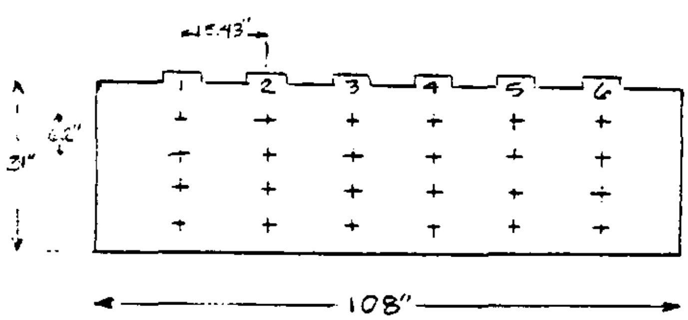

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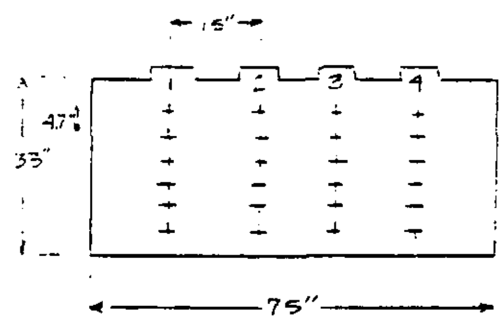
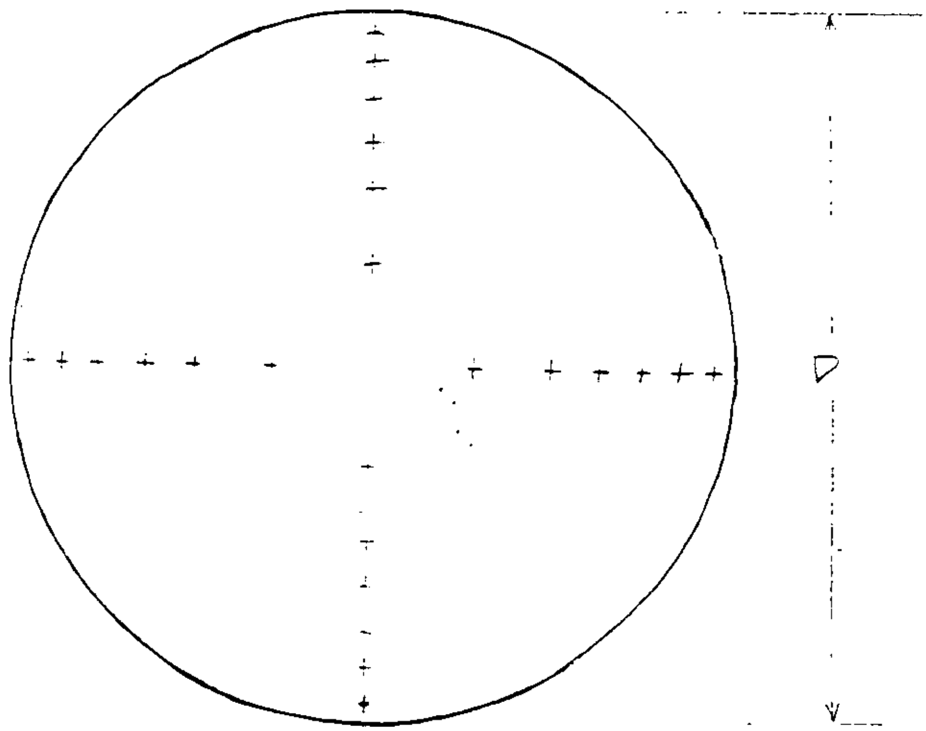


Scrubber 106

Figure 9. Sampling Point Locations, Inlet



SCRUBBER NUMBER	102	103	105	106
DIAMETER (D), INCHES	64	64	66	66
NO. of SAMPLING POINTS	24	24	24	24

Figure 10. Sampling Point Locations, Outlet

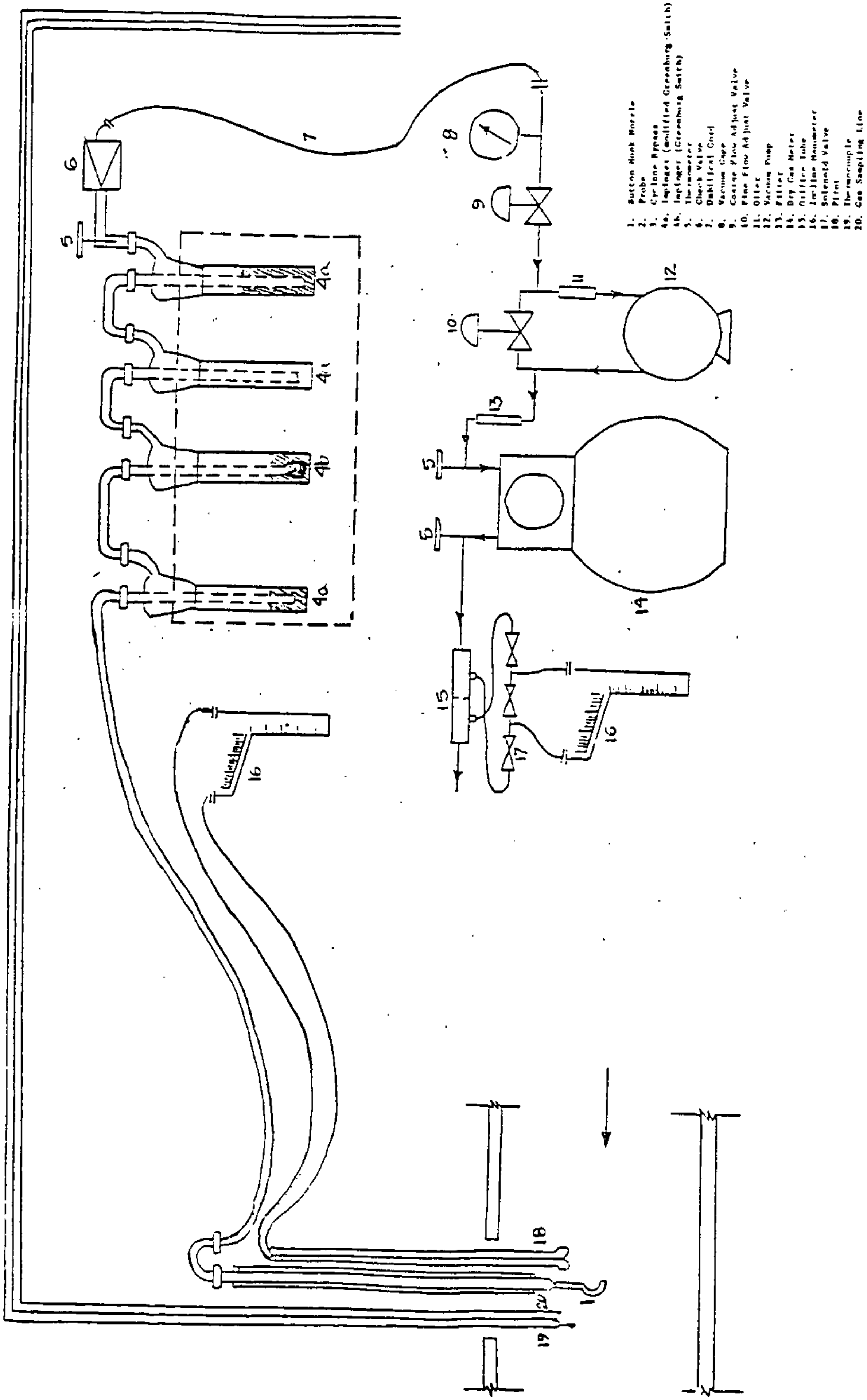


Figure 11. Mass Emissions Sampling Train Inlet

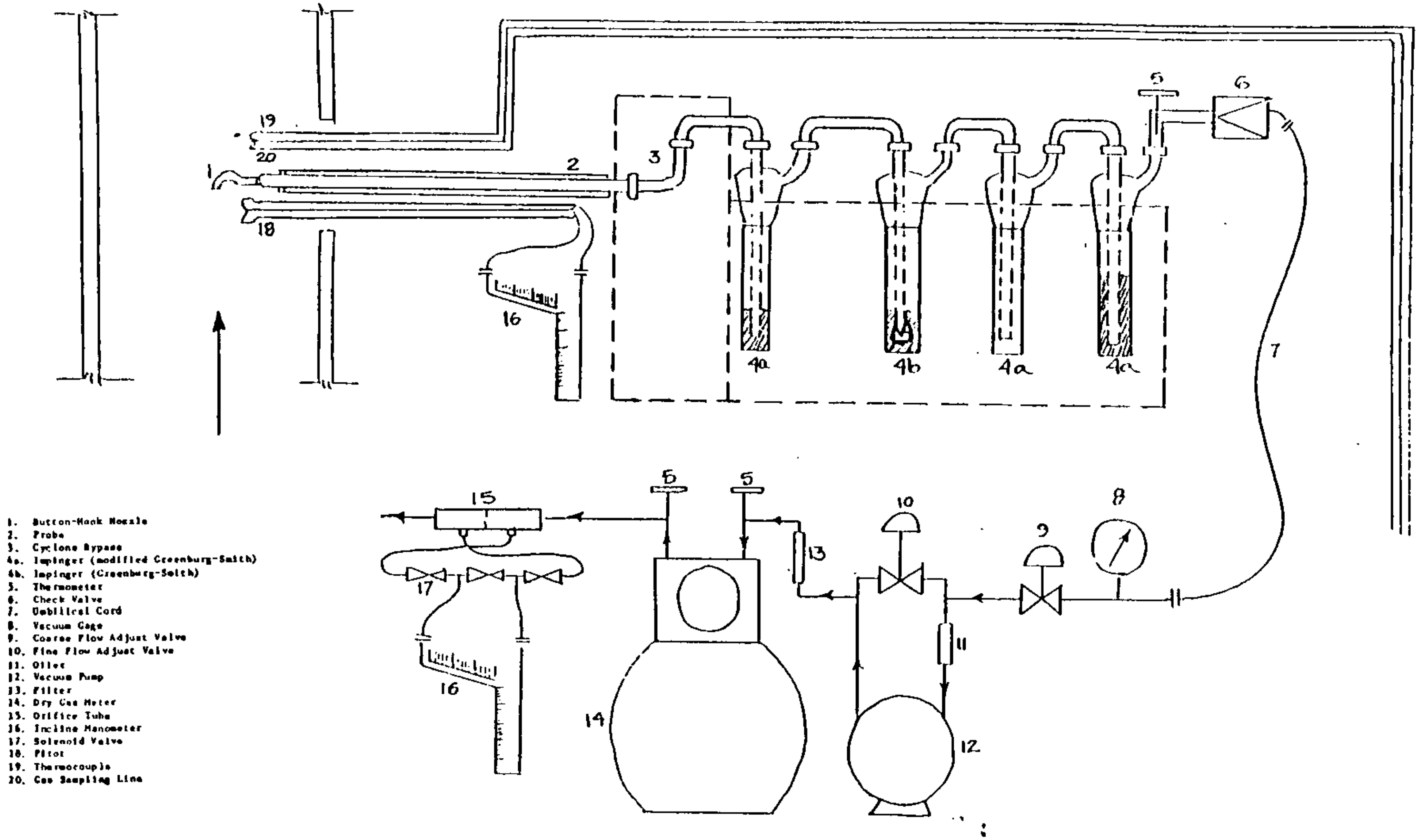


Figure 12. Mass Emissions Sampling Train, Outlet

d. Leak checks were performed both before and after each sampling sequence at the pitot tubes, at the beginning of the impingers and at the sampling nozzle as detailed in Method V, Section 4.1.4.1, Federal Register.

e. Impingers were initially weighed, tared, then weighed with the following: 100 ml 0.1 N KOH (1st impinger, modified Greenburg-Smith design), 100 ml deionized water (2nd impinger, Greenburg-Smith design with standard tip), dry (3rd impinger, modified Greenburg-Smith design), and 200 ml silica gel (4th impinger, modified Greenburg-Smith design). Impingers were reweighed following each run to determine water gain. This method is both simpler and more accurate than the specified transfer/weigh procedure (Method V, Section 2.2.6 and Section 4.2), as the samples are handled less and temperature error is eliminated. A Mettler PB 3000 electronic balance, calibrated using International Organization of Legal Metrology (IOLM) specification metric weights, was used for all field impinger weighings.

f. O_2 and CO_2 monitors were used instead of an Orsat to determine dry stack gas molecular weight (Method III, modified). The gas sample was passed through polyethylene tubing to the gas conditioner (Figure 13) to remove moisture and particulate, then to the monitors. Solid-state, nondispersive infrared analyzers were used. The zero point was set using zero grade air rather than nitrogen, and one span point was set using a National Bureau of Standards (NBS) traced span gas. Plating shop exhaust ventilation O_2 and CO_2 concentrations are the same as ambient air concentrations (O_2 = 20.9%, $CO_2 \cong$ 0.0%).

g. Following each run the sampling nozzle, probe liner, connecting glassware, and teflon tubing (inlet sampling train only) were rinsed with deionized water and the rinse water collected in a borosilicate glass recovery bottle or polyethylene "cubitainer." Liquid from the first three impingers was poured into the same recovery bottle or "cubitainer."

Total sample weight was determined and the samples delivered to Truesdail Laboratories, Tustin, California, for chemical analysis. The Truesdail Laboratories report is included in Appendix C.

h. Percent isokinetic was calculated for each run. An isokinetic value between 90% and 110% was required for the run to be considered valid.

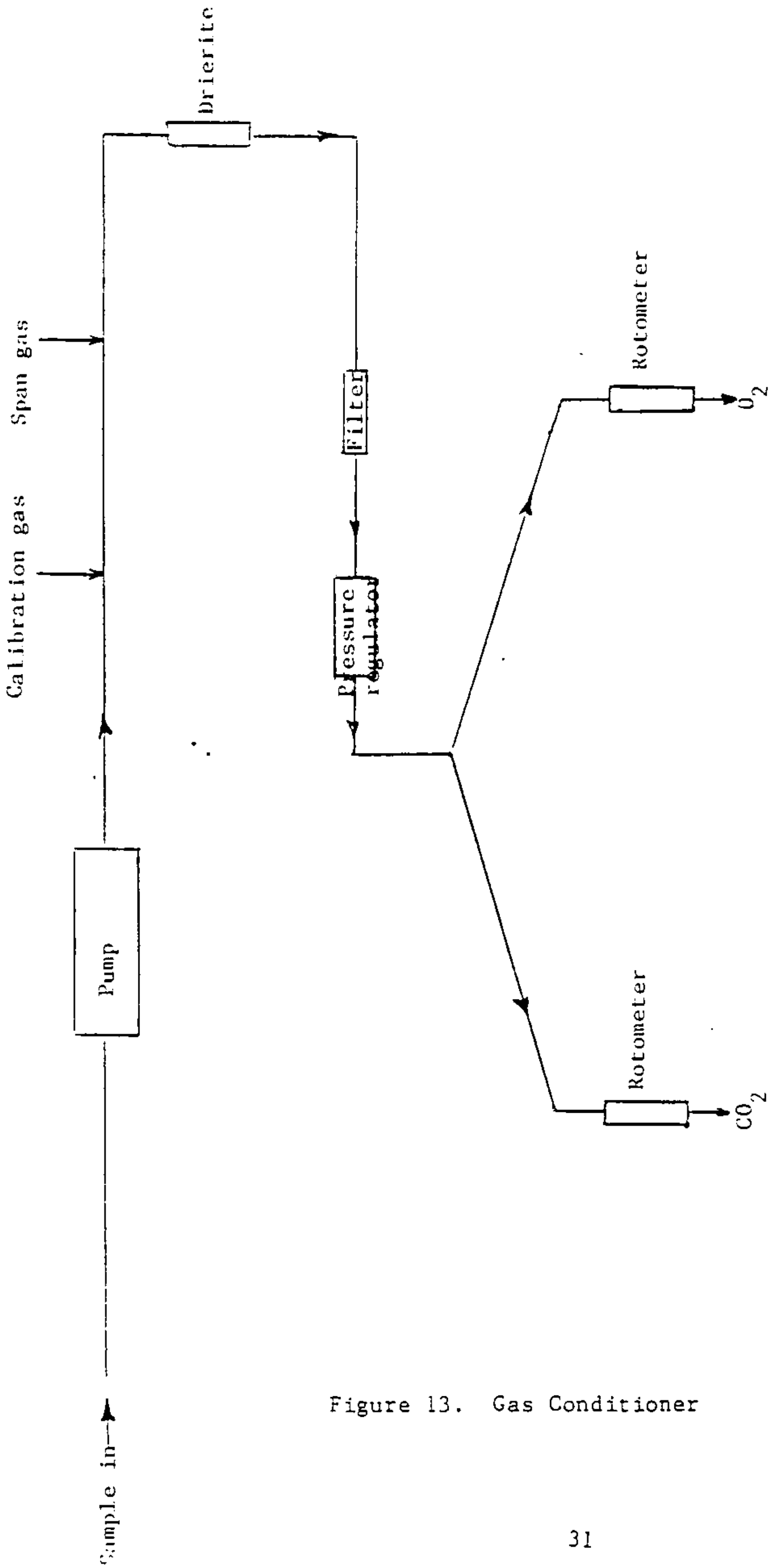


Figure 13. Gas Conditioner

i. The following constants were used to reflect the change by EPA from 70°F to 68°F for standard temperature in the above Federal Register:

Symbol	Unit	Description
g/lb	453.59237	Conversion factor
K_p	$85.39 \frac{ft}{sec} \frac{(lb/lb\text{-}mole)(in.Hg)}{(°R)(in.\ H^2O)}^{1/2}$	Pitot tube constant (Method II)
K_1	0.04710 ft^3/ml	Conversion factor (Method IV)
K_2	0.04718 ft^3/ml	Conversion factor (Method IV)
K_3	17.65 °R/in. Hg	Standardizes temperature and pressure (Method IV)
K_1	17.65 °R/in. Hg	Standardizes temperature and pressure (Method V)
K_2	0.04710 ft^3/ml	Conversion factor (Method V)
K_4	$0.09444 \frac{(min)\ (in.\ Hg)}{(°R)(sec)}$	Constant for standard pressure and temperature (Method V)
MW_{air}	28.9641 lb/lb-mole	Molecular weight of air
MW H_2O	18.01534 lb/lb-mole	Molecular weight of water
P_{std}	29.92126 "Hg	Absolute standard pressure
P_{air}	0.0752236 lb/ft^3	Density of air at 20°C
pH_2O	0.99824 g/ml	Density of water at 20°C

2. Particle Size Distribution Test.

a. Sampling locations, procedures and equipment used were similar to those used during the mass emissions test and followed EPA Methods I through IV, given in Federal Register Vol 42, No. 160, Part II of 18 August 1977. The following guidelines were also used:

(1) ASME Performance Test Code (PTC) 28--Determining Properties of Fine Particulate Matter (draft revision).[5]

(2) Operations Manual--University of Washington Mark III Cascade Impactor.[6]

b. Particle size distribution sampling trains are shown in figures 14 and 15. The differences between a mass emissions sampling train and a particle size distribution sampling train are as follows:

(1) University of Washington Mark III Cascade Impactors replaced gold-plated nozzles at the probe tip.

(2) Stainless-steel probe liners replaced quartz glass probe liners. The torque imposed on the tip of the glass probe liner by the weight of the impactor caused the glass liner to break. Using stainless-steel probe liners eliminated this problem.

c. The University of Washington Mark III Cascade Impactor was assembled as shown in Figure 16. Teflon O-ring gaskets were used on both sides of the backup filter to prevent the filter from sticking to the screen. The Mark III Cascade Impactor was modified to contain only four stages. See Appendix D.

d. Reeve Angel 934AH fiberglass filters were used. Filters were pre-washed in sulfuric acid solution as follows:

(1) Filters were submerged in a 50-50 mixture (by volume) of distilled water and reagent grade concentrated sulfuric acid at 230-239°F for two hours.

(2) Filters were removed from the acid bath, cooled to room temperature, then thoroughly rinsed with distilled water until the pH of the rinsewater was nearly the same as that of the distilled water.

(3) Filters were submerged in reagent grade isopropanol (isopropyl alcohol) and allowed to stand for several minutes. This step was repeated four to five times, each time using fresh isopropanol.

(4) Filters were drained, spread out to dry in a clean, dry place, then baked at 120°F for two hours, at 390°F for two additional hours, and finally at 700°F for three more hours.

(5) As a final check, two filters were torn into small pieces, placed in distilled water and the pH checked.

All filters and aluminum filter holders were stablized at 30% $\pm$ 5% relative humidity and 68°F $\pm$ 4°F for 24 hours prior to weighing. Filters were combined with filters holders using 5 to 10 mg of Apiezon H grease as an adhesive. Filters were weighed using a Mettler AK 160 electronic balance at intervals greater than six hours until a constant weight ($<$0.5 mg change from previous weighings) was achieved for three consecutive weighings. The results of the three weighings were averaged and recorded to the nearest 0.1 mg. See Appendix F.

e. Prior to sampling, a velocity traverse was performed as outlined in Method II, Federal Register, cited above. Velocity traverses were performed without the impactor attached.

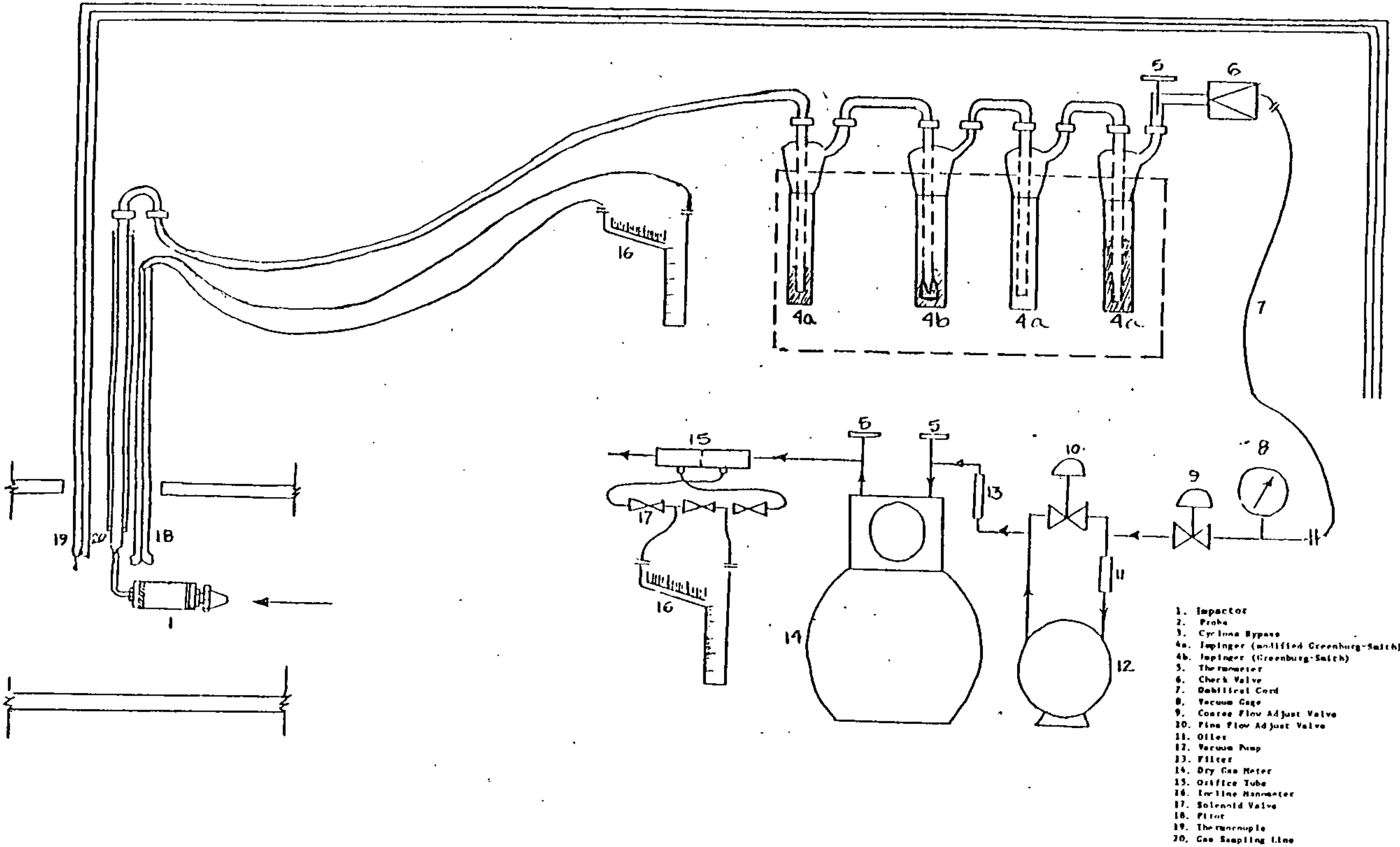


Figure 14. Particle Sizing Sampling Train, Inlet

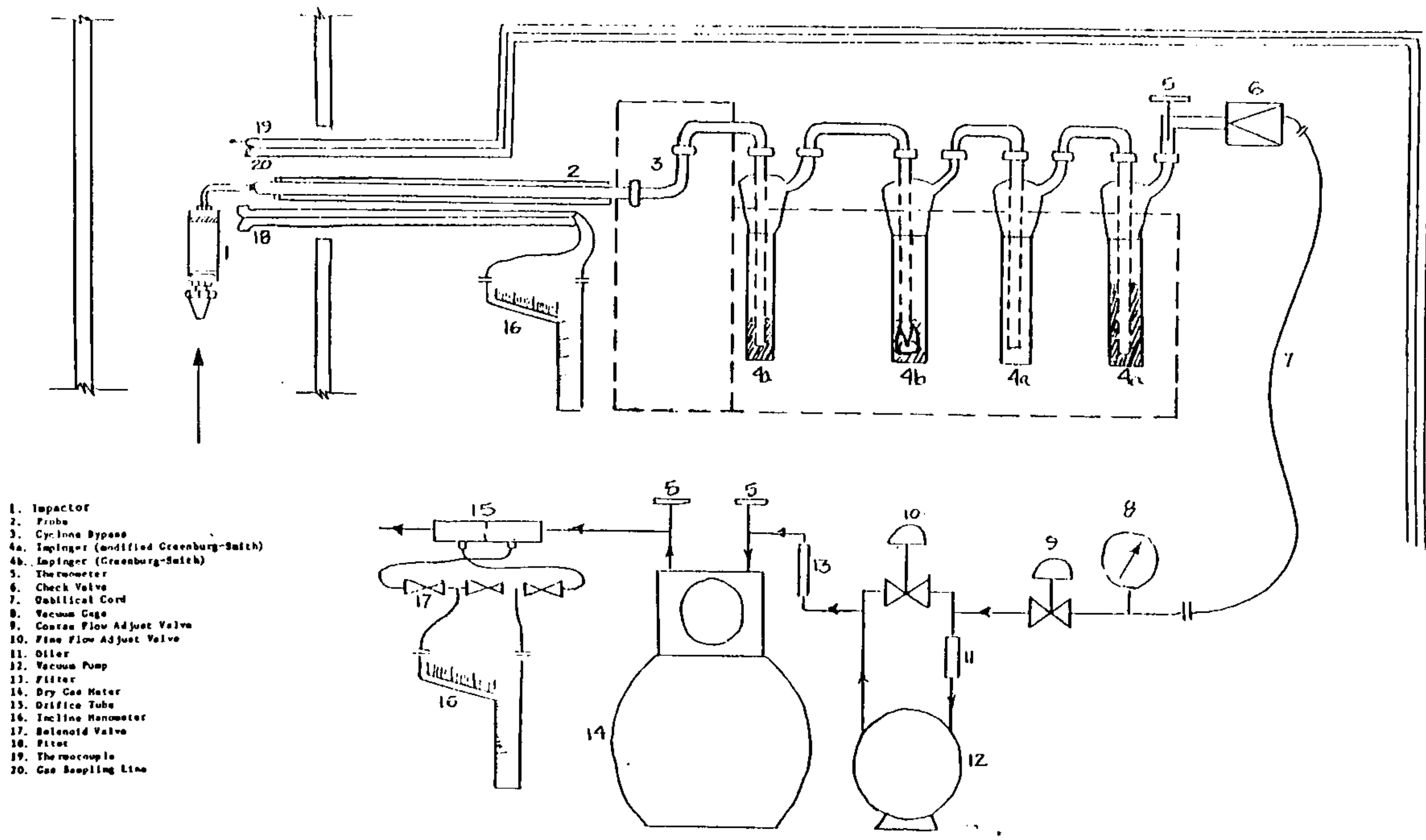


Figure 15. Particle Sizing Sampling Train, Outlet

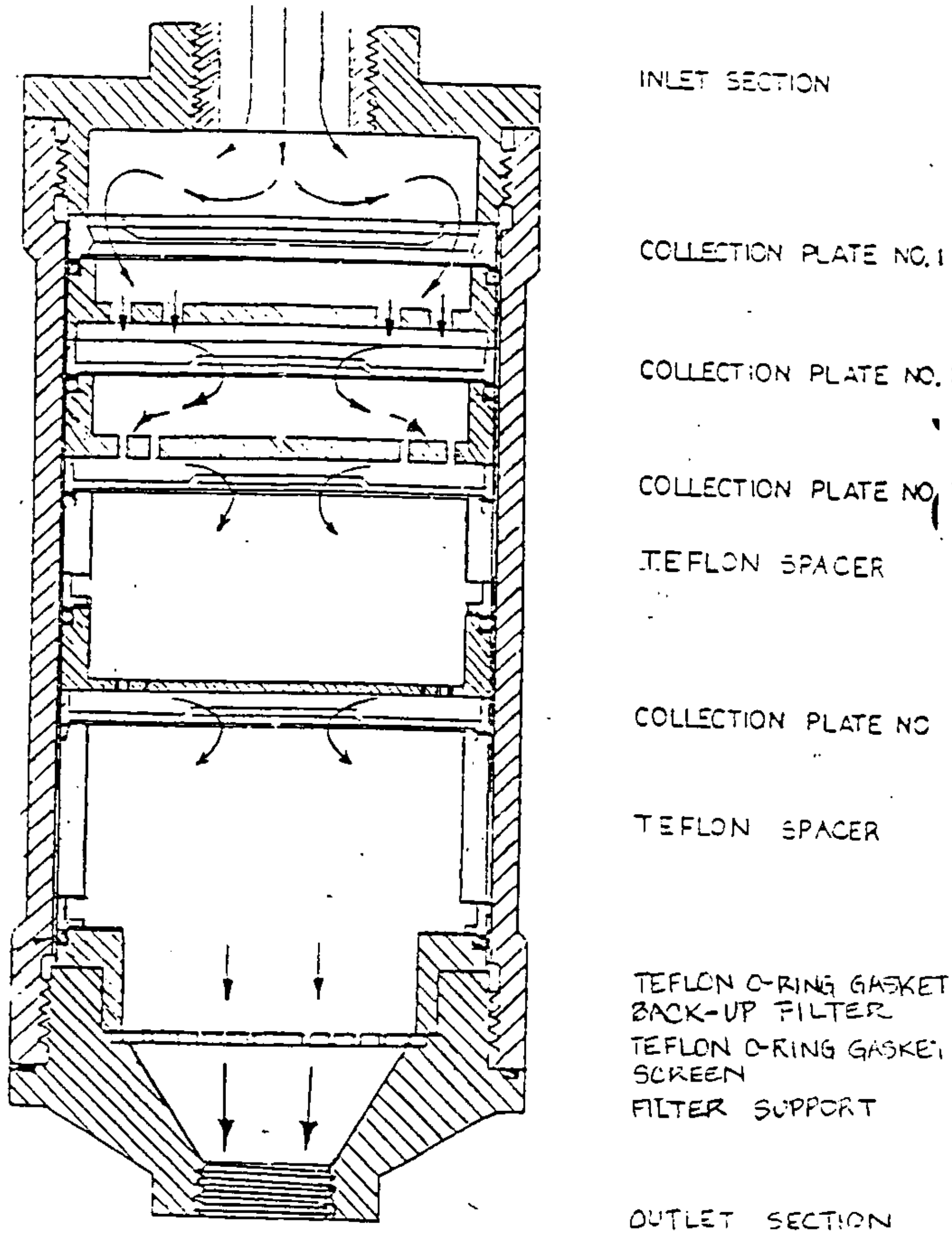


Figure 16. University of Washington Mark III Cascade--Impactor (Modified)

f. Pitot tubes were leak checked before and after each run as detailed in Method V, Section 4.1.4.1, Federal Register. A leak check was performed at the impactor nozzle prior to the beginning of a sampling run. No leak check was performed at the impactor nozzle following a sampling run to prevent any disturbance to particulate collected on the impactor stages.

g. Impactor sampling runs varied in duration from one hour to four hours. Sampling times were based on anticipated particulate loading in the gas stream. Four hours was used as a maximum sampling time on scrubber lines with very low particulate loadings.

h. One or two sampling points were used during a sampling run depending on the velocity profile within the duct. An average duct velocity was determined from the initial velocity profile and velocity points at or near the average velocity were chosen as sampling points. In several cases only one sampling point was within 10% of average velocity, and in such cases one sampling point was used. In cases where several points had acceptable velocities, the two most symmetrically spaced points were used. A maximum of two sampling points were used to minimize impactor jostling caused by insertion and removal from sampling ports.

i. Impingers were initially weighed, tared, then weighed with the following; 100 ml deionized water (1st impinger, modified Greenburg-Smith design and 2nd impinger, Greenburg-Smith design with standard tip), dry (3rd impinger, modified Greenburg-Smith design), and 200 ml silica gel (4th impinger, modified Greenburg-Smith design). Impingers were reweighed following each run to determine water gain. The impinger water was disposed of following the weighing.

j. As in the mass emission tests, O_2 and CO_2 solid-state, nondispersive infrared analyzers were used instead of an Orsat to determine dry stack gas molecular weight (Method III, modified). The zero point was set using zero grade air rather then nitrogen, and one span point was set using NBS traced span gas. Plating shop exhaust ventilation O_2 and CO_2 concentrations are the same as ambient air concentrations (O_2 = 20.9%, $CO_2 \cong$ 0.0%).

k. Following a sampling run the impactor was dismantled and each filter stage placed in a disposable plastic petri dish. The back-up filter (with teflon O-rings) was placed in an pre-weighed aluminum foil pouch. The filter stages were then weighed at approximately 30 minute intervals for 2 to 3 weighings. Whenever a significant weight gain (>0.5 mg) was observed three weighings were made. See Appendix F for details. A Mettler AK 160 electronic balance, calibrated using IOLM specification metric weights, was used for all field filter stage weighings. The test support van was set on blocks during the test period to minimize the transmission of vibration to the balance.

l. Filter stages showing visual indications of collected particulate were sent to Truesdail Laboratories for chemical analysis. A copy of the laboratory results appears in Appendix C.

m. Percent isokinetic was calculated for each sampling run. An isokinetic value between 80% and 120% was necessary for the run to be considered valid.

B. Ventilation Survey

The supply air flow rates were measured for heating and ventilating (HV) units 10, 12, and 13 at locations in Figure 8. Measurements were taken using a standard pitot tube and a dual U/inclined manometer. Twenty, twenty-five, and thirty point pitot traverses were performed to measure velocity pressures in round, rectangular, and square ducts, respectively.

Smoke tests were conducted inside the plating shop to identify any turbulent air currents that might affect local exhaust systems. The tests were performed by igniting smoke pellets at different elevations near perimeter walls, opened doors, wall-mounted air grills, and ventilated tank surfaces, and observing the direction and velocity of the smoke.

IV. CHAIN OF CUSTODY

A. Source Emission Test

	Inlet	Outlet
Stack	Peter Fanning Darrow Kirkpatrick Bill Powers	Susan Suzuki Tom Belanger Tim Quarles
Sample Train Set-Up and Recovery	Susan Suzuki Bill Powers Charles Yee	

B. Sample Recovery and Analysis

Bill Powers
Charles Yee
Susan Suzuki

C. Industrial Ventilation Study

Bob Wood

D. Sample Transport.

Samples were stored in an onsite mobile freezer for up to five days. Each mass emissions sample, KOH blank, deionized water blank, and tank solution sample was sealed in a glass borosilicate container or polyethylene "cubitainer." Impactor filter stages were sealed in zip-lock plastic bags. Samples were then transported by car to Truesdail Laboratories in Tustin, California. No damage was caused during transport.

V. RESULTS

A. Air Emissions

Tables 1 through 4 summarize tank data and transformer electrical ratings. Table 5 contains flowrates and isokinetic calculations for all mass emissions runs. The sample volume and lab sample weight are presented in Table 6. Table 7 lists the chemical analyses performed on each sample. Table 8 lists the results of chemical analyses and scrubber efficiencies. Sample pollutant concentrations are compared to OSHA workplace standards in Table 9. Table 10 contains flowrates and isokinetic calculations for all impactor runs. Stage 5 impactor cutpoints for all impactor runs are listed in Table 11. Results from impactor runs on Scrubber 103 are given in Table 12. Static pressure drops measured across each scrubber are listed in Table 13.

An error was found in the source test calculator program during report preparation. The program error was corrected and all field test calculations were redone. The correction resulted in scrubber flowrates dropping an average of 0.1%.

B. Ventilation Survey

Table 14 lists the measured flowrates for three of the four supply air HV units. The rated flow for both HV-10 and HV-11 is 30,000 cfm. The rated flow for both HV-12 and HV-13 is 40,000 cfm. The measured flowrate for HV-10 was 20500 cfm. HV-11 was not operating during the study and it is assumed that HV-11 has a flowrate approximately equal to HV-10. The measured flowrates for units HV-12 and HV-13 were 27800 and 27300 cfm, respectively.

Table 15 lists the average exhaust volume flowrates measured during emission testing. Table 15 also lists the exhaust air flowrates required to meet recommended exhaust ventilation standards.[2]

VI. DISCUSSION

A. General

Tanks were loaded with actual workpieces or with scrap metal to produce tank loads at or above the maximum load expected during shop operation. Workpieces were lifted on regular intervals to simulate emissions caused by moving workpieces from tank to tank. Lifting intervals and tank loads are indicated in Appendix A.

Testing initially was attempted during the day shift. Problems were encountered maintaining high loads in the tanks without interfering with the production schedule of the shop. A week into the test, the workday was moved to the swing shift (1600 to 0200) to prevent conflicts with the production schedule.

No air emission limits are specified for chemicals typically emitted from plating shops. Occupational Safety and Health Administration (OSHA) exposure limits do exist for these chemicals, however, and these limits are used as a standard to compare test results. It is important to note that OSHA

TABLE 5
MASS EMISSIONS DATA
FLOW RATE AND ISOKINETIC

DATE	SCRUBBER	TEST-RUN	VOL FLOW RATE(ACFM)		VOL FLOW RATE(SCFM)		ISOKINETIC(%)	
			INLET	OUTLET	INLET	OUTLET	INLET	OUTLET
MAY 30	101	X-X	27985.05	XX	XX	XX	XX	XX
16	102	2-1	31991.6	38700.4	31669.3	38760.1	91.1	104.2
17	102	2-2	29984.3	38073.2	29676.8	38278.8	100.3	103.5
18	102	2-3	32306.6	36983.7	31779.5	37199.4	92.4	101.8
18	102	2-4	30727.4	38730.5	30737.7	38845.6	95.3	101.9
22	103	4-1	32385.8	30009.9	32454.8	30126.9	85.8	99.5
22	103	4-2	31476.3	29466.9	31735.9	29669.8	96.4	103.1
23	103	4-3	32857.1	30225.5	32771.5	30272.6	106.5	99.4
23	103	4-4	33645.0	27640.4	33835.1	27747.2	96.2	104
25	104	6-1	32276.8	XX	32262.4	XX	103.1	XX
25	104	6-2	32687.7	XX	32745.9	XX	104.6	XX
26	104	6-3	33265.1	XX	33078.5	XX	104.1	XX
31	105	10-1	49278.9	50239.8	48696.1	50462.7	101.5	94.8
31	105	10-2	49360.4	49687.9	49070.9	50110.3	103.2	96
31	105	10-3	49064.2	49234.3	48793.9	49700.4	101.5	96.7
29	106	8-1	43581.0	44181.0	43272.7	44160.8	95.1	102.5
29	106	8-2	43717.8	44133.4	43501.6	44269.1	96.1	101.2
29	106	8-3	44053.9	44988.9	43995.6	45129.6	95.4	101.2

TABLE 6
MASS EMISSIONS DATA
SAMPLE VOLUME AND LAB SAMPLE WEIGHT

DATE	SCRUBBER	TEST-RUN	SAMPLE VOL(SCF)		LAB SAMPLE WT(GRAM)	
			INLET	OUTLET	INLET	OUTLET
MAY 16	102	2-1	104.63	71.59	698.9	482.7
17	102	2-2	109.76	70.22	686.9	486.7
18	102	2-3	105.82	67.07	743.4	624.5
18	102	2-4	53.75	69.02	676	647
22	103	4-1	62.57	123.46	766.4	536.8
22	103	4-2	68.03	123.33	904.3	663.6
23	103	4-3	74.03	121.1	701	473.5
23	103	4-4	70.08	118.18	805.9	790.5
25	104	6-1	94.78	XX	930.5	XX
25	104	6-2	92.54	XX	825.4	XX
26	104	6-3	95.67	XX	790	XX
31	105	10-1	66.75	62.73	640.9	387.4
31	105	10-2	65.1	63.08	682.2	519.2
31	105	10-3	64.2	63.03	641.6	499.9
29	106	8-1	73.38	61.55	745.8	446.2
29	106	8-2	74.54	60.18	750.3	522.5
29	106	8-3	73.64	60.88	715.9	473.7

TABLE 7
Analysis Schedule for Samples
From Building 210 Plating Shop
Long Beach Naval Shipyard

Scrubber Line	Specie
102	Cl^-, $SO_4^{=}$, Al^{+++}, Na^+, Ni^{++}
103	Cr_{tot}, SO_4
104	Cl^-, Cr_{tot}, SO_4, F^-
105	Cl^-, CN^-, Ag^+, Cd^{++}, Cu^{++}, Na^+, Ni^{++}
106	Cl^-, Cr_{tot}, F^-, PO_4^{-3}

TABLE 8
MASS EMISSIONS CHEMICAL ANALYSIS RESULTS

SCRUBBER 102

TEST-RUN	SPECIE	LOADING (ug/m3) INLET	OUTLET	EFFICIENCY (%)
2-1	Cl-	100	0	100
2-1	SO4	---	---	---
2-1	Al	---	---	---
2-1	Na	110	95	14
2-1	Ni	---	---	---
2-2	Cl-	208	0	100
2-2	SO4	---	---	---
2-2	Al	---	---	---
2-2	Na	152	93	39
2-2	Ni	---	---	---
2-3	CL-	227	362	-59
2-3	SO4	---	---	---
2-3	Al	---	---	---
2-3	Na	113	165	-46
2-3	Ni	---	---	---
2-4	CL-	224	232	-4.
2-4	SO4	---	---	---
2-4	Al	---	---	---
2-4	Na	220	0	100
2-4	Ni	---	---	---

TABLE 8 (CONTD.)
MASS EMISSIONS CHEMICAL ANALYSIS RESULTS

SCRUBBER 103

TEST-RUN	SPECIE	LOADING (ug/m3) INLET	OUTLET	EFFICIENCY (%)
4-1	Cr	554	28	95
4-1	SO4	---	---	---
4-2	Cr	284	48	85
4-2	SO4	---	---	---
4-3	Cr	1389	19	99
4-3	SO4	---	---	---
4-4	Cr	504	57	89
4-4	SO4	---	---	---

SCRUBBER 104

TEST-RUN	SPECIE	LOADING (ug/m3) INLET	OUTLET	EFFICIENCY (%)
6-1	Cl	36821	---	---
6-1	Cr	3864	---	---
6-1	SO4	---	---	---
6-1	F	---	---	---
6-2	Cl	27837	---	---
6-2	Cr	3413	---	---
6-2	SO4	---	---	---
6-2	F	---	---	---
6-3	Cl	31857	---	---
6-3	Cr	2347	---	---
6-3	SO4	---	---	---
6-3	F	---	---	---

TABLE 8 (CONTD.)
MASS EMISSIONS CHEMICAL ANALYSIS RESULTS

SCRUBBER 105

TEST-RUN	SPECIE	LOADING (ug/m3) INLET	OUTLET	EFFICIENCY (%)
10-1	Cl-	---	---	---
10-1	CN	17	24	-41
10-1	Ag	---	---	---
10-1	Cd	---	---	---
10-1	Cu	---	---	---
10-1	Na	426	337	21
10-1	Ni	---	---	---
10-2	CL-	135	160	-19
10-2	CN	10	49	-390
10-2	Ag	---	---	---
10-2	Cd	---	---	---
10-2	Cu	---	---	---
10-2	Na	30	106	>>>
10-2	Ni	---	---	---
10-3	Cl-	14	41	-192
10-3	CN	32	38	-19
10-3	Ag	---	---	---
10-3	Cd	---	---	---
10-3	Cu	---	---	---
10-3	Na	229	220	3.9
10-3	Ni	---	---	---

TABLE 8 (CONTD.)
MASS EMISSIONS CHEMICAL ANALYSIS RESULTS

SCRUBBER 106

TEST-RUN	SPECIE	LOADING (ug/m3) INLET	OUTLET	EFFICIENCY (%)
8-1	Cl^-	11	40	264
8-1	Cr_{tot}	---	---	---
8-1	F^-	---	---	---
8-1	PO_4^{-3}	---	---	---
8-2	Cl^-	182	230	-26
8-2	Cr_{tot}	---	---	---
8-2	F^-	---	---	---
8-2	PO_4^{-3}	---	---	---
8-3	Cl^-	45	41	9
8-3	Cr_{tot}	---	---	---
8-3	F^-	---	---	---
8-3	PO_4^{-3}	---	---	---

TABLE 9
MASS EMISSIONS DATA
CONCENTRATION vs OSHA STANDARDS

SCRUBBER	CHEMICAL	OSHA STD* (mg/m3)	INLET CONC. AVE(mg/m3)	ABOVE(+) OR BELOW(-) STD	OUTLET CONC AVE(mg/m3)	ABOVE(+) OR BELOW(-) STD*
102	NaOH	2.0	0.26	-	0.16	-
	HCl	7.0	0.19	-	0.15	-
	Ni	1.0	0.00	-	0.00	-
103	CrO3	0.1	1.31	+	0.08	-
104	HCl	7.0	32.20	+	N.A.	N.A.
	H2SO4	1.0	0.00	-	N.A.	N.A.
105	Ag	0.01	0.00	-	0.00	-
	Cd	0.1	0.00	-	0.00	-
	Cl	7.0	0.05	-	0.07	-
	NaCN/KCN	5.0	0.02	-	0.04	-
	Cu	0.1	0.00	-	0.00	-
	Ni	1.0	0.00	-	0.00	-
106	HCl	7.0	0.08	-	0.10	-
	Cr	0.1	0.00	-	0.00	-

* OSHA WORKPLACE STANDARD (PERMISSIBLE EXPOSURE LIMIT) IS FOR AN 8-HOUR TIME WEIGHED AVERAGE.

TABLE 10
IMPACTOR DATA
FLOW RATE AND ISOKINETIC

DATE	SCRUBBER	TEST-RUN	VOLUME (SCF)	FLOW RATE (ACFM)	FLOW RATE (SCFM)	ISOKINETIC (%)
MAY 21	102	3-1 INLET	40.40	29901.75	29490.32	115.2
MAY 21	102	3-1 OUTLET	45.94	38809.95	38804.47	100.2
MAY 21	102	3-2 INLET	92.98	30424.26	30157.49	115.2
MAY 21	102	3-2 OUTLET	97.72	38866.91	38876.35	95.4
MAY 24	103	5-1 INLET	79.52	31911.59	31556.02	123.2
MAY 24	103	5-1 OUTLET	116.62	31855.72	31867.28	105.8
MAY 24	103	5-2 INLET	79.27	31893.18	31626.56	123.0
MAY 24	103	5-2 OUTLET	73.89	31771.81	31828.66	101.6
MAY 26	104	7-1 INLET	180.44	33807.88	33374.18	105.1
MAY 26	104	7-2 INLET	63.00	33539.28	33419.78	108.1
JUN 1	105	11-1 INLET	120.51	45075.22	44505.27	105.2
JUN 1	105	11-1 OUTLET	119.92	50577.63	50891.25	98.6
JUN 1	105	11-2 INLET	117.90	44919.58	44659.57	102.5
JUN 1	105	11-2 OUTLET	121.65	50518.74	50950.58	95.5
MAY 15	106	1-1 INLET	63.52	42527.42	42954.40	128.4
MAY 15	106	1-1 OUTLET	41.00	44650.10	45369.29	107.6
MAY 15	106	1-2 OUTLET	42.28	50676.92	51631.78	99.1
MAY 15	106	1-3 INLET	55.04	43985.09	44009.16	109.5
MAY 15	106	1-3 OUTLET	44.10	50671.82	51551.96	105.2
MAY 30	106	9-1 INLET	142.79	44389.89	42817.19	97.3
MAY 30	106	9-1 OUTLET	127.17	47498.81	47492.18	106.3

TABLE 11
IMPACTOR DATA
STAGE 5 AERODYNAMIC CUTPOINTS

DATE	SCRUBBER	TEST-RUN	SAMPLE TIME (min)	FLOW RATE* (CFM)	CUTPOINT (Um)
MAY 21	102	3-1 INLET	80	0.52	1.3<X<4.4
MAY 21	102	3-1 OUTLET	80	0.59	1.3<X<4.2
MAY 21	102	3-2 INLET	180	0.54	1.3<X<4.3
MAY 21	102	3-2 OUTLET	180	0.57	1.3<X<4.2
MAY 24	103	5-1 INLET	240	0.35	1.6<X<5.5
MAY 24	103	5-1 OUTLET	240	0.51	1.3<X<4.7
MAY 24	103	5-2 INLET	240	0.35	1.6<X<5.5
MAY 24	103	5-2 OUTLET	240	0.50	1.3<X<4.7
MAY 26	104	7-1 INLET	180	1.07	0.87<X<3.2
MAY 26	104	7-2 INLET	60	1.12	0.83<X<3.2
JUN 1	105	11-1 INLET	180	0.71	1.1<X<3.8
JUN 1	105	11-1 OUTLET	180	0.72	1.1<X<3.8
JUN 1	105	11-2 INLET	180	0.70	1.1<X<3.8
JUN 1	105	11-2 OUTLET	180	0.73	1.1<X<3.8
MAY 15	106	1-1 INLET	60	1.11	0.83<X<3.2
MAY 15	106	1-1 OUTLET	60	0.72	1.1<X<3.8
MAY 15	106	1-2 OUTLET	60	0.74	1.1<X<3.7
MAY 15	106	1-3 INLET	60	0.95	0.92<X<3.2
MAY 15	106	1-3 OUTLET	60	0.78	1.1<X<3.6
MAY 30	106	9-1 INLET	180	0.87	0.98<X<3.3
MAY 30	106	9-1 OUTLET	180	0.75	1.1<X<3.7

* CALCULATED FLOW RATE= (NET METER VOLUME-FT3)/(SAMPLE TIME-MIN)

TABLE 12
Scrubber 103
Total Chromium Particle Sizing Test Results

Test 5-Run 1, Inlet
Total Catch Weight = 92.5 grams
Gas Flow Rate = .35

	D50	Cutpoints (μm)	%	Cum. % Less than D50
Stage 1	19	x>19	12	88
Stage 2	15	15<x<19	2	86
Stage 3	5.5	5.5<x≤15	53	33
Stage 5	1.6	1.6 < x ≤ 5.5	26	7
Filter		x ≤ 1.6	7	

Test 5-Run 2, Inlet
Total Catch Weight = 77.3 grams
Gas Flow Rate = 0.35

	D50	Cutpoints (μm)	%	Cum. % Less than D50
Stage 1	19	x>19	14	86
Stage 2	15	15<x≤19	7	79
Stage 3	5.5	5.5<x<15	47	32
Stage 5	1.6	1.6 < x ≤ 5.5	27	5
Filter		x ≤ 1.6	5	

TABLE 12 (CONTD.)
Scrubber 103
Total Chromium Particle Sizing Test Results (Contd.)

Test 5-Run 1, Outlet
Total Catch Weight = 16.1 gms
Gas Flow Rate = 0.5 acfm

	D50	Cutpoints (μm)	%	Cum. % Less than D50
Stage 1	17	$x>17$	14	86
Stage 2	12	$12<x\leq17$	13	73
Stage 3	4.7	$4.7<x\leq12$	12	61
Stage 5	1.3	$1.3<x\leq4.7$	28	33
Filter		$x\leq1.3$	33	

Test 5-Run 2, Outlet
Total Catch Weight = 11.0 grams
Gas Flow Rate = 0.5 acfm

	D50	Cutpoints (μm)	%	Cum. % Less than D50
Stage 1	17	$x>17$	21	79
Stage 2	12	$12<x\leq17$	18	61
Stage 3	4.7	$4.7<x\leq12$	18	43
Stage 5	1.3	$1.3<x\leq4.7$	25	18
Filter		$x\leq1.3$	18	

TABLE 13
STATIC PRESSURE DROP ACROSS SCRUBBERS

SCRUBBER	INLET STATIC PRESSURE (in.H2O)	OUTLET STATIC PRESSURE (in.H2O)	STATIC PRESSURE DROP (in.H2O)
101	1.9	6.8	4.8
102	3.3	6.4	3.1
103	1.7	5.4	3.7
104	FAN NOT OPERATIONAL		
105	3.8	5.1	1.3
106	FAN NOT OPERATIONAL		

NOTE: THE CROSS-SECTIONAL AREA OF THE INLET STATIC PRESSURE MEASURING POINT IS APPROXIMATELY EQUAL TO THE CROSS-SECTIONAL AREA OF THE OUTLET STATIC PRESSURE MEASURING POINT FOR EACH SCRUBBER. THESE MEASUREMENTS WERE MADE ON 24 JUL 84, DURING A FOLLOW-UP VISIT TO THE PLATING SHOP.

TABLE 14

Supply Air Flowrates

Heating and Ventilating Unit No.	Measured Flow Rates (cfm)
10	20520
11	* 20520
12	27784
13	27327
Total	96151

*Unit not operating during survey.

TABLE 15
Exhaust Air Flowrates

Scrubber Fan #	Recommended Flowrate (SCFM)*	Measured Flowrate (SCFM)		Measured Fan Inlet SP (inches WG
		Scrubber Inlet	Fan Outlet	
101	25140	28129		-6.8
102	22785	30966	38271	-6.4
103	37625	32700	29454	-5.4
104	23625	32696	**	*
105	28350	48854	50091	-5.1
106	45450	43590	44520	***

*See Appendix G.
**Line 104 outlet flowrate was not measured because existing scrubber and fan are scheduled to be replaced.
***Fan on Line 106 was not operable.

standards indicate the time-weighted permissible exposure limit (PEL) of a pollutant over an 8-hour workday. Pollutant concentrations measured at levels lower than the OSHA standard indicate that the pollutant is at a safe workplace concentration.

Strong odors emanate from both the paint strip tank (Tank 52) and the large vapor degreaser tank (between Tank 12 and Tank 13). Although both tanks present potential health hazards, neither tank is ventilated. The paint strip tank contains approximately 80 percent methylene chloride (CH_2Cl_2). The PEL for methylene chloride is 100 parts per million. The vapor degreaser contains full strength 1,1,1 trichloroethane (Cl_3CCH_3). The PEL for trichloroethane is 350 parts per million.[7]

B. Air Emissions

1. Scrubber 102 (Alkaline). Mass emissions data show an average inlet sodium hydroxide (NaOH) emission rate of 0.26 mg/m^3. The average outlet NaOH emission rate is 0.16 mg/m^3. Both inlet and outlet emission rates for NaOH are well below the OSHA workplace standard of 2.0 mg/m^3. See Table 9.

The inlet hydrochloric acid (HCl) emission rate was 0.19 mg/m^3. The HCl outlet emission rate was 0.15 mg/m^3. Both the inlet and outlet HCl emission rates are well below the allowable workplace limit of 7.0 mg/m^3. See Table 9.

Nickel (Ni) emission rates were below detectable limits ($>$ 0.01 mg/m^3) at both inlet and outlet sampling sites.

One 80-minute impactor run and one 180-minute impactor run were performed on Scrubber 102. No significant weight gains ($>$0.5 mg) were measured on any of the inlet or outlet impactor filter stages. The lack of measurable weight gain on the impactor stages is consistent with the low emission rates measured during mass emissions testing.

2. Scrubber 103 (Decorative/Hard Chrome Plating). The average inlet chromic acid concentration of 1.31 mg/m^3 is well above the 0.1 mg/m^3 OSHA workplace standard.[7] The average scrubber outlet chromic acid concentration is $<$0.1 mg/m^3. Scrubber efficiency is good, with an average removal efficiency of 92%.

Particle size distribution data show an inlet median aerodynamic diameter of 7.6 um for the chromic acid mist. See figures 17 and 18. No significant weight gains ($>$0.5 mg) were measured on any of the inlet or outlet impactor stages, though collected particulate was visibly evident on all filter stages. Each filter stage was chemically analyzed to determine quantities of chromic acid mist collected. See Appendix C. The high efficiency measured across Scrubber 103 is consistent with the scrubber manufacturer's claims for particulate removal efficiency.[8] See Appendix I for photographs of Scrubber 103 impactor filter stages.

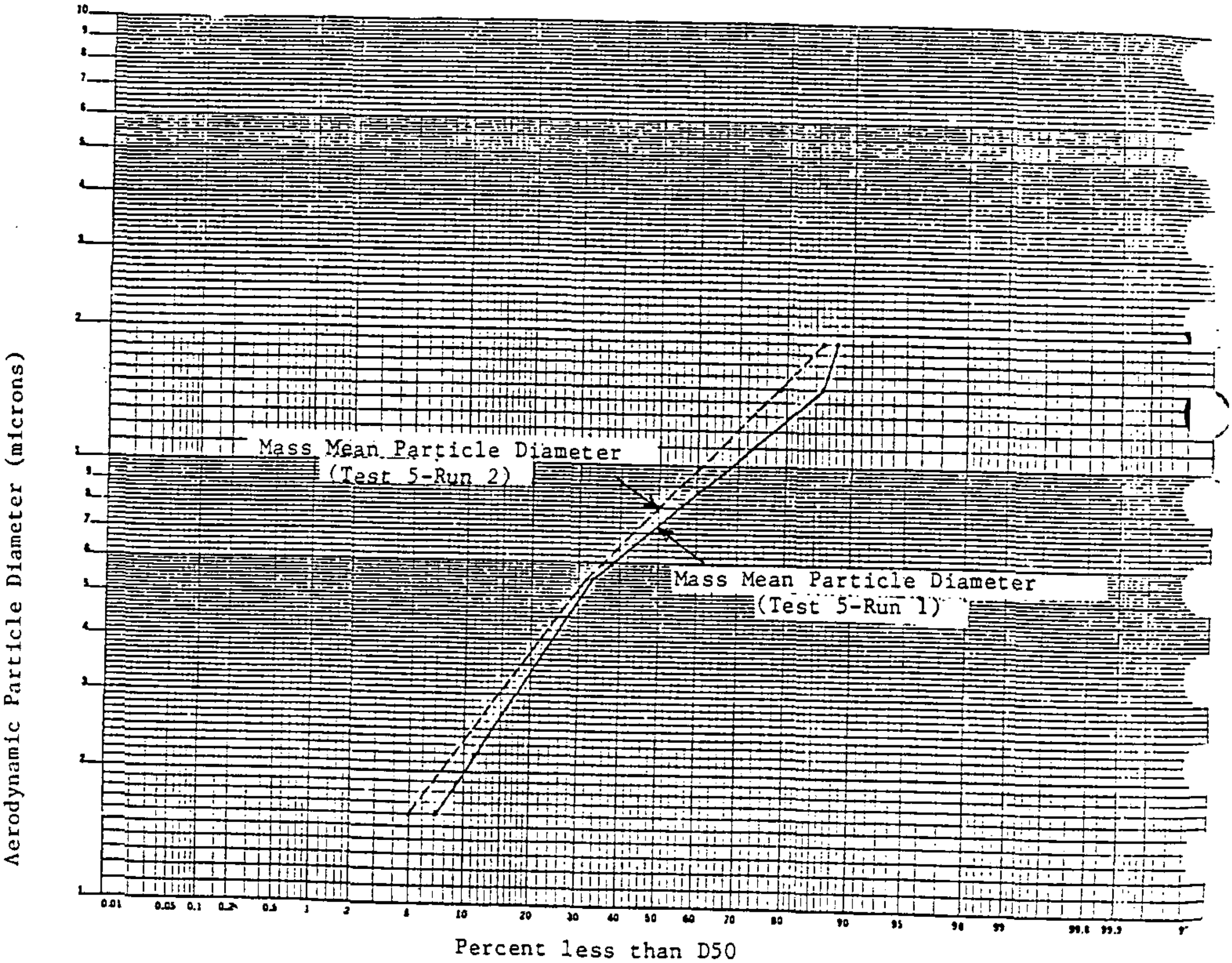


Figure 17. Mass Mean Particle Diameter, Scrubber 103 Inlet

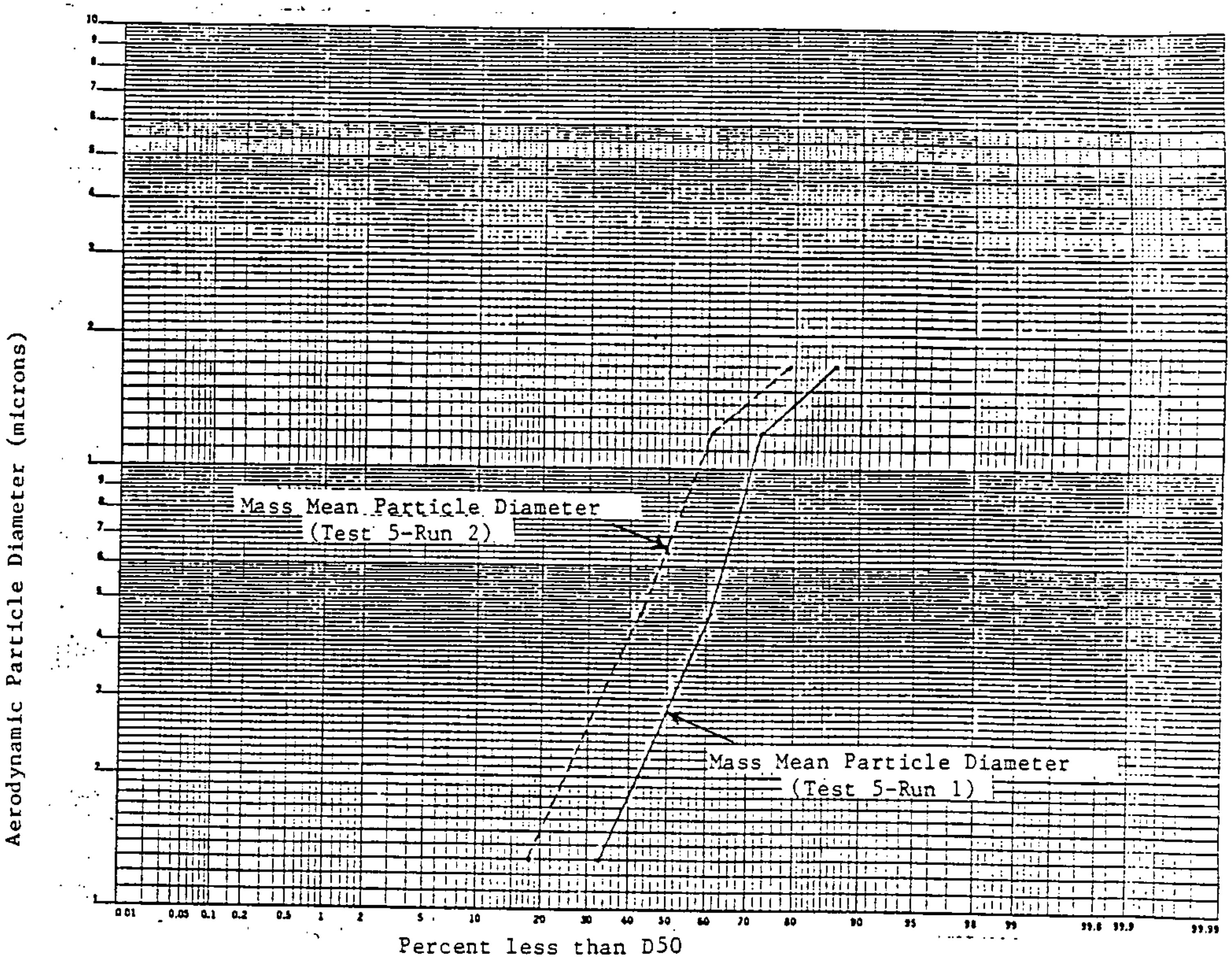


Figure 18. Mass Mean Particle Diameter, Scrubber 103 Outlet

NOTE: The Scrubber 103 inlet duct dimensions were incorrectly assumed to be the same as the inlet duct dimensions of scrubbers 101 and 102. Measurements made of the Scrubber 103 inlet duct during the initial velocity traverse showed the duct width to be 64 inches versus 43 inches on scrubbers 102 and 103. The three test ports installed prior to testing allowed sampling of only 60% of the duct cross-section. Measured inlet flow rates averaged 3% higher than the outlet flow rates. Test results have not been modified to account for the higher measured velocities at the scrubber inlet.

3. Scrubber 104 (Acid). The average inlet hydrochloric (HCl) acid concentration of 32.2 mg/m^3 is well above the OSHA workplace standard of 7.0 mg/m^3. Acid attack was evident on metal structures within 100 feet of this scrubber. Outlet emissions were not measured, as the scrubber and fan are scheduled for replacement in the immediate future.

Particle size distribution data was inconclusive. The acid aerosol deposited on all interior surfaces of the impactor, invalidating the weight gains measured on individual filter stages. See Appendix I for photographs of the Scrubber 104 impactor filter stages.

High levels of chromium were detected in each mass emissions sample collected at Scrubber 104. The presence of chrome in the samples was inconsistent with the fact that no tank connected to Scrubber 104 contained chromates. Heavy acid attack was evident on all stainless-steel sampling probe components exposed to the exhaust gases. The probable source of the chrome is the sampling nozzle. The sampling nozzle interior had been gold-plated prior to the test teams' arrival at Long Beach NAVSHIPYD, and frequent measurements of the inside diameter with a steel micrometer (required to calculate actual sample flow rate) had chipped away some of the protective gold-plating. Reaction between HCl and the high chrome content (17%) of the stainless-steel nozzle would contribute chrome to the emissions sample. No inconsistent chrome levels were noted in samples taken from the other four scrubbers tested, indicating that the high reactivity of HCl with the stainless-steel was the source of the chrome detected in Scrubber 104 samples.

4. Scrubber 105 (Heavy Metal). Average inlet concentrations of Silver (Ag), Cadmium (Cd), Chlorine (Cl), Cyanide (CN), Copper (Cu), and Nickel (Ni) were all well below OSHA workplace standards. See Table 9. No reduction in emissions was achieved by the scrubber on Ag, Cd, Cu, and Ni.

Scrubber outlet emissions increased slightly for Cl and CN. This phenomenon occurs under certain conditions in wet scrubbers treating gas streams with very low particulate loadings. Circulating scrubber water acts as a reservoir concentrating captured pollutants, and some of this scrubber water is entrained as mist and carried out the stack.

Two 3-hour impactor runs were performed on Scrubber 105. No significant weight gains (>0.5 mg) were measured on any of the inlet or outlet impactor filter stages. The lack of measureable weight gain on the impactor stages is consistent with the low emission rates measured during mass emissions testing.

On both inlet and outlet, collected particulate was visible on Stage 5 of each impactor following each run. The aerodynamic particle size range collected on Stage 5 was between 1.1 um and 3.8 um. See Table 11. Wet scrubber efficiencies on particles in this size range are low (<50%).

5. Scrubber 106 (Chromates). Both the scrubber inlet and outlet chromium emission levels were below detectable limits. Hydrochloric acid concentrations averaged 0.1 mg/m^3 at both the scrubber inlet and the outlet. These hydrochloric concentrations are well below the OSHA workplace standard of 7.0 mg/m^3.

The tanks connected to Scrubber 106 contain proprietary chromate solutions used to clean and coat aluminum, brass, and copper components. Compressed air provides mechanical agitation to these tanks. No visual indications of chemical action are evident when a workpiece is immersed in the chromate solutions, unlike the gassing which is evident at the workpiece during electrocleaning or hard chrome electroplating.

Three 1-hour impactor runs and one 3-hour impactor run were performed on Scrubber 106. The results are identical to the impactor results discussed for Scrubber 105.

C. Ventilation Survey

1. Smoke Tests. Turbulent air currents were identified by observing smoke travel at different locations within the shop. Along the perimeter walls smoke rose upward at different velocities from floor level to 25 feet above the floor. Near tank exhaust hoods in the northwest half of the shop, where cross drafts had been identified, smoke was not effectively captured. Throughout the shop smoke traveled in various directions at relatively high velocities (greater than 200 fpm).

NAVENENVSA and Long Beach NAVSHIPYD personnel discussed causes for the turbulent cross drafts. The quantity of supply air is insufficient and is not distributed uniformly throughout the shop. Infiltration through existing openings is excessive.

A solution to control the cross drafts is: Supply additional air into the shop, install perforated ducting horizontally three to four feet below the ceiling to provide uniform distribution of supply air, seal off the three 8-foot by 8-foot wall grills, and close perimeter doors.

Good engineering practice[2] requires maintaining the plating shop under a negative pressure by mechanically supplying a quantity of air equal to 90 percent of the exhaust air. A uniform distribution of supply air, entering the plating shop at a rate of 50 to 100 feet per minute (fpm), is necessary. The remaining supply air will infiltrate through existing openings.

2. A sump trench connecting lines 101, 102, and 103 was identified. This trench causes the three fans to compete for air. Mist and liquid waste from one line can be drawn through the trench and contaminate another line. This condition was observed on a subsequent visit to Long Beach

NAVSHIPYD. Liquid solution from a hard chrome tank on Line 103 overflowed into the exhaust system and was drawn into the scrubber on Line 102 through the sump trench.

Scrubber 102 has an elevated inlet static pressure relative to scrubbers 101 and 103, causing a portion of the exhaust air in lines 101 and 103 to flow through the trench to Line 102. Pitot tube traverse point locations were directly above the trench. Because of this location, the quantity of air flow into Line 102 from lines 101 and 103 was not "seen" by the pitot tube. A 7300 scfm increase in air flow was measured between the Scrubber 102 inlet and outlet. See Table 10. No leaks were evident in the scrubber housing, indicating that the additional air was coming through the sump trench.

A 3200 scfm decrease in air flow between scrubber inlet and fan outlet was measured at Line 103. The outlet air flow at Line 101 was not measured, but it is expected that the fan outlet flow rate is approximately 4100 scfm less than the inlet flowrate.

3. Prefilters in the roof-mounted heating and ventilating (HV) units were in poor condition during a pretest inspection. These prefilters were replaced for the tests. However, the filter support screens were broken and torn open (apparently when replacing filters), prefilter supports were misaligned, two of the four supply air units were operating with loose fan belts, and HV-11 was not in operation. No monitoring instrumentation (such as magnahelics) is located inside the plating shop for the roof-mounted HV units.

VII. CONCLUSIONS

A. General

Emissions test data demonstrate that several types of metal cleaning and plating processes do not produce sufficient emissions to justify the use of air pollution control equipment. An exhaust ventilation system without air pollution control equipment is sufficient for caustic tanks, chromate tanks, and metal (non-chrome) plating tanks. Chrome plating tanks and HCl tanks do require control equipment.

B. Specific

1. Line 101. Scrubber 101 emissions were not tested, as tanks containing similar solutions existed on lines 102 and 106. Tanks solutions that are unique to Line 101, sodium orthosilicate (Tank 8) and phosphate cleaner (Tank 9), are not significant sources of atmospheric air pollution.

A scrubber is not necessary on Line 101, based on emission test results from lines 102 and 106. Exhaust ventilation alone is required. Removal of the scrubber internals will reduce fan static pressure requirements by approximately 4.5" H_2O. See Table 13. Fan horsepower required to maintain the present exhaust volume can be reduced by 27 hp, resulting in a yearly electricity cost reduction of $11,100. See Appendix E for calculations. Cost savings would also result by eliminating a source of wastewater to the water treatment system. Yearly scrubber maintenance costs will be reduced as scrubber water pumping and recirculating systems will no longer be used.

2. Line 102. Inlet emission rates for NaOH and Ni are well below OSHA workplace standards.[7] Exhaust ventilation alone is required on Line 102. Removal of scrubber internals would reduce fan static pressure requirements by approximately 3.0 "H_2O. Fan horsepower required to maintain the present exhaust volume can be reduced by 18.6 hp, resulting in a yearly electricity cost reduction of $7,600. Wastewater treatment costs and scrubber maintenance costs will be eliminated.

3. Line 103. Inlet chromic acid emission rates exceed the OSHA workplace standard.[7] The high collection efficiency of the scrubber is consistent with particle sizing test data, which show a relatively large mean particle diameter of approximately 7.6 um.

Scrubber collection efficiency varies depending on the scrubber water flowrate. An accurate scrubber water flowrate meter is necessary to ensure that an adequate volume of water is reaching the scrubber spray nozzles.

4. Line 104. Inlet HCl emission rates exceed the OSHA workplace standard.[7] Inlet sulfuric acid emission rates are below detectable limits. Reduction of the HCl emission rate using a wet scrubber is necessary to protect personnel and equipment in the immediate vicinity of the fan outlet.

Commercially available wet scrubbers can achieve HCl collection efficiencies exceeding 95%. A wet scrubber operating continuously at collection efficiencies exceeding 95% will provide adequate protection to personnel and equipment located near the Line 104 fan outlet. A scrubber water flowrate meter is necessary to insure that a sufficient volume of water reaches the spray nozzles.

5. Line 105. Inlet emission rates for Ag, Cd, Cl, KCN, NaCN, Cu, and Ni are all well below OSHA workplace standards. See Table 9. Scrubber outlet concentrations for NiCl and CN are slightly higher than inlet concentrations. Outlet concentrations for Ag, Cd, Cu were below detectable limits.

Air pollution control equipment is not required on Line 105. Removal of the scrubber internals will reduce fan static pressure requirements by approximately 1.0" H_2O. Fan horsepower required to maintain the present exhaust volume can be reduced by 12 hp, resulting in a yearly electricity cost reduction of $4,900. Wastewater treatment cost and scrubber maintenance costs will be eliminated.

6. Line 106. Inlet chromate emissions are below detectable limits. Inlet HCl emissions are well below the OSHA workplace standard. HCl emissions at the scrubber outlet are slightly above the inlet HCl emission level.

Air pollution control equipment is not required on Line 106. Removal of scrubber internals will reduce fan static pressure requirements by approximately 1.0" H_2O. Fan horsepower required to maintain the present exhaust volume can be reduced by 12 hp, resulting in a yearly electricity cost reduction of $4,900. Wastewater treatment costs and scrubber maintenance costs will be eliminated.

C. Ventilation Survey

1. Turbulent cross-drafts which adversely affect contaminant control are the result of the following:

a. Mechanical supply air deficiency of 94,000 scfm.

b. Non-uniform distribution of air supplied through sixteen ceiling-mounted concentric cone diffusers.

c. Supply air drawn in through three 8-foot by 8-foot northwest wall air grills.

d. Supply air drawn in through two 6-foot by 9-foot doors in the northwest wall.

2. Exhaust flow rates for lines 101, 102, 104, 105, and 106 are sufficient to control contaminants if turbulent cross-drafts are eliminated.

3. The measured exhaust flowrate from Line 103 is not sufficient to control chromic acid mist from tanks 41, 42, 43, and 44.

4. Maintenance of roof-mounted supply air equipment is inadequate. Plating shop and maintenance personnel must be able to identify the ventilation system operating conditions. The lack of indicating devices contributes to system maintenance neglect.

VIII. RECOMMENDATIONS

A. Air Emissions

1. Scrubbers 101 and 102. Remove the scrubber internals to reduce static pressure at the exhaust fan inlet. Adjust the fan RPMs to maintain present exhaust flowrates.

2. Scrubbers 103 and 104. Install a flowmeter on the scrubber feedwater pump outlet pipe. Scrubber efficiency is proportional to the flow through the spray nozzles. A flowmeter is necessary to insure an adequate flowrate. A simple rotometer is available through Harrington Industrial Plastics Company, Anaheim, California, for this application. Record the flowrate in a daily log.

Perform a source test on Scrubber 104. Acid emissions from Line 104 are the cause of extensive property damage. This scrubber must meet the manufacturer's claims for HCl removal efficiency, otherwise HCl emissions will continue to be a problem.

3. Scrubbers 105 and 106. Remove the scrubber internals to reduce static pressure at the exhaust fan inlet. Adjust the fan RPMs to maintain present exhaust flowrates.

B. Ventilation Survey

1. Supply Air.

   a. Close off three 8-foot by 8-foot outside air grills located on the northwest wall.

   b. Close all doors during process operations.

   c. Add roof-mounted heating and ventilating units to increase the supply air flowrate by 94,000 scfm.

   d. Recommend that air be supplied through perforated round ducting, running horizontally below the ceiling. Supply air will be distributed uniformly at low velocity using this perforated ducting.

   e. Recommend measurement of pressure drop across prefilters on each roof-mounted supply-air HV unit. Install magnahelic gauges for each prefilter on a panel unit located within the plating shop. Record pressure drop across each prefilter in a daily log. Replace filters when pressure drop exceeds manufacturer's recommendation.

   f. Recommend installation of annuciator panel displaying status of supply-air fan motors inside the plating shop.

2. Exhaust Air.

   a. Install baffles six to eight inches high at the ends of each tank with push-pull exhaust hoods. Install baffles perpendicular to the exhaust slot faces. Also, install 6-inch to 8-inch high baffles at each end of tanks 35, 36, 41, 42, 43, 44, 45, 47, 48 and 50 (lateral exhaust hoods).

   b. Install exhaust ventilation on the large paint strip tank (Tank 52). Recommend a push-pull exhaust hood to minimize the required exhaust air. Appendix H provides design data.

   d. Recommend removable cover for the anodes located in tanks 41, 42, 43, and 44. An anode cover will reduce tank surface area, lessening exhaust air requirements.

   e. Recommend installation of magnahelic gauges at the inlet and outlet of scrubbers 103 and 104 to monitor system operating conditions. Locate these four magnahelic gauges on the panel containing the supply air magnahelics. Recommend a three-way valve at the connection of each magnahelic gauge pressure tap for calibration purposes.

f. Recommend installation of magnahelic gauges upstream of existing scrubbers, 101, 102, 105, and 106 to monitor system operating conditions. Locate the four gauges on the panel containing the supply air magnahelics. Recommend a three-way valve at the connection of each magnahelic gauge pressure tap for calibration purposes.

g. Isolate lines 101, 102, and 103 by sealing off the interconnecting sump trench.

References

1. CO WESTNAVFACENGCOM ltr 1141E:WJD:eca NAVSHIPYD Long Beach ser 1141/65 of 27 Mar 84.

2. Industrial Ventilation a Manual of Recommended Practice, Committee on Industrial Ventilation, American Conference of Governmental Industrial Hygienists, Ann Arbor, Michigan, Seventeenth Edition, 1982.

3. NESO 2-039, Analysis of Emission Controls at the Electronics Weapon Precision Facility Rating Shop, Long Beach Naval Shipyard, February 1976.

4. Federal Register, Environmental Protection Agency, Standards of Performance for New Stationary Sources, Vol 42, No. 160, August 1977.

5. American Society of Mechanical Engineers Performance Test Code (PTC) 28 Determining Properties of Fine Particulate Matter, (draft edition)

6. Pollution Control Systems Corporation, Operations Manual, Pilat Mark 3 and Mark 5 Source Test Cascade Impactors, Seattle, Washington, January 1983.

7. 29 CFR 1910.

8. Harrington Industrial Plastics, Inc., Anaheim, California, Air Pollution Control Equipment Specifications.

APPENDIX A
TANK DATA

TANK ELECTRICAL DATA SHEET

Location LBNSY
Building 210
Tank 4
Scrubber 102
Read by [illegible]
Date 16 MAY 1984

Rectifier -7 (ID# 616691)
Make CLINTON PLATOR
Type 3Φ, 60 CYCLE
Voltage Rating 480 V_{in}, 0-15 V_{out}
Amperage Rating 69 AMP_{in}, 3,000 Amp_{out}
Workplace Size

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
3:34	N/A*				
4:05	≐ 5 V				
4:10	4.8 V				
4:15	4.8 V				
4:25	4.8 V				
4:35	4.8 V				
4:45	4.7 V				
5:00	4.7 V				
6:00	4.7 V				
END of TEST		4.8 V			

* The electrical current is not on while pieces within the tank are being moved.

(Tanks 4, 33, 40, 48, 50)

16 MAY 1984

- pm — Tank 48 - empty

Tank 33 - Not used Today

Tank 4 — 2 pieces 9" x 2½' x 3½' = 26 ft²
1 piece

Tank 40 — No work

Tank 50 — No work

3:34 Start Emission Test

#4 - 3 pieces within tank however there is no current being use because the operator (Terry) is moving the pieces arou In my conversation w/ Terry he had said that yes when the pieces are moved, more vapors are released. How vapors are released even w/o workpieces in the tank and because of this evaporation, water is regularily added to the tank to replenish the soln. (He said that this is done twic every 24 hour period)

4:00-4:01 #50 - 1 cylinder Rod ≈ 3"(OD) × 6'

4:05 #4 — turned electrical current on. ≈ 5V..
4:10 #4 — 4.8 V
4:15 #4 — 4.8 V
4:25 #4 — 4.8 V
4:35 #4 — 4.8 V (actually 4.75 V)
4:45 #4 — 4.7 V
5:00 #4 — 4.7 V

5:30 #4 — 4.7 V The Same 3 pieces from 3:34 were still in the tank. None o the other tanks (40, 33, 48, 50) were being use
6:00 END of TEST Only one operator in the shop @ that time.

TANK ELECTRICAL DATA SHEET

Location LBNSY
Building
Tank 4,30
Scrubber 102
Read by [illegible signature]
Date 17 May 89

Rectifier
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

TANK 4
[illegible] (misc parts) 6" x 1/2 x 3'
4.5 ft² = Hooks w/ misc [illegible] (4×2')
4.CA =
20.5 ft²

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
5:10	8.2V 2,000 Amps		510	5V 140 Amps	
* 515	6.4 2000		525	5 140	
525	6.6 2025		540	5 140	
540	6.6 2000		555	5 140	
555	6.6 2025		610	5 140	
610	6.7 2000		625	5 140	
625	6.7 2000		640	5 140	
640	6.8 2025		655	5 140	
655	6.85 2025		710	5 140	
710	7.0 2000		725	5 140	
725	7.0 2025		740	5 140	
740	7.1 2000			End of TEST	
	END of TEST				

T...
1/2 x 1/2 x ...
(one side ...

* 2nd load added

'BNSY
17 May 1984

Scrubber 102

\# 4 (cleaner) ⟶ ≐ 2000 Amps
\# 33 (Ni Plate) ⟶ ≐ 5V
\# 48 (Rinse)
\# 50 (Al Etch)

5:10 #4 has load of 2 hooks w/valve bodies (misc ≈ 4'x2' = 8ft²) 16
\#33 has load of 1 piece ≐ 1½x1½ (2¼ft²) 2¼
\#50 had load of 2 pieces ≐ 2'x2' (4ft²) 16
5:15 #4 add load of basket ≈ 6"x1½'x3' of misc parts (4½ft²) 4½
\#4 – 6.4V, 2000 Amps
\#50 – load raised
5:25 load raised @ Tanks #4 & 50 & elect. data taken @ #4 & #33 (approx 3-5 min later)
40 " " " " " " " " "
5:55 " " " " " " "
6:10 " " " " " " "
6:25 "both pieces in T50 replaced" because the 1st 2 pieces were getting too thin. 1 @ 1x1½, 1 @ 2x2 = (
6:40 " " " " " " "
6:55 " " " " " " "
7:10 " " " " " " "
7:25 " " " " " " "
7:40 " " " " " " "

END of TEST.

18 MAY 1984
LBNSY, B210

TEST 2 RUN 3

Scrubber # 102

#33 — 1 piece (1/2x1 1/2) 2.25"

#50 — misc pieces sheet mtl. (8ft²) ~~1 lrg piece (8ft²)~~ 450

#4 - 2 pieces - 7'x 1' LD) 1 PIECE IS HEAT EXCH CORE (TUBES) VERY LARGE SURFACE AREA

-5 misc parts

4:30 Begin Test. Water added into tank #4 & pieces in tank 4 were lifted. Items in tanks #33 #50 were inserted at approx. 4:25.

⟹ TANK 4 & 50 will have their loads lifted every 15 min.

4:50 Tank 50 — new lrg AL piece added — 8ft²

↓ TOTAL AL AREA IN TANK = 16 FT.²

6:30

NOTE: TOTAL SURFACE AREA OF WORKPIECES IN TANKS ABOVE IS NORMAL DOUBLE THE WORKPIECE AREA STATED ABOVE.

MAY 1984 TEST 2 RUN 3

L&NSY, B210

Scrubber #102

#33 — 1 piece (1½x1½) 2.25 ft

#50 — misc pieces that nd. (8ft²) ~~lrg piece (8ft²)~~ 450

#4 — 2 pieces — 7'x1'LD) 1 PIECE IS HEAT EXCH CORE (TUBES) VERY LARGE SURFACE AREA 16.

-5 misc parts

4:30 Begin test. Water added into tank #4 & pieces in tank 4 were lifted. Items in tanks #33 & #50 were inserted at approx. 4:25.

TANK 4 & 50 will have their loads lifted every 15 min.

50 Tank 50 — new lrg AL piece added — 8ft²

TOTAL AL AREA IN TANK = 16 FT.²

6:30

NOTE: TOTAL SURFACE AREA OF WORKPIECES IN TANKS ABOVE IS NORMAL DOUBLE THE WORKPIECE AREA STATED ABOVE.

TANK ELECTRICAL DATA SHEET

2055 → 2255

Location LBNSY
Building B210
Tanks 4 & 33
Scrubber 102
Read by SC Suzuki
Date 18 May 1984

Rectifier TEST 2 RUN 4
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

TANK #4 - Caustic Cleaner

TANK #33 - Ni Plate

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
8:45	8.7V	2050 Amps	8:45	5V	140 Amps
9:00	8.7V	2025	9:00	5V	140
9:15	8.7V	2000	9:15	5V	140
9:30	8.1V	2025	9:30	5V	140
9:45	8.7V	2000	*9:45	3V	100
10:00	8.4V	1900	10:00	5V	150
10:15	8.4V	1850	10:15	5V	150
10:30	8.5V	1975	*10:30	3V	100
10:45	8.4V	1850	10:45	5V	150
11:00	8.6V	2050	11:00	5V	150

9:15 Collected liq samples from Tank #4, 33, 50
Tank 4 may have oil in the sample due to prior cleaning of a part which uses diesel oil (on Thursday)

*945 Tank 33 Voltage dropped to 3V from 5V because operator needed to Ni plate a small (≈5in) part — for 3min only.

WORKLOAD IN TANKS:

#4 - 1 long cylinder (heat sink/cooler coil - copper), MISC (steel parts - Nest tubings) 1½ FT DIA. × 7 FT. 9 FT² TOTAL

#33 - 1 plate of steel 1½' × 1½' = 2.25 FT²

#50 - 6 plates of aluminum. = 11 FT²

TANK ELECTRICAL DATA SHEET

TEST 3 RUN 1

Location LBNSY
Building 210
Tank 4, 33, 50
Scrubber 102
Read by SUZUKI, POW
Date 21 MAY 84

Rectifier -
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

TANK 4 [3 CHAIRS = 12 FT^2; 8 LARGE CYL. HOODS = 32 FT^2; 5 STEEL BOXES = 20 FT^2; TOT = 64 FT^2 SURFACE]

TANK 33 [1.5' x 1.5' x ¼" STEEL PLATE]

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
START 1850	6.8 V	2000 amps LOAD ENTERS		5.0 V	150 amps LOAD ENTERS
1915	7.5 V	2050 amps LIFT & DROP		5.0 V	150 amps LIFT & DROP
1930	7.6 V	2025 amps LIFT & DROP		5.0 V	150 amps —
1945	7.6 V	2025 amps LIFT & DROP		5.0 V	150 amps —
2000	6.8 V	1975 amps LIFT & DROP		5.0 V	150 amps —
2010	7.6 V	1975 amps LIFT & DROP		5.0 V	150 amps —
END OF TEST					

TANK 50 [Al ¼" PLATE 24 FT^2 TOTAL SURFACE]

Time			
1850	LOAD ENTERS TANK		
1915	LOAD LIFTED & DROPPED		
1930	" "	"	"
1945	" "	"	"
2000	" "	"	"
2010	" "	"	"

TANK ELECTRICAL DATA SHEET

Test 3 Run 2

Location: LENSY
Building: 210
Tank: 4, 33, 50
Scrubber: 102
Read by: S. Suzuki
Date: 21 May 1984

Rectifier:
Make:
Type:
Voltage Rating:
Amperage Rating:
Workplace Size:

TANK 4 [2 @ 7'x12"D ~~14~~ pipe = 16 ft²; 4 ... = ... ; 5 steel ... = 20 ft²; 2 ... + misc. parts = 10 ... ; 66 ft²]

TANK 33 [1.5'x1.5'x1/4" st. Plate]

Time	Reading	Avg. Reading		Time	Reading	Avg. Reading
21:45	6.4V	2000 Amps			5.0V	150 Amps
22:00	6.4V	1975 Amps	Lift & Drop		5.0V	150 amps
22:15	6.0V	1950 amps	"		5.0V	150 amps
22:30	0.8V	50 amps	"		5.0V	150 amps
22:45	6.7V	1875 amps	"		5.0V	150 amps
23:00	7.0V	1950 amps	"		5.0V	150 amps
23:15	7.0V	1950 amps	"		5.0V	150 amps
23:30	6.4V	1995 amps	"		5.0V	150 amps
23:45	7.2V	2000 amps	Crew Change		5.0V	150 amps
24:00	7.2V	2000 amps	Lift & Drop		5.0V	150 amps
24:15	6.7V	1900 amps	"		5.0V	150 amps
24:30	9.2V	2000 amps	"		5.0V	150 amps
24:45	7.2V	1995 amps	"		5.0V	150 amps
01:00	7.2V	2000 amps	"		5.0V	150 amps
END of TEST				END of TEST		

TANK 50 [AL 1/4" plate 24 ft²]

21:45 LOAD DROPPED
22:00 LOAD LIFTED & DROPPED EVERY 15 MIN.
" " " " " "
23:00 LOAD REPLACED w/ equivalent load of 24 ft²
23:15 LOAD LIFTED & DROPPED EVERY 15 MIN.

TANK ELECTRICAL DATA SHEET

TEST 4 RUN 1

Location LBNSY
Building 210
Tanks 41, 42, 43, 44
Scrubber 103
Read by QUARLES / BEL
Date 22 MAY 84

Rectifier -
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

TANK #41 [ROTOR BEARING SURFACE 1.0 FT2] TANK #42 [3 1/4" STEEL PLATE DUMMIES 9.0 FT2 ONE SIDE]

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
6:23PM	7.0 V	400 a	6:23PM	7.2 V.	2200 a
6:32	7.0	400	6:32	8.0	2000
6:48	7.0	400	6:48	8.0	2000
7:46	7.0	400	7:47	8.0	2000
8:00	7.0	400	8:00	8.0	2000
8:12	7.0	400	8:12	8.0	2000
8:24	7.0	400	8:24	8.0	2000
8:36	7.0	400	8:36	8.0	2000
8:50	7.0	400	8:50	8.0	2000

TANK #43 [SMALL ROTOR SHAFT 0.5 FT2] TANK #44 [3 1/4" STEEL DUMMIES 14 FT2 ONE SIDE]

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
6:23 PM	4.5	0	6:23 PM	8.4	1250
6:32	7.7	1100 a	6:32	1.5	150
6:48	7.7	1100	6:48	1.5	150
7:47	7.7	1100	7:48	8.6	1000 a
8:01	7.7	1100	8:01	8.6	1000
8:13	7.7	1100	8:13	8.6	1000
8:25	7.7	1100	8:25	8.6	1000
8:37	7.7	1100	8:37	8.6	1000
8:51	7.7	1100	8:51	8.6	1000

6:27 moved plate (~4 ft²) from 44 to 43. removed small rotor shaft from 43. moved plate (~3 ft²) from 42 to 4

TEST 4 RUN 2

TANK ELECTRICAL DATA SHEET

Location 1 BNSY
Building 210
Tank 41, 42 43, 44
Scrubber 103
Read by QUARLES
Date 22 MAY 84

Rectifier –
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

TANK 41 [Rotor bearing surface ~ 1 ft^2] TANK 42 [2 - 1/4" steel plate dummies ~ 4 ft^2]

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
1104 PM	7.0 v	450 a	1104 PM	8.0 v	2000 a
1115	7.0 v	450 a	1115	8.0 v	2000
1125	7.0	450	1125	8.0 v	2000
~~1153~~ 1210 AM	7.0	~~8~~ 450	~~1153~~ 1210 AM	8.0	2000
1245	7.0	450	1245 AM	8.0	2000
110	7.0	450	110 AM	8.0	2000

TANK 43 [2 - 1/4" steel plate dummies TANK 44 [2 - 1/4" steel plate dummies ~ ''

1104 PM	7.6 v	1100 a	1104 PM	9 v	1100 a
1115	7.6	1100	1115	9 v	1100
1125	7.6	1100	1125	9 v	1100
1153	7.6	1100	1153	9.0 v	1100
1210 AM	7.6	1100	1210 AM	9.0	1100
1245 AM	7.6	1100	1245 AM	9.0	1100
110 AM	7.6	1100	110 AM	9.0	1100

All tanks are mechanically agitated

TEST 4 RUN 3

TANK ELECTRICAL DATA SHEET

12 - 6" long 2" dia.

Location LBNSY
Building 210
Tank 41, 42, 43, 44
Scrubber 103
Read by QUARLES
Date 23 MAY 84

Rectifier –
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

TANK 41 {2 - 1/4" steel plate dummies ~ 8.5 FT² (in TANK 43 yesterday)}

TANK 42 {2 - 1/4" steel plate dummies ~ 6 FT²}

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
5:00 PM	8.9 V	2000 a	5:00 PM	8.5 V	2000 a
5:15 PM	8.9	2000	5:15 PM	8.5 V	2000
5:35	8.9	2100	5:35	8.5	1950
6:00 PM	8.9	2100	~~535~~ 6:00	8.5	2000
6:25	9.0	2100	6:25	8.5	2000
6:45	9.0	2100	6:45	8.5	2000
7:05	9.0	2100	7:05	8.5	2000
7:30	9.0	2100	7:30	8.5	2000

TANK 43 {12 shafts @ ~12 FT² - surface 6" long x 2" dia}

TANK 44 {2 - 1/4" steel plate dummies ~ 9.75 FT²}

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
5:00 PM	6.4 V	950 a	5:00 PM	9.6 V	900 a
5:15 PM	6.4 V	950 a	5:15 PM	9.6 V	900 a
5:35	6.4	950	5:35	9.7	950
6:00 PM	6.4	950	6:00	9.6	950
6:25	6.4	950	6:25	9.6	950
6:45	6.4	1000	6:45	9.6	950
7:05	6.4	1000	7:05	9.6	1000
7:30	6.4	1000	7:30	9.6	1000

Location	[illegible]	Rectifier	TEST 4 RUN 4
Building	[illegible]	Make	
Tank	[illegible]	Type	
Scrubber	[illegible]	Voltage Rating	
Read by	[illegible]	Amperage Rating	
Date	[illegible]	Workplace Size	

Tank [illegible] 8.5 ft² — 1/4" steel plate | Tank [illegible] 6 ft² — 1/4" steel plate

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	9 V	2200 A	[illegible]	9.5 V	2000 A
[illegible]	9 V	22[illegible]	[illegible]	9.5 V	2000 A
[illegible]	9	[illegible]	[illegible]	[illegible]	2000 A
[illegible]	[illegible]	22[illegible]	[illegible]	[illegible]	[illegible]
	9 V	[illegible]		[illegible]	[illegible]
[illegible]	9 V	2200 A	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	2200 A	[illegible]	9.5 V	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	9.5 V	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]			
	Tank [illegible]	3.5 ft² 1/4" steel plate		Tank [illegible]	9.75 ft² 1/4" steel plate
	6.4 V	1050 A	[illegible]	9.0 V	1275 A
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	9.0 V	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]50 A	[illegible]	9.0 V	[illegible]
[illegible]	[illegible]	1025 A	[illegible]	[illegible]	1275 [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1275 A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]				[illegible]

TANK ELECTRICAL DATA SHEET

TEST 5 RUN 1

Location: LBNSY
Building: 210
Tank: 41-44
Scrubber:
Read by: BEL
Date: 24 MAY 84

Rectifier: IMPACTOR
Make:
Type:
Voltage Rating:
Amperage Rating:
Workplace Size:

TEST 5 RUN 1

Time	VOLTS TANK 41 Reading	CURRENT 8.5 FT² 1/4" STEEL PLATE Avg. Reading	Time	VOLTS TANK 42 Reading	CURRENT 6 FT² 1/4" STEEL Avg. Reading
1800	8.4	2000	1800	8.1	2000
1828	8.4	2000	1628	8.1	2000
1855	8.4	2100	1855	8.1	2000
1921	8.4	2100	1921	8.1	2000
1950	8.4	2100	1950	8.0	2000
2054	8.5	2300	2054	8.1	2000
2132	8.5	2300	2132	8.0	2000
2149	8.5	2300	2148	8.0	2000
	TANK 43	5.5 FT² 1/4" STEEL		TANK 44	9.75 FT² 1/4" STEEL
1800	8.0	1050	1800	8.0	1100
1827	7.8	1050	1827	8.0	1100
1854	7.8	1050	1854	8.0	1100
1920	7.8	1050	1920	7.9	1100
1950	7.7	1000	1950	7.9	1100
2000	11.2	1700	2053	7.8	1100
2053	11.2	1700	2132	7.8	1100
2132	11.2	1750	2147	7.7	1075
2148	11.2	1750			

TANK ELECTRICAL DATA SHEET

TEST 5 RUN 2

IMPACTOR

Location ______________________ Rectifier ______________________

Building ______________________ Make ______________________

Tank ______________________ Type ______________________

Scrubber ______________________ Voltage Rating ______________________

Read by ______________________ Amperage Rating ______________________

Date ______________________ Workplace Size ______________________

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	[illegible]	[illegible]		[illegible]	6 FT2
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	[illegible]
[illegible]		[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]			[illegible]	[illegible]
				[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	5.5 FT[illegible]		[illegible]	9.75 F[illegible]
	[illegible] V	[illegible]	[illegible]	[illegible] V	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	7.7 V	[illegible]
	[illegible]	[illegible]	[illegible]	7.7V	[illegible]
	[illegible]	[illegible]	[illegible]	7.[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]				[illegible]
				[illegible]	
	[illegible]	[illegible]		7.7	[illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

TANK ELECTRICAL DATA SHEET

Location L3NSY	Rectifier
Building 210	Make
Tank 3, 5, 6	Type
Scrubber 1&4	Voltage Rating
Read by D. Kirkpatrick	Amperage Rating
Date 5/25/84	Workplace Size

Tank 3 (HCl) — Tank 5 (H_2SO_4)

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
2007	2 pcs rad st @ 4 ft2 each		2007	2ft2 Ni plate [illegible] 2ft2 Chrome [illegible]	
			1955	5V	1375 A [illegible]
	2 pcs [illegible]		2030	[illegible]	1300 [illegible]
				(2 pcs. [illegible]	
	[illegible] (new)				
	1 - 5 ft2		[illegible]	5V	[illegible]
	1 - 5 ft2			[illegible]	
	[illegible]				
			2050	4ft2 - Nickel - [illegible] [illegible]	[illegible]
				2ft2 - Chrome - [illegible]	[illegible]
	1 - 5 ft2		[illegible]	5V	[illegible]
	1 - 3 ft2			[illegible]	
2150	[illegible]		2150	low [illegible] 5V	[illegible]

The shop [illegible] plated a set of steel pieces [illegible] Chrome [illegible] HCl tank, [illegible] the test [illegible]

TEST 6
RUN 1 (CONT.)

TANK ELECTRICAL DATA SHEET

Location LBNSY
Building 210
Tank 3, 5, 6
Scrubber 1C4
Read by D. Kirkpatrick
Date 5/25/84

Rectifier
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

~~Tank~~ 6 (HCl)

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
2007	2 pcs Cad [illegible]				
	@ 4 ft² each				
2024	2 pcs Cad [illegible] (same)				
2015	2 (new) pcs. Cad				
	Std				
	1 – 6 ft²				
	1 – 3 ft²				
	[illegible]				
[illegible]	[illegible]				
[illegible]	[illegible]				
	[illegible]				
	1 [illegible]				
	[illegible]				
2140	[illegible]				

END TEST

[illegible] HCl [illegible]

during [illegible] test

Test 6
Run 2

TANK ELECTRICAL DATA SHEET

Location LBNSY
Building 210
Tank 3, 5, 6
Scrubber [illegible]
Read by [illegible]
Date [illegible]

Rectifier
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

Tank 3 (HCl) — Tank 5 (H_2SO_4)

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
2235	2 new pieces [illegible]		2235	1 pc [illegible]	(4 ft²)
	Cadmium steel			1 pc Nickel plated	(4 ft²)
	1 - 15 [illegible]				
	1 - [illegible]				
2255	2 new pieces		2255	Low-MOD activity	
	Cad plated steel			5V	1300 Amps.
	[illegible]				
2315	LOW ACTIVITY		2315	LOW-MOD STEADY	ACTIVITY
2325	2 PCS. 4 FT² ADDED FOLLOWING			5V	1300 AMPS.
	'CAD' PLATE - VERY HIGH ACTIVITY		2350	LOW-MOD STEADY	ACTIVITY
2350	LOW-MOD.	ACTIVITY		5V	1300 AMPS.
	2 PCS. 4 FT²		1205	END TEST	
1205	END TEST				
	TANK 6	(HCL)			
2245	2 PCS.	4 FT. LOW-MOD ACT.			
2310	2 PCS.	4 FT² LOW ACT.			
2320	2 PCS.	3 FT² ADDED			
	FOLLOWING CAD PLATING				
	TANK VERY ACTIVE				
2345	2 PCS.	4 FT² ADDED			
	VERY HIGH ACTIVITY				
1205	END TEST				

Shop continuously [illegible] steel pieces with Cadmium for [illegible] the HCl tanks

Test 6 #2

TANK ELECTRICAL DATA SHEET

Location ______________________ Rectifier ______________________

Building ______________________ Make ______________________

Tank ______________________ Type ______________________

Scrubber ______________________ Voltage Rating ______________________

Read by ______________________ Amperage Rating ______________________

Date ______________________ Workplace Size ______________________

Tank 6 [illegible]

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
[illegible]	[illegible]	[illegible]			
	[illegible]	[illegible]			
	[illegible]	[illegible]			
	[illegible]				
[illegible]	[illegible]	[illegible]			
	[illegible]				
	[illegible]				
	[illegible]				

TEST 6, RUN

TANK ELECTRICAL DATA SHEET

Location [illegible]	Rectifier
Building [illegible]	Make
Tank [illegible]	Type
Scrubber	Voltage Rating
Read by	Amperage Rating
Date	Workplace Size

TANK 2 / TANK [illegible]

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
1236	2 1/2	x 2' — 6FT²	1235	3FT²	1/4 CHROME PLATED STEEL
	1/4 CADMIUM	PLATED STEEL		1 1/2 FT²	1/4 NICKEL PLATED STEEL
	HIGH ACT	IVITY		5V	1800 A
1255	LOW ACTIVITY			LOW	ACTIVITY
				STEADY	STATE
~~1255~~ 1256	2 1/2	x 1 1/2' 6FT²	1255	5V	1200 A
	1/4 CADMIUM PLATED STEEL		1316	5V	1250 A
	HIGH ACTIVITY		[illegible]	5V	[illegible] A
1316	LOW ACTIVITY		[illegible]	5V	[illegible] A
1317	2 - 1/2	x 2	1415	[illegible]	[illegible]
	HIGH	ACTIVITY			
[illegible]	[illegible]	[illegible]			
[illegible]	2	x 1			
	1 1/2	x [illegible]			
	[illegible]	[illegible]			
[illegible]	2 - 1 1/2	x 2			
	[illegible]	[illegible]			
[illegible]	LOW	[illegible]			

ALL PLATES
CADMIUM PLATED 1/4 STEEL

TEST 6, RUN

TANK ELECTRICAL DATA SHEET

Location ______________________ Rectifier ______________________
Building ______________________ Make ______________________
Tank ______________________ Type ______________________
Scrubber ______________________ Voltage Rating ______________________
Read by ______________________ Amperage Rating ______________________
Date ______________________ Workplace Size ______________________

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
1236	2 - 1½'	x2' - 6FT²			
	¼ CADMIUM PLATED STEEL				
	HIGH	ACTIVITY			
1255	LOW	ACTIVITY			
1257	1 - ~~2~~ x 1½	= 6FT²			
	1 - 1½ x 1½				
	HIGH ACTIVITY				
	¼ CADMIUM PLATED STEEL				
~~[illegible]~~					
1316	LOW ACTIVITY				
1324	2 1½ x 1½				
	HIGH ACTIVITY				
		[illegible]			
	[illegible]	[illegible]			
	1 - 1½	x 1½			
[illegible]					
	[illegible]	[illegible]			
	1 -	1 x 2			
	1 -	[illegible]			
	[illegible]	[illegible]			

TANK ELECTRICAL DATA SHEET

Location [illegible]
Building [illegible]
Tank [illegible]
Scrubber [illegible]
Read by [illegible]
Date [illegible]

Rectifier TEST 7 RUN 1
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

TANK 2 | TANK 5

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
1:15	2-1/2 x 2			1 —	3FT [illegible]
	[illegible]	[illegible]		1 —	1½ FT
			[illegible]	5V	[illegible] A
	[illegible]		[illegible]	5V	[illegible] A
			1712	5V	[illegible] A
	2-1/2 x 1/2		[illegible]	V	[illegible] A
			[illegible]	[illegible]	[illegible]
				5V	[illegible]
			[illegible]	5V	[illegible]
			[illegible]	[illegible]	[illegible]
			[illegible]	[illegible]	
				[illegible]	[illegible]

[illegible] CADMIUM [illegible]

TANK ELECTRICAL DATA SHEET

Location
Building
Tank
Scrubber
Read by
Date

Rectifier Test 7 Run 1
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
[illegible]	[illegible]	[illegible]			
		[illegible]			
	[illegible]				
	[illegible]	[illegible]			
[illegible]	[illegible]	[illegible]			
	[illegible]	[illegible]			
	[illegible]	[illegible]			
[illegible]		[illegible]			
[illegible]					
		[illegible]			
		[illegible]			
		[illegible]			
[illegible]					
[illegible]	[illegible]	[illegible]			
	[illegible]	[illegible]			

TEST 7- RUN 2

TANK ELECTRICAL DATA SHEET

Location ____________________ Rectifier ____________________
Building ____________________ Make ____________________
Tank ____________________ Type ____________________
Scrubber ____________________ Voltage Rating ____________________
Read by ____________________ Amperage Rating ____________________
Date ____________________ Workplace Size ____________________

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	[illegible]			[illegible]	[illegible]
	[illegible]				[illegible]
				[illegible]	

TEST 7 RUN 2

TANK ELECTRICAL DATA SHEET

Location ____________________

Building ____________________

Tank ____________________

Scrubber ____________________

Read by ____________________

Date ____________________

Rectifier ____________________

Make ____________________

Type ____________________

Voltage Rating ____________________

Amperage Rating ____________________

Workplace Size ____________________

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading

TANK ELECTRICAL DATA SHEET

TEST 8
RUN 1

Location LBNSY
Building 210
Tank
Scrubber 106
Read by POWERS
Date 29 May 84

Rectifier –
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

TEST START: 1730

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	TANK 16	CONTENTS: 3 FT² SQ TOTAL		TANK 19	CONTENTS: 1/4" STEEL PLATE
1730	LIFT & DROP	~~Al 1/2 PLATE~~		LIFT & DROP	8 FT² TOTAL
		WAVEGUIDE	1750		
1915	END TEST		1915	END TEST	
		MECHANICALLY AGITATED			MECHANICALLY AGITATED
	TANK 28B	CONTENTS: 2 WAVE GUIDES		TANK 28A	CONTENTS: 2 PCS.
1730	LIFT & DROP	TOTAL SQ FT = 3 FT²	1730	LIFT & DROP	1/4 Al PLATE
					4 1/2 FT² TOTAL
1915	END		1915	END TEST	
		MECHANICALLY AGITATED		MECHANICALLY AGITATED	
	TANK 35	CONTENTS: 2 PCS.		TANK 36	CONTENTS: 3 WAVEGUIDES COPPER
1735	LIFT & DROP	3 FT² 1/4" Al PLATE	1735	LIFT & DROP	AREA: 3 FT²
		TOTAL ONE SIDE			TOTAL
			1915		
1915	END TEST			END TEST	

TEST 8
RUN 1

TANK ELECTRICAL DATA SHEET

Location LBNSY
Building 210
Tank
Scrubber 106
Read by POWERS
Date 29 MAY 84

Rectifier
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	TANK 38	[NON EXISTANT]		TANK 45	[CONTENTS: 4½ FT² TOTAL
			1730	LIFT & DROP	¼" Al PL
					2 PCS. ONE SIDE]
			1915	END TEST	
	MECHANICALLY	AGITATED			
	TANK 47	CONTENTS	3 PCS.		
1730	LIFT & DROP	4 FT²	¼	Al PLATE	
				(TOTAL)	
				ONE SIDE	
1915	END TEST				

TEST 8
RUN 2

TANK ELECTRICAL DATA SHEET

Location: LBNSY
Building: 210
Tank:
Scrubber: 106
Read by: POWERS
Date: 29 MAY 84

Rectifier: -
Make:
Type:
Voltage Rating:
Amperage Rating:
Workplace Size:

ALL TANK CONTENTS IDENTICAL TO TANK CONTENTS FOR TEST 8 RUN 1

TEST START: 110

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	TANK 16			TANK 19	
2115	LIFT & DROP		2125	LIFT & DROP	
2150	LIFT & DROP		2150	LIFT & DROP	
2240	LIFT & DROP		2240	LIFT & DROP	
2255	END TEST		2255	END TEST	
			2255	END TEST	
2125	TANK 28A			TANK 28B	
2125	LIFT & DROP		2125	LIFT & DROP	
2150	LIFT & DROP		~~2240~~		
2240	LIFT & DROP		2150	LIFT & DROP	
2255	END TEST		2240	LIFT & DROP	
			2255	END TEST	
2125	TANK 35			TANK 36	
2125	LIFT & DROP		2125	LIFT & DROP	
2150	LIFT & DROP		2150	LIFT & DROP	
2240	LIFT & DROP		2240	LIFT & DROP	
2255	END TEST		2255	END TEST	

TANK ELECTRICAL DATA SHEET

TEST 8
RUN 2

Location LBNSY
Building 210
Tank
Scrubber 1067
Read by POWERS
Date 29 MAY 84

Rectifier
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	TANK 38	NON EXISTANT		TANK 45	
~~2125~~	~~LIFT & DROP~~		2125	LIFT & DROP	
~~2150~~	~~LIFT & DROP~~		2150	LIFT & DROP	
~~2240~~	~~LIFT & DROP~~		2240	LIFT & DROP	
~~2255~~	~~END TEST~~		2255	TEST END	
	TANK 47			~~[illegible]~~	
2125	LIFT & DROP				
2150	LIFT & DROP				
2240	LIFT & DROP				
2255	TEST END				

TEST 8
RUN 3

TANK ELECTRICAL DATA SHEET

Location	LBNSY	Rectifier	-
Building	210	Make	
Tank		Type	
Scrubber	#106	Voltage Rating	
Read by	POWERS	Amperage Rating	
Date	29 MAY 84	Workplace Size	

ALL TANK CONTENTS ARE SAME AS IN TEST 8 RUN 1

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	TANK 16			TANK 19	
0000	TEST START		0000	TEST START	
0010	LIFT & DROP		0010	LIFT & DROP	
0050	" "		0050	" "	
0110	" "		0110	" "	
0135	END TEST		0135	END TEST	
	TANK 28A			TANK 28B	
0000	TEST START		0000	TEST START	
0010	LIFT & DROP		0010	LIFT & DROP	
0050	" "		0050	" "	
0110	" "		0110	" "	
	TANK 35			TANK 36	
0000	TEST START		0000	TEST START	
0010	LIFT & DROP		0010	LIFT & DROP	
0050	" "		0050	" "	
0110	" "		0110	" "	

Test 8
Run 3

TANK ELECTRICAL DATA SHEET

Location LBNSY
Building 210
Tank
Scrubber #106
Read by Powers
Date 29 May 87

Rectifier -
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	Tank 38	NON EXISTANT		Tank 45	
~~0000~~	~~Test Start~~		0000	Test Start	
~~0010~~	~~Lift & Drop~~		0010	Lift & Drop	
			0050	" "	
			0110	" "	
	Tank 47				
0000	Lift & Drop/Start Test				
0010	Lift & Drop				
0050	" "				
0110	" "				

TANK ELECTRICAL DATA SHEET

Test 9
Run 1

Location LBNSY
Building 210
Tank
Scrubber 106
Read by DL
Date 5/30/[illegible]

Rectifier -
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

TEST END: 2125

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	Tank 16			Tank 19	
1800	Lift	(1 3 ft oc 3"Ø	1800	Lift	(8 ft² Steel)
1825	Start	elect pipe.)	1825	Start	
1855	Lift Drop	" "	1855	Lift Drop	
1940	Lift & Drop	(3 times)	1940	Lift & Drop	(3 times)
2050	LIFT & DROP	(4 ")	2050	LIFT & DROP	(4 ")
2115	Lift & DROP	4X	2115	Lift & DROP	4X
	Tank 28B			Tank 28A	
1800	Lift	3 ft (exused	1800	Lift	5 ft² ...
1825	Start	3 ft-1 (wave)	1825	Start	A1
1850	Lift Drop		1850	Lift Drop	3 ft² oc A1
1940	Lift & Drop	3 times)	1940	Lift & Drop	(3 times)
2050	LIFT & DROP	(4 ")	2050	LIFT & DROP	(4 ")
2120	Lift & DROP	4X	2120	Lift & DROP	4X
	Tank 35			Tank 36	
1800	Lift	2 3 ft² ocs	1800	Lift	3 1 ft ocs
1825	Start	A1	1825	Start	[illegible]
1855	Lift Drop		1855	Lift Drop	
1940	Lift Drop	3 times	1940	Lift Drop	3 times
2050	LIFT & DROP	(4 ")	2050	LIFT & DROP	4 TIMES
2123	Lift & DROP	4X	2125	LIFT & DROP	4X

Scrubber 106: Tanks 16, 19, 28, 35, 36, 38, 45, 47
All wave guide is copper material.

TANK ELECTRICAL DATA SHEET

Test Run

Location 1 PNSY

Building 2 [illegible]

Tank

Scrubber [illegible]

Read by DK

Date [illegible]

Rectifier -

Make

Type

Voltage Rating

Amperage Rating

Workplace Size

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	Tank 38			Tank 45	
	(nine ... start)		1800	Lift	2 pcs 4ft² one
			1825	Start	Al.
			1845	Lift & Up	
			1925	Lift & Up	(3 times)
			~~[illegible]~~		
			2050	LIFT & DROP	(4 ")
			2127	LIFT & DROP	4.X
	Tank 47				
1800	Lift & Up	3 5ft² pcs			
1825	Start	Al			
1845	Lift & Down				
1935	Lift & Up	(3 times)			
2050	LIFT & DROP	(4 ")			
2125	LIFT & DROP	4X			

TANK ELECTRICAL DATA SHEET

TEST 10 RUN 1

Location	LBNSY	Rectifier	
Building	210	Make	
Tank		Type	
Scrubber	#105	Voltage Rating	
Read by	Rivers	Amperage Rating	
Date	31 May 94	Workplace Size	

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	TANK 1	CADMIUM / 5 FT² / 2 STEEL PLATES		TANK 11	CADMIUM / 5 FT² / 2 STEEL PLATES
1700	TEST START		1700	TEST START	
1715	4 V. 400 amp	TANK LOADED	1715	4 V. 400 amp	TANK LOADED
1745	4 V 400 amp		1745	4 V. 400 amp	
1800	4 V. 400 amp		1800	4 V. 400 amp	
1815	4 V. 400 amp.		1815	4 V. 400 amp.	
1840	4 V. 400 amp.		1840	4 V. 400 amp	
1850	END TEST		1850	END TEST	
	TANK 20	NICKEL-STRIKE / 4 FT² STEEL DRAWER		TANK 21	SILVER / 2 FT² / STEEL PLATE
1700	TEST START		1700		
1710	6 V. 300 amp	TANK LOADED	1705	1 V. 20 amp	TANK LOADED
1745	6 V. 320 amp		1745	1 V. 20 amp	
1800	6 V. 320 amp.		1800	1 V. 20 amp.	
1815	6 V. 310 amp		1815	1 V. 20 amp	STEEL PLATE REMOVED - NO ACTION IN TANK - CONSERVE SILVER
1840	6 V. 310 amp.		1850	END TEST	
1850	END TEST				
	TANK 22	SILVER STRIKE / 2 FT² / STEEL PLATE		TANK 29	COPPER / 4 FT² / 3 WASHERS
1700	TEST START		1700	TEST START	
1705			1710	2 V 300 amp	TANK LOADED
1816	30 SECOND SILVER STRIKE		1745	2.5 V 320 amp	
1817			1800	2.5 V. 320 amp.	
1850	END TEST		1815	2.5 V. 310 amp	
			1840	2.5 V. 310 amp	
			1850	END TEST	

7C M.

NOTES: ① TANK 1 & TANK 11 SHARE RECTIFIER

② TANK 20 & TANK 29 SHARE RECTIFIER

③ SURFACE AREAS GIVEN ARE TOTAL SURFACE AREAS OF PIECE(S) IN TANK

Test 10
Run 2

TANK ELECTRICAL DATA SHEET

Location LBNSY
Building 210
Tank
Scrubber # 105
Read by POWERS
Date 31 MAY 84

Rectifier --
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	TANK 1	[9 FT² STEEL 3 PCS.]		TANK 11	[8 FT² STEEL 3 PCS.]
2005	START TEST		2005	START TEST	
	4V. 400amp			4V. 100amp	
2030	4V 410a		2030	4V 410a	
[illegible]	4V [illegible] ([illegible] added)		2035	4V 500a	
2100	4V [illegible] (4 ft² steel)		2100	4V 475a	
2135	4V [illegible]		2135	4V 475a	
2150	END TEST		2150	END TEST	
	TANK 20	[4 FT² STEEL DRAWER]		TANK 21	[2 FT² STEEL PLA
2005	START TEST		2005	START TEST	
~~20~~	6V. 350amp.			1V. 20 amp	
2030	6.2V 350amp		2030	1V 20 amp	
2100	6.2V [illegible] amp		2100	1V 20 amp	
2135	6.2V [illegible] amp		2135	1V 20 amp	
2150	END TEST		2150	END TEST	
	TANK 22	[NO LOAD]		TANK 29	[4 FT² 3 [illegible]]
2005	START TEST		2005	START TEST	
2030				2.5V 320 amp	
2150	END TEST		2030	2.4V 300a	
			2100	2.[illegible]V 3[illegible]a	
			2135	2.[illegible]V [illegible]a	
			2150	END TEST	

TEST 10
RUN 3

TANK ELECTRICAL DATA SHEET

Location	LBNSY	Rectifier	
Building	210	Make	
Tank		Type	
Scrubber	# 105	Voltage Rating	
Read by	POWERS	Amperage Rating	
Date	31 MAY 84	Workplace Size	

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	TANK 1	[9 FT² ¼" STEEL PLATE 3 PCS]		TANK 11	[8 FT² ¼" STEEL PLATE 3 PCS]
2305	TEST START		2305	TEST START	
2310	4 V. 500 amp.		2310	4 V. 500 amp	
2355	4V 480 amp.		2355	4 V 480 amp	
0055	4V 480 amp.		0055	4V 480 amp	
0055	TEST END		0055	TEST END	
	TANK 20	[4 FT² STEEL DRAWER]		TANK 21	[2 FT² STEEL PLATE]
2305	TEST START		2305	TEST START	
2310	6.0V 350 amp		2310	1.5V 30 amp	
2355	6.2V 360 amp		2355	1.2V 30 amp.	
0055	6.0V 350 amp		0005	RECTIFIER SHUT DOWN	(CONSERVE SILVER)
0055	TEST END		0055	TEST END	
	TANK 22	[2 FT² ¼" STEEL PLATE]		TANK 29	[4 FT² 3" WAVEGUIDES]
2305	TEST START		2305	TEST START	
2310			2310	2.5V 350 amp.	
0001	30 SECOND SILVER STRIKE		2325→2345	REACTOR SHIRT - NO CURRENT FLOW	
0002	(MODERATE REACTION IN TANK)		2355	2.3 V 280 amp.	
0055	TEST END		0055	2.5V 300 amp	
			0055	TEST END	

Test 11
Run 1

TANK ELECTRICAL DATA SHEET

Location L-RMSY
Building 210
Tank 1, 11, 20, 21, 22, 29
Scrubber [illegible]
Read by [illegible]
Date 6/1/[illegible]

Rectifier
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

Test Start 1730 (Same pieces as previous test TIGR)

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	Tank 1	(Cad. Cyanide)		Tank 11	(Cad. Cyan.)
1716	3.9V 375a		1716	3.9V 375a	
1745	3.8V 450a		1745	3.8V 450a	
1815	[illegible] 440a		1815	3.8V 440a	
1855	3.8V 450a		1855	3.8V 450a	
1925	[illegible] 450a		1925	3.8V 450a	
1955	3.9V 460a		1955	3.9V 450a	
2025	3.8V 450a		2025	3.8V 440a	
	Tank 20	(Nickel Strike)		Tank 21	(Sil. Cyan.)
			1716	1.2V 20a	
1716	6V 320a		1745	1.2V 20a	
1745	6V 320a		1815	1.25V 15a	
1815	6V 330a		1855	1.2V 20a	
1855	6V 330a		1925	1.2V 20a	
1925	6V 330a		1955	1.2V 20a	
1955	6V 330a		2025	1.1V 20a	
2025	6V 320a				
	Tank 22	(Silver Strike)		Tank 29	(Cad. Cyanide)
			1716	2.2V 290a	
1725	Silver Strike		1745	2.1V 300a	
	[illegible]		1815	2.25V 290a	
			1855	2.3V [illegible]	
			1925	2.3V [illegible]	
			1955	2.4V 310a	
			2025	2.25V [illegible]	

Test End 2030

Test II
Run 2

TANK ELECTRICAL DATA SHEET

Location LRNSY
Building 210
Tank [illegible]
Scrubber [illegible]
Read by [illegible]
Date 6/11/87

Rectifier
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	TNWC1	[illegible]		[illegible]	[illegible]
[illegible]	4V	[illegible] A	2135	4V	[illegible]
[illegible]	3.4V	[illegible]	2210	[illegible]	[illegible]
2245	4V	510 A	2245	4V	500 A
2315	4V	550 A	2315	4V	500 A
[illegible]	4V	500 A	2350	[illegible]	500 A
0030	END	OF TEST	0030	END OF	TEST
	TNK30			TANK [illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	1V	200 A
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	200 A
2245	6V	320 A	2245	1V	20 A
2315	6V	320 A	2315	0.5V	20 A
[illegible]	6V	320 A	[illegible]	[illegible]	20 A
[illegible]	END	[illegible]	[illegible]	END OF	TEST
	TANK 32			TANK 33	
	[illegible]	[illegible]	[illegible]	2V	300 A
		[illegible]		2 [illegible]	[illegible]
			2245	2.6V	310 A
			2315	2.75V	380 A
			2330	0V	0 A
				DONE	

[illegible] OFF

No. 1 INLET/OUTLET IMPACTOR RUN
1515 → 1545 11 MAY 84

TANK ELECTRICAL DATA SHEET

Location: LBNSY
Building: 210
Tank:
Scrubber: 106
Read by: POWERS
Date: 11 MAY 84

Rectifier:
Make:
Type:
Voltage Rating:
Amperage Rating:
Workplace Size:

~~Time~~	~~Reading~~ WORKPIECE CONTENTS	~~Avg. Reading~~ MECHANICAL AGITATION	Time	Reading	Avg. Reading
'EMPTY' TANK 16	EMPTY				
		~~NONE~~			
19	NONE	NONE			
28A	NONE	? (SOME)			
28B	NONE	? (SOME)			
35	NONE	? (SOME)			
36	NONE	SOME			
45	NONE	YES			
47	NONE	NONE			

/ #1 INLET / OUTLET IMPACTOR RUN SCRUBBER # 16

TANK ELECTRICAL DATA SHEET

Location LENSY
Building 210
Tank
Scrubber 106
Read by [illegible]
Date 14 MAY 94

Rectifier
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

10:05 AM

~~Time~~ TANK	Reading WORKPIECE FT^2	~~Avg. Reading~~ MECHANICAL AGITATION	~~Time~~ workpiece (ft^2)	~~Reading~~ Mech Agitation	Avg. Reading
16	EMPTY TANK		N/A	N/A	
19	NO WORK	NO		No	
28A	~~NO~~ WORK	YES	✓	yes	
	2 FT^2 AVE.				
	(EST.)				
28B	~~NO~~ WORK	YES	✓	yes	
	2 FT^2 AVE				
		YES			
35	2 FT.^{2} AVE		✓	yes	
36	2 FT.^{2} AVE	YES	✓	yes	
45	0.5 FT^2 →	YES	✓	yes	(approx 7' x 1' Area / 7 Ft^2)
	2 FT^2 AVE.				
47	NO WORK	NO	✓	NO	

TANK ELECTRICAL DATA SHEET

Location LBNSY
Building 21C
Tank 19, 28A, 28B, 36, 45, 47
Scrubber 1C6
Read by [illegible]
Date 15 May 84

~~Rectifier~~ TEST 1 RUNS 1,
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	Tank 19			Tank 28B	
Tank Not in use			intermittent dipping from 830-1100	26 pieces @ 2ft² ea. =	52ft²
			Tot = 40 min	2 pieces @ 1ft² =	2ft²
				1 piece @ ½ft² =	1ft²
					55 ft²
	Tank 28A			Tank 36	
intermittent dipping of parts			Same pieces as Tank 28B		
5-10 min each					55 ft²
Total 1 hours					
8-815 on	6 pieces 3½ft² / 4 pieces 2ft²	21ft² / 8ft²	intermittent dipping of pieces = 40 min		
		29ft²			

TEST 1

RUNS 1, 2, 3

TANK ELECTRICAL DATA SHEET

Location UDNSY
Building 210
Tanks 19, 25A, 25B, 35, 36, 45, 47
Scrubber 106
Read by SA Burwell
Date 15 May 84

Rectifier
Make
Type
Voltage Rating
Amperage Rating
Workplace Size

Time	Reading	Avg. Reading	Time	Reading	Avg. Reading
	Tank 45			Tank 47	
7:45-	16 wire Baskets @ 2ft² = 32ft²			Same as Tank 45	
8:00 AM	(1/2 min each)				
2-3	4 Boxes @ 1½ x 1½ x 1½ = 9ft²				
3	3 Misc @ 2x2 = 4ft²				
		45ft²			
	approx 12 min				

APPENDIX B
FIELD DATA

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :5 MAY 84

SCRUBBER:101-IN

TEST :

RUN :

-dP--	--SQRT dP--
.01	.1
.02	.1414214
.3	.5477226
.36	.6
.45	.6708204
.47	.6855655
.45	.6708204
.44	.6633250
0	0
.02	.1414214
.13	.3605551
.15	.3872983
.2	.4472136
.34	.5830952
.42	.6480741
.42	.6480741
0	0
0	0
.03	.1732051
.04	.2
.11	.3316625
.25	.5
.35	.5916080
.39	.6244998
	.4048493

dP AVE = .1639029

$Q = VA$

$= (1,266.951\ ft/min)(43^{3/4}/12\ ft)(74^{1/4}/12\ ft)$

$= 27,985.05\ ft^3/min$

Scrubber 101

SOURCE EMISSIONS TESTING DATA SHEET
1100-EHC-3960/62 (Rev. 11-78)

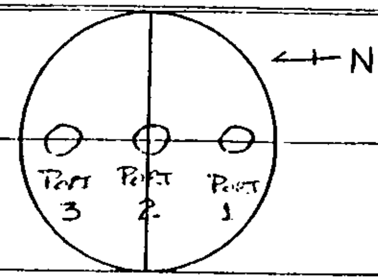
DUCT DIMENSIONS: 43" × 86" · 14"

VELOCITY TRAVERSE
30 MAY 84

SCRUBBER # 101

POWERS/KIRKPATRICK

PLANT Bld. 210	LOCATION LBNS	SCHEMATIC OF STACK CROSS SECTION (Show Traverse Points)	AMBIENT TEMPERATURE 62	BAROMETRIC PRESSURE, IN HG
OPERATOR Kirk/Pow	DATE 5/30/84		ASSUMED MOISTURE, %	HEATER BOX SETTING
RUN NO. 1	SAMPLE BOX NO.		PROBE # (PITOT #) 10-2	PROBE LENGTH, in. 120"
METER BOX NO. 3	METER ΔH@		NOZZLE I.D. NO.	NOZZLE DIAMETER, in.
C FACTOR (Nomograph)	PITOT COEFFICIENT, CP 0.78		PROBE HEATER SETTING	PROBE LINER MATERIAL SS / LEAK RATE (CFM) @ " HG



TRAVERSE POINT NUMBER	SAMPLING TIME (θ) MIN	GAS METER READING (V_m) ft3	STACK TEMPERATURE (T_s) °F	~~VELOCITY HEAD (ΔP_s)~~ In. H_2O	~~PRESSURE ACROSS ORIFICE (ΔH)~~ in. H_2O	~~GAS SAMPLE TEMPERATURE AT DRY GAS METER~~ ~~Inlet~~ (T_{min}) °F	Outlet (T_{mout}) °F	SAMPLE BOX TEMPERATURE °F	TEMPERATURE IMPINGER °F	SAMPLE VACUUM in. Hg.	CO_2 %	O_2 %
			Port >	1	2	3						
1			→	Ø,01	Ø	Ø						
2			→	Ø,Ø2	Ø,Ø2	Ø						
3			→	Ø,30	Ø,13	Ø,Ø3						
4			→	Ø,36	Ø,15	Ø,Ø4						
5			→	Ø,45	Ø,2Ø	Ø,11						
6			→	Ø,47	Ø,34	Ø,25						
7			→	Ø,45	Ø,42	Ø,35						
8			→	Ø,44	Ø,42	Ø,39						
TOTAL												
AVERAGE												

[illegible]

--dP-- --SQRT dP--

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE   : 16 MAY 1984

SCRUBBER: 102-IN

TEST   : 2

RUN   : 1

--dP--	--SQRT dP--
0	0
.06	.2449490
.19	.4358899
.31	.5567764
.40	.6324555
.78	.8831761
.54	.7348469
.42	.6480741
0	0
.02	.1414214
.10	.3162278
.25	.5
.35	.5916080
.48	.6928203
.53	.7280110
.35	.5916080
0	0
0	0
.08	.2828427
.22	.4690416
.36	.6
.38	.6164414
.38	.6164414
.25	.5
	.4492763

dP AVE = .2018492

SOURCE EMISSIONS TESTING DATA SHEET

Date :16 May 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 2	Box # : 5	I.D. # : 2	I.D. # : 6M-2	I.D. # : 2	I.D. # : 5
Run # : 1	Delta H@: 1.273	Liner :glass	Diam : .35	Coeffic: .8	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .996	Length : 10			Leak rt : .002cfm
Source : 102 -IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:KIRK/FAN					H2O gain: 38.6ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	65F	Stack gas dry wt :	29lb/lb-mol	length:	74in.
Barometer:	29.89in. Hg	Water vap proport:	.018	width:	43in.
Stk Stat:	-2.8in. H2O			area-in2:	3182in.2
				area-ft2:	22.09722ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	772.59	67	67	66	.00	.00	0	0	20.9
2	5	772.59	68	68	67	.07	.70	3	0	20.9
3	10	775.62	69	71	48	.22	2.21	8	0	20.9
4	15	780.10	69	79	56	.32	3.27	14	0	20.9
5	20	786.02	69	91	65	.39	4.07	16	0	20.9
6	25	792.35	69	99	68	.80	8.47	16	0	20.9
7	30	798.74	69	105	68	.57	6.10	17	0	20.9
8	35	805.11	70	110	67	.40	4.31	17	0	20.9
9	40	811.54	70	95	68	.00	.00	0	0	20.9
10	45	811.54	70	88	68	.02	.21	4	0	20.9
11	50	813.79	69	88	56	.10	1.04	6	0	20.9
12	55	817.26	70	91	59	.26	2.71	12	0	20.9
13	60	822.48	70	100	63	.35	3.70	18	0	20.9
14	65	828.78	70	107	61	.52	5.57	19	0	20.9
15	70	835.24	69	111	57	.58	6.27	18	0	20.9
16	75	841.73	70	114	56	.36	3.91	18	0	20.9
17	80	848.39	69	82	65	.00	.00	0	0	20.9
18	85	948.39	69	81	67	.00	.00	0	0	20.9
19	90	848.39	69	81	67	.07	.72	5	0	20.9
20	95	851.48	69	81	48	.23	2.36	12	0	20.9
21	100	856.30	69	81	54	.36	3.69	18	0	20.9
22	105	862.60	69	82	56	.40	4.10	18	0	20.9
23	110	869.08	69	84	55	.38	3.91	18	0	20.9
24	115	875.60	69	85	54	.27	2.79	13	0	20.9
25	120	881.23					.00			
AVERAGE			69.16667	89.20833	60.79167	.21	2.92	11.20833	0	20.9

METER VOLUME =	108.21 ft3	ABS STACK PRES =	29.68 in. Hg
DRY GAS VOL.SCF =	104.63 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.82 ft3	STACK GAS VELO =	24.57 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0006681 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	31991.58 CFM
		DUCT GASFLOW.SCFM=	31669.32 CFM

------------------------->> ISOKINETIC VARIATION = 91.11 %

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :16 MAY 84

SCRUBBER: 102-OUT

TEST : 2

RUN : 1

--dP--	--SQRT dP--
.43	.6557439
.41	.6403124
.35	.5916080
.29	.5385165
.23	.4795832
.15	.3872983
.11	.3316625
.12	.3464102
.13	.3605551
.17	.4123106
.19	.4358899
.24	.4898979
.47	.6855655
.43	.6557439
.44	.6633250
.42	.6480741
.37	.6082763
.26	.5099020
.06	.2449490
.12	.3464102
.21	.4582576
.32	.5656854
.43	.6557439
.47	.6855655
	.5165536

dP AVE = .2668276

SOURCE EMISSIONS TESTING DATA SHEET

Date : 16 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 2	Box # : 5	I.D. # : 1	I.D. # : -	I.D. # : 1	I.D. # : 5
Run # : 1	Delta H@: 1.8443	Liner : GLASS	Diam : .246	Coeffic: .85	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9998	Length : 6			Leak rt : .02cfm
Source : 102-OUT	Heat Set: -	Heater : -			@ : 25in. H2O
Eginneer : GUA/BEL					H2O gain: 32.1ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	65F	Stack gas dry wt :	29lb/lb-mol	length:	64in. dia.
Barometer:	29.89in. Hg	Water vap proport:	.02	width:	- in.
Stk Stat:	.20in. H2O			area-in2:	3217in.2
				area-ft2:	22.34028ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	813.79	69	69	67	.36	1.45	2	0	20.9
2	5	817.38	68	78	68	.36	1.47	2	0	20.9
3	10	820.86	68	87	69	.33	1.37	2	0	20.9
4	15	824.30	67	90	70	.30	1.26	2	0	20.9
5	20	827.58	67	92	71	.23	.97	1.5	0	20.9
6	25	830.51	67	93	73	.16	.67	1.5	0	20.9
7	30	833.00	67	93	74	.11	.46	1.5	0	20.9
8	35	.00	67	92	75	.11	.46	1.5	0	20.9
9	40	.00	67	92	76	.14	.59	1.5	0	20.9
10	45	.00	67	93	76	.17	.72	<2	0	20.9
11	50	.00	67	94	77	.25	1.05	<2	0	20.9
12	55	844.75	67	98	78	.32	1.36	<2	0	20.9
13	60	848.19	67	78	75	.48	1.97	2.5	0	20.9
14	65	.00	66	92	76	.46	1.94	2.5	0	20.9
15	70	856.24	66	98	77	.43	1.83	2.5	0	20.9
16	75	860.10	66	104	78	.42	1.81	2.5	0	20.9
17	80	864.00	66	106	79	.39	1.68	2.5	0	20.9
18	85	867.82	66	108	80	.26	1.13	2.5	0	20.9
19	90	871.31	67	107	81	.07	.30	<2	0	20.9
20	95	873.10	67	103	82	.09	.39	<2	0	20.9
21	100	874.96	67	104	83	.20	.86	<2	0	20.9
22	105	877.64	67	111	84	.32	1.39	2	0	20.9
23	110	881.20	67	114	85	.41	1.79	2.3	0	20.9
24	115	885.05	66	115	86	.45	1.97	2.5	0	20.9
25	120	889.11					.00			
AVERAGE			66.91667	96.29167	76.66667	.27	1.20	2.072222	0	20.9

METER VOLUME =	75.31 ft3	ABS STACK PRES =	29.90 in. Hg
DRY GAS VOL,SCF =	71.59 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.51 ft3	STACK GAS VELO =	29.40 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003301 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	38700.39 CFM
		DUCT GASFLOW,SCFM=	38760.14 CFM

------------------------->> ISOKINETIC VARIATION = 104.24 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :17 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 2	Box # : 8	I.D. # : 2	I.D. # : 2.00	I.D. # : 2	I.D. # : 8
Run # : 2	Delta H@: 1.2014	Liner :GLASS	Diam : .353	Coeffic: .8	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: 1.063	Length : 10			Leak rt : 0cfm
Source :102-IN	Heat Set: -	Heater : -			@ : 25in. H20
Engineer:KIRK/FAN					H20 gain: 27.9ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	67F	Stack gas		length:	74in.
Barometer:	29.96in. Hg	dry wt :	291b/lb-mol	width:	43in.
Stk Stat:	-3.00in. H20	Water vap		area-in2:	3182in.2
		proport:	.015	area-ft2:	22.09722ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H20)	Orifice Delta H (in H20)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	883.79	71	72	69	.00	.00	0	0	20.9
2	5	883.79	71	72	69	.09	.89	4	0	20.9
3	10	887.25	71	75	42	.20	1.98	4	0	20.9
4	15	891.87	71	82	49	.30	3.01	6	0	20.9
5	20	897.41	71	91	54	.41	4.18	8	0	20.9
6	25	903.85	71	99	58	.77	7.96	11	0	20.9
7	30	911.17	70	109	62	.40	4.22	15	0	20.9
8	35	917.89	70	112	61	.18	1.91	11	0	20.9
9	40	922.75	71	95	64	.00	.00	0	0	20.9
10	45	922.75	71	94	65	.02	.21	4	0	20.9
11	50	925.13	70	93	50	.09	.92	5	0	20.9
12	55	928.32	70	94	52	.24	2.46	9	0	20.9
13	60	933.29	70	100	57	.36	3.74	12	0	20.9
14	65	939.49	70	108	60	.45	4.74	14	0	20.9
15	70	946.43	69	115	62	.43	4.59	14	0	20.9
16	75	953.50	69	119	62	.21	2.26	8	0	20.9
17	80	958.78	71	101	62	.00	.00	0	0	20.9
18	85	958.78	71	99	63	.00	.00	0	0	20.9
19	90	958.78	70	97	64	.08	.83	6	0	20.9
20	95	962.29	70	99	45	.22	2.28	9	0	20.9
21	100	967.16	70	104	48	.38	3.97	13	0	20.9
22	105	973.48	70	112	50	.41	4.35	14	0	20.9
23	110	980.38	69	118	50	.37	3.97	-	0	20.9
24	115	987.06	69	119	50	.22	2.37	9	0	20.9
25	120	992.36					.00			
AVERAGE			70.25	99.125	57	.18	2.53	7.652174	0	20.9

METER VOLUME =	115.40 ft3	ABS STACK PRES =	29.74 in. Hg
DRY GAS VOL.SCF =	109.76 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.31 ft3	STACK GAS VELO =	23.03 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0006796 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	29984.32 CFM
		DUCT GASFLOW.SCFM=	29676.82 CFM

------------------------->> ISOKINETIC VARIATION = 100.27 %

SOURCE EMISSIONS TESTING DATA SHEET

Date : 17 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 2	Box # : 5	I.D. # : 1	I.D. # : -	I.D. # : 1	I.D. # : 5
Run # : 2	Delta H@: 1.8443	Liner : GLASS	Diam : .246	Coeffic: .85	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9998	Length : 6			Leak rt : .017cfm
Source : 102-OUT	Heat Set: -	Heater : -			@ : 10in. H2O
Engineer: GUA/BEL					H2O gain: 32ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	67F	Stack gas		length:	64in. dia.
Barometer:	29.96in. Hg	dry wt :	29lb/lb-mol	width:	- in.
Stk Stat:	.20in. H2O	Water vap		area-in2:	3217in.2
		proport:	.02	area-ft2:	22.34028ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	890.60	67	73	42	.40	1.62	<2	0	20.9
2	5	894.27	67	81	45	.36	1.48	<2	0	20.9
3	10	.00	67	88	49	.34	1.42	<2	0	20.9
4	15	901.24	67	93	52	.27	1.14	<2	0	20.9
5	20	.00	67	92	54	.22	.93	<2	0	20.9
6	25	.00	67	95	55	.14	.59	<2	0	20.9
7	30	909.60	66	93	56	.11	.46	<2	0	20.9
8	35	.00	66	95	50	.10	.42	<2	0	20.9
9	40	.00	66	95	48	.12	.51	<2	0	20.9
10	45	.00	66	98	48	.15	.64	<2	0	20.9
11	50	918.20	66	96	48	.20	.85	<2	0	20.9
12	55	920.75	66	97	48	.25	1.06	<2	0	20.9
13	60	923.78	66	84	47	.52	2.16	2	0	20.9
14	65	928.30	66	97	44	.48	2.04	2	0	20.9
15	70	.00	66	106	47	.45	1.94	2	0	20.9
16	75	936.01	66	108	47	.42	1.82	2	0	20.9
17	80	939.97	66	112	48	.40	1.75	2	0	20.9
18	85	944.00	66	114	48	.26	1.14	<2	0	20.9
19	90	947.05	66	112	49	.05	.22	<2	0	20.9
20	95	948.60	66	108	50	.11	.48	<2	0	20.9
21	100	950.70	66	108	47	.20	.87	<2	0	20.9
22	105	.00	65	111	47	.31	1.35	<2	0	20.9
23	110	956.80	65	111	47	.40	1.75	<2	0	20.9
24	115	960.65	65	111	48	.44	1.92	2	0	20.9
25	120	964.68					.00			
AVERAGE			66.125	99.08333	48.5	.26	1.19	2	0	20.9

METER VOLUME =	74.06 ft3	ABS STACK PRES =	29.97 in. Hg
DRY GAS VOL.SCF =	70.22 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.51 ft3	STACK GAS VELO =	28.92 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003301 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	38073.20 CFM
		DUCT GASFLOW.SCFM=	38278.75 CFM

-------------------------->> ISOKINETIC VARIATION = 103.52 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :18 may 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 2	Box # : 4	I.D. # : 2	I.D. # : GM-2	I.D. # : 2	I.D. # : 4
Run # : 3	Delta H@: 1.2014	Liner :GLASS	Diam : .349	Coeffic: .8	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: 1.063	Length : 10			Leak rt : 0cfm
Source :102-IN	Heat Set: -	Heater : -			@ : 27in. H2O
Engineer:KIRK/FAN					H2O gain: 38.4ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	71F	Stack gas		length:	74in.
Barometer:	29.98in. Hg	dry wt :	29lb/lb-mol	width:	43in.
Stk Stat:	-3.00in. H2O	Water vap		area-in2:	3182in.2
		proport:	.015	area-ft2:	22.09722ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	.00	75	78	73	.04	.38	4	0	20.9
2	5	2.13	74	79	43	.03	.28	4	0	20.9
3	10	4.07	75	81	45	.07	.66	4	0	20.9
4	15	6.38	75	85	46	.06	.57	4	0	20.9
5	20	8.96	75	85	49	.40	3.82	10	0	20.9
6	25	15.16	75	100	54	.78	7.66	16	0	20.9
7	30	22.51	74	111	60	.47	4.72	13	0	20.9
8	35	29.57	74	117	55	.33	3.35	9	0	20.9
9	40	35.69	74	97	67	.00	.00	0	0	20.9
10	45	35.69	75	96	68	.01	.10	5	0	20.9
11	50	36.83	75	76	52	.10	.94	6	0	20.9
12	55	39.60	75	99	46	.25	2.45	9	0	20.9
13	60	44.38	74	107	50	.35	3.49	11	0	20.9
14	65	50.26	74	115	54	.48	4.85	15	0	20.9
15	70	57.22	74	122	57	.50	5.12	15	0	20.9
16	75	64.51	74	126	54	.32	3.30	11	0	20.9
17	80	70.74	73	103	67	.07	.69	6	0	20.9
18	85	73.57	73	103	45	.07	.69	6	0	20.9
19	90	76.42	73	103	47	.08	.79	6	0	20.9
20	95	49.42	73	103	48	.22	2.18	9	0	20.9
21	100	83.27	73	106	51	.70	6.98	10	0	20.9
22	105	88.36	72	109	53	.43	4.32	13	0	20.9
23	110	94.19	72	113	54	.37	3.74	13	0	20.9
24	115	100.56	72	116	54	.27	2.74	10	0	20.9
25	120	104.96					.00			
AVERAGE			73.875	101.25	53.83333	.21	2.66	8.708333	0	20.9

METER VOLUME =	111.57 ft3	ABS STACK PRES =	29.76 in. Hg
DRY GAS VOL.SCF =	105.82 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.81 ft3	STACK GAS VELO =	24.81 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0006643 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	32306.59 CFM
		DUCT GASFLOW.SCFM=	31779.52 CFM

------------------------->> ISOKINETIC VARIATION = 92.35 %

ISOURCE EMISSIONS TESTING DATA SHEET

Date : 18 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 2	Box # : 3	I.D. # : 1	I.D. # : -	I.D. # : 1	I.D. # : 3
Run # : 3	Delta H@: 1.8088	Liner : GLASS	Diam : .246	Coeffic: .85	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9996	Length : 6			Leak rt : .004cfm
Source : 102-OUT	Heat Set: -	Heater : -			@ : 15in. H2O
Engineer: QUA/BEL					H2O gain: 28.3ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	74F	Stack gas		length:	64in. dia.
Barometer:	29.98in. Hg	dry wt :	29lb/lb-mol	width:	- in.
Stk Stat:	.20in. H2O	Water vap		area-in2: 3217	in.2
		proport:	.02	area-ft2: 22.34028ft.2	

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	964.83	68	78	52	.39	1.56	4	0	20.9
2	5	967.70	67	86	45	.35	1.43	4	0	20.9
3	10	971.11	66	95	47	.33	1.37	4	0	20.9
4	15	974.55	65	101	50	.28	1.18	3.5	0	20.9
5	20	977.77	65	102	50	.22	.93	3.5	0	20.9
6	25	980.55	65	98	49	.14	.59	2.5	0	20.9
7	30	.00	65	101	50	.10	.42	2	0	20.9
8	35	984.80	65	102	49	.11	.46	2	0	20.9
9	40	986.82	65	104	46	.13	.55	2.5	0	20.9
10	45	989.05	65	107	46	.17	.72	3	0	20.9
11	50	991.57	66	110	45	.23	.98	3.5	0	20.9
12	55	994.50	66	113	44	.28	1.20	3.5	0	20.9
13	60	997.75	67	99	54	.28	1.17	3.5	0	20.9
14	65	1001.10	66	108	44	.30	1.28	3.5	0	20.9
15	70	1004.40	66	112	46	.29	1.24	3.5	0	20.9
16	75	1007.70	67	116	46	.43	1.85	4.5	0	20.9
17	80	1011.61	67	121	46	.37	1.61	4.5	0	20.9
18	85	1014.90	67	120	48	.26	1.13	3.5	0	20.9
19	90	1018.64	67	117	49	.06	.26	<2	0	20.9
20	95	1020.30	67	110	50	.11	.47	2.5	0	20.9
21	100	1022.37	67	107	48	.20	.85	3	0	20.9
22	105	1025.04	67	109	47	.32	1.36	4	0	20.9
23	110	1028.49	67	112	47	.41	1.75	4.5	0	20.9
24	115	1032.39	67	114	47	.46	1.97	4.8	0	20.9
25	120	1036.44					.00			
AVERAGE			66.25	105.9167	47.70833	.25	1.10	3.469565	0	20.9

METER VOLUME =	71.58 ft3	ABS STACK PRES =	29.99 in. Hg
DRY GAS VOL.SCF =	67.07 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.33 ft3	STACK GAS VELO =	28.10 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003301 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	36983.71 CFM
		DUCT GASFLOW.SCFM=	37199.35 CFM

------------------------->> ISOKINETIC VARIATION = 101.76 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :18 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 2	Box # : 8	I.D. # : 2	I.D. # : 12	I.D. # : 2	I.D. # : 8
Run # : 4	Delta H@: 1.8739	Liner :GLASS	Diam : .249	Coeffic: .8	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: 1.0085	Length : 10			Leak rt : 0cfm
Source :102-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:KIRK/FAN					H2O gain: 36.4ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 62F	Stack gas dry wt : 29lb/lb-mol	length: 74in.
Barometer: 29.98in. Hg	Water vap proport: .015	width: 43in.
Stk Stat: -2.80in. H2O		area-in2: 3182in.2
		area-ft2: 22.09722ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	706.68	66	71	64	.00	.00	0	0	20.9
2	5	706.68	65	69	64	.06	.23	0	0	20.9
3	10	708.00	65	70	47	.19	.73	0	0	20.9
4	15	710.09	65	75	40	.31	1.20	1	0	20.9
5	20	712.88	65	82	39	.42	1.65	1	0	20.9
6	25	716.14	65	90	42	.83	3.30	5	0	20.9
7	30	720.52	65	102	47	.49	1.99	2	0	20.9
8	35	724.58	66	105	50	.40	1.63	2	0	20.9
9	40	728.11	66	92	57	.00	.00	0	0	20.9
10	45	728.11	66	90	58	.02	.08	0	0	20.9
11	50	728.96	66	89	52	.10	.40	0	0	20.9
12	55	730.57	66	91	43	.22	.87	0	0	20.9
13	60	732.99	66	96	38	.36	1.44	1	0	20.9
14	65	736.13	65	102	41	.45	1.83	2	0	20.9
15	70	739.65	65	105	43	.48	1.96	2	0	20.9
16	75	746.32	65	107	45	.31	1.27	1	0	20.9
17	80	745.99	65	96	56	.00	.00	0	0	20.9
18	85	745.99	65	96	56	.00	.00	0	0	20.9
19	90	745.99	65	94	57	.08	.32	0	0	20.9
20	95	747.54	65	92	43	.21	.84	0	0	20.9
21	100	749.88	64	95	40	.38	1.53	1	0	20.9
22	105	753.00	65	100	40	.39	1.58	1	0	20.9
23	110	756.34	65	105	52	.32	1.31	1	0	20.9
24	115	759.51	65	106	44	.21	.86	1	0	20.9
25	120	762.22					.00			
AVERAGE			65.25	92.5	48.25	.19	1.04	.875	0	20.9

METER VOLUME =	56.01 ft3	ABS STACK PRES =	29.77 in. Hg
DRY GAS VOL.SCF =	53.75 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.71 ft3	STACK GAS VELO =	23.60 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003382 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	30727.44 CFM
		DUCT GASFLOW.SCFM=	30737.66 CFM

-------------------------> ISOKINETIC VARIATION = 95.28 %

SOURCE EMISSIONS TESTING DATA SHEET

Date : 18 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 2	Box # : 6	I.D. # : 1	I.D. # : -	I.D. # : 1	I.D. # : 6
Run # : 4	Delta H@: 1.8088	Liner : GLASS	Dias : .244	Coeffic: .85	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9996	Length : 6			Leak rt : .004cfm
Source : 102-OUT	Heat Set: -	Heater : -			@ : 15in. H2O
Engineer: QUA/BEL					H2O gain: 32.9ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	62F	Stack gas		length:	64in. dia.
Barometer:	29.98in. Hg	dry wt :	29lb/lb-mol	width:	- in.
Stk Stat:	.20in. H2O	Water vap		area-in2:	3217in.2
		proport:	.02	area-ft2:	22.34028ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	37.43	67	69	45	.40	1.53	2.8	0	20.9
2	5	41.00	68	78	41	.36	1.40	2.5	0	20.9
3	10	44.50	68	85	43	.33	1.30	2.5	0	20.9
4	15	.00	68	89	45	.27	1.07	2.5	0	20.9
5	20	50.72	68	90	46	.22	.87	2	0	20.9
6	25	53.44	67	90	46	.14	.56	<2	0	20.9
7	30	55.66	67	91	45	.11	.44	<2	0	20.9
8	35	57.63	67	92	45	.10	.40	<2	0	20.9
9	40	59.54	67	94	45	.13	.52	2	0	20.9
10	45	61.68	67	98	45	.19	.77	2.5	0	20.9
11	50	64.20	67	99	46	.25	1.01	2.5	0	20.9
12	55	67.17	67	103	46	.30	1.22	2.5	0	20.9
13	60	70.37	68	95	50	.53	2.12	3.5	0	20.9
14	65	74.53	68	109	48	.50	2.05	3	0	20.9
15	70	78.62	68	114	49	.44	1.82	3	0	20.9
16	75	82.53	68	116	50	.41	1.70	3	0	20.9
17	80	86.34	68	116	50	.38	1.58	2.5	0	20.9
18	85	90.00	68	116	50	.26	1.08	2.5	0	20.9
19	90	93.05	68	113	51	.06	.25	<2	0	20.9
20	95	94.68	68	108	50	.12	.49	<2	0	20.9
21	100	96.76	68	108	49	.20	.82	2.5	0	20.9
22	105	99.40	68	110	49	.31	1.28	2.8	0	20.9
23	110	102.67	69	113	50	.42	1.73	3.5	0	20.9
24	115	106.47	69	117	50	.44	1.83	3.5	0	20.9
25	120	110.41					.00			
AVERAGE			67.75	100.5417	47.25	.27	1.16	2.715789	0	20.9

METER VOLUME =	72.95 ft3	ABS STACK PRES =	29.99 in. Hg
DRY GAS VOL.SCF =	69.02 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.55 ft3	STACK GAS VELO =	29.42 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003247 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	38730.49 CFM
		DUCT GASFLOW.SCFM=	38845.60 CFM

------------------------->> ISOKINETIC VARIATION = 101.93 %

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :21 MAY 84

SCRUBBER:102-IN/IMPACTOR

TEST : 3

RUN : 2

--dP--	--SQRT dP--
0	0
.07	.2645751
.22	.4690416
.31	.5567764
.43	.6557439
.81	.9
.55	.7416198
.24	.4898979
0	0
.02	.1414214
.1	.3162278
.25	.5
.35	.5916080
.5	.7071068
.51	.7141428
.28	.5291503
0	0
.01	.1
.08	.2828427
.23	.4795832
.38	.6164414
.39	.6244998
.37	.6082763
.23	.4795832
	.4486291

dP AVE = .2013219

IMPACTOR TESTING DATA SHEET

Date : [illegible] MAY 94	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 3	Box # : 1	I.D. # : 10-2	I.D. # : 3	I.D. # : 10-2	I.D. # : 3
Run # : 1	Delta H@: 1.8779	Liner : STAINLESS	Diam : .2455	Coeffic: .79	Filter #: -
Location: LBNSY - Bldg 210	Corr Fact: 1.0080	Length : 10			Leak rt : 0cfm
Source : 100-IN	Heat Set: -	Heater : -			@ : 15in. H2O
Engineer: KIRK/FAN					H2O gain: 25ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	59F	Stack gas dry wt :	29.15 lb/lb-mol	length:	74in.
Barometer:	29.84in. Hg	Water vap present:	.015	width:	43in.
Stk Stat:	+0.80in. H2O			area-in2:	3182in.2
				area-ft2:	22.09722ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	761.75	70.25	90.5	57.38	.19	.66	.875	0	20.9
2	40	782.45	70.25	80.5	57.38	.19	.66	.875	0	20.9
3	80	803.17	70.25	80.5	57.38	.19	.66	.875	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
						-	-	-	0	20.9
AVERAGE			70.25	90.5	57.38	.19	.66	.875	0	20.9

METER VOLUME = 41.42 ft3	ABS STACK PRES = 29.90 in. Hg
DRY GAS VOL,SCF = 40.40 ft3	WETGAS MOLE WT = 28.64 lb/lb-mole
WATER VAPOR VOL = 1.19 ft3	STACK GAS VELO = 22.90 ft/sec
MOIST CONTENT = .02	NOZZLE AREA = .0003287 ft2
MOL FRAC DRY GAS= .98	DUCT GASFLOW,ACFM= 29901.75 CFM
	DUCT GASFLOW,SCFM= 29490.72 CFM

------------------------> ISOKINETIC VARIATION = 115.19 %

IMPACTOR TESTING DATA SHEET

Date : 21 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 3	Box # : 5	I.D. # :-	I.D. # : -	I.D. # : -	I.D. # : 4
Run # : 1	Delta H@: 1.8098	Liner : S-STEEL	Diam : .246	Coeffic: .85	Filter #: -
Location:LENBY - Bldg 210	Crct Fac: .9996	Length : 6			Leak rt : .012cfm
Source : 100-OUT	Heat Set: -	Heater : -			@ : 15in. H2O
Engineer:GUA/BEL					H2O gain: 20.9ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	59F	Stack gas		length:	66in. dia.
Barometer:	29.94in. Hg	dry wt :	29lb/lb-mol	width:	- in.
Stk Stat:	.26in. H2O	Water vap		area-in2:	3317in.2
		percent:	.02	area-ft2:	23.74029ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	110.82	67	95.25	46.775	.27	1.10	2.8	0	20.9
2	40	134.78	67	95.25	46.775	.27	1.10	2.8	0	20.9
3	80	158.28	67	95.25	46.775	.27	1.10	2.5	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			67	95.25	46.775	.27	1.10	2.8	0	20.9

METER VOLUME	=	47.46 ft3	ABS STACK PRES	=	29.96 in. Hg
DRY GAS VOL,SCF	=	45.94 ft3	WETGAS MOLC WT	=	28.77 lb/lb-mole
WATER VAPOR VOL	=	.98 ft3	STACK GAS VELO	=	29.57 ft/sec
MOIST CONTENT	=	.02	NOZZLE AREA	=	.0003301 ft2
VOL FRAC DRY GAS	=	.98	DUCT GASFLOW,ACFM	=	38609.95 CFM
			DUCT GASFLOW,SCFM	=	38804.47 CFM

-------------------------> ISOKINETIC VARIATION = 100.27 %

IMPACTOR TESTING DATA SHEET

Date :21 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 3	Box # : 1	I.D. # : 10-2	I.D. # : -	I.D. # : 10-2	I.D. # : 7
Run # : 2	Delta H@: 1.8779	Liner : GLASS	Dia : .2455	Coeffic: .78	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: 1.0085	Length : 10			Leak rt : 0cfm
Source :102-IN	Heat Set: -	Heater : -			@ : 26in. H2O
Engineer:KIRK/FAN					H2O gain: 51.4ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	57F	Stack gas dry wt :	29lb/lb-mol	length:	43in.
Barometer:	29.84in. Hg	Water vap proport:	.015	width:	74in.
Stk Stat:	-2.80in. H2O			area-in2:	3182in.2
				area-ft2:	22.09722ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	804.00	67.56	57.11	49.61	.20	.71	1	0	20.9
2	90	851.53	67.59	87.11	49.61	.20	.71	1	0	20.9
3	180	895.66	67.58	87.11	49.61	.20	.71	1	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			67.58	57.11	49.61	.20	.71	1	0	20.9

METER VOLUME =	96.47 ft3	ABS STACK PRES =	29.63 in. Hg
DRY GAS VOL.SCF =	92.99 ft3	WETGAS MOLC WT =	28.73 lb/lb-mole
WATER VAPOR VOL =	2.42 ft3	STACK GAS VELO =	23.54 ft/sec
MOIST CONTENT =	.03	NOZZLE AREA =	.0003287 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	30424.26 CFM
		DUCT GASFLOW.SCFM=	30157.49 CFM

-------------------------> ISOKINETIC VARIATION = 115.21 %

IMPACTOR TESTING DATA SHEET

Date : 21 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 3	Box # : 5	I.D. # : -	I.D. # : -	I.D. # : -	I.D. # : 5
Run # : 2	Delta H@: 1.8068	Liner : GLASS	Diam : .245	Coeffic: .85	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9996	Length : 6			Leak rt : .004cfm
Source : 102-OUT	Heat Set: -	Heater : -			@ : 15in. H2O
Engineer: GUA/BEL					H2O gain: 42.4ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 58F	Stack gas	length: 64in. dia.
Barometer: 29.94in. Hg	dry wt : 29lb/lb-mol	width: - in.
Stk. Stat: .20in. H2O	Water vap	area-in2: 3217in.2
	proport: .02	area-ft2: 22.34028ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	159.20	66.72	96.28	51.17	.27	1.10	2.9	0	20.9
2	90	210.54	66.72	96.28	51.17	.27	1.10	2.9	0	20.9
3	180	262.23	66.72	96.28	51.17	.27	1.10	2.9	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			66.72	96.28	51.17	.27	1.10	2.9	0	20.9

METER VOLUME =	102.95 ft3	ABS STACK PRES =	29.85 in. Hg
DRY GAS VOL.SCF =	97.72 ft3	WETGAS MOLC WT =	28.79 lb/lb-mole
WATER VAPOR VOL =	2.00 ft3	STACK GAS VELO =	29.56 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003274 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	38866.91 CFM
		DUCT GASFLOW,SCFM=	38876.35 CFM

-----------------------------> ISOKINETIC VARIATION = 95.35 %

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :24 MAY 94

SCRUBBER:103-IN

TEST : 4

RUN : 1

--dP--	--SQRT dP--
0	0
0	0
0	0
.15	.3872983
.17	.4123106
.19	.4358899
.19	.4358899
.19	.4358899
0	0
0	0
.01	.1
.15	.3872983
.17	.4123106
.18	.4242641
.19	.4358899
.19	.4358899
0	0
0	0
.01	.1
.12	.3464102
.18	.4242641
.19	.4358899
.19	.4358899
.19	.4358899
	.2700531

dP AVE = .0729287

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :24 MAY 84

SCRUBBER:103-OUT

TEST : 4

RUN : 1

--dP--	--SQRT dP--
.22	.4690416
.26	.5099020
.22	.4690416
.18	.4242641
.15	.3872983
.06	.2449490
.07	.2645751
.12	.3464102
.22	.4690416
.31	.5567764
.37	.6082763
.46	.6782330
.2	.4472136
.2	.4472136
.18	.4242641
.15	.3872983
.13	.3605551
.08	.2828427
.04	.2
.08	.2828427
.14	.3741657
.21	.4582576
.29	.5385165
.36	.6
	.4262908

dP AVE = .1817238

SOURCE EMISSIONS TESTING DATA SHEET

Date :22 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 4	Box # : 4	I.D.,# : 2	I.D. # : DM-3	I.D. # : 2	I.D. # : 4
Run # : 1	Delta H@: 1.7782	Liner :GLASS	Diam : .3623	Coeffic: .81	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: 1.0049	Length : 10			Leak rt : 0cfm
Source :103-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:KIRK/FAN					H2O gain: 55.6ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	60F	Stack gas dry wt :	29lb/lb-mol	length:	64in.
Barometer:	29.9in. Hg	Water vap proport:	.03	width:	86in.
Stk Stat:	-1.50in. H2O			area-in2:	5504in.2
				area-ft2:	38.22222ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	899.91	65	66	64	.00	.00	0	0	20.9
2	5	899.91	65	66	64	.00	.00	0	0	20.9
3	10	899.91	65	66	64	.00	.00	0	0	20.9
4	15	899.91	65	66	64	.14	2.27	12	0	20.9
5	20	963.83	65	75	42	.18	2.97	17	0	20.9
6	25	908.08	65	86	50	.19	3.20	17	0	20.9
7	30	912.38	65	93	54	.18	3.07	17	0	20.9
8	35	916.69	65	99	55	.20	3.45	-	0	20.9
9	40	920.99	65	90	61	.00	.00	0	0	20.9
10	45	920.99	65	88	62	.00	.00	0	0	20.9
11	50	920.99	65	86	62	.01	.17	1	0	20.9
12	55	922.20	65	84	54	.15	2.52	15	0	20.9
13	60	925.59	65	93	49	.18	3.07	17	0	20.9
14	65	929.93	65	102	52	.19	3.29	17	0	20.9
15	70	934.29	64	107	51	.18	3.15	17	0	20.9
16	75	938.68	64	110	51	.18	3.17	17	0	20.9
17	80	943.05	64	100	59	.00	.00	0	0	20.9
18	85	943.05	64	97	60	.00	.00	0	0	20.9
19	90	943.05	64	96	60	.00	.00	0	0	20.9
20	95	943.05	64	94	61	.15	2.57	16	0	20.9
21	100	947.29	64	103	48	.17	2.96	17	0	20.9
22	105	951.62	64	109	50	.18	3.17	17	0	20.9
23	110	956.00	64	112	51	.18	3.18	17	0	20.9
24	115	960.38	64	114	52	.18	3.19	17	0	20.9
25	120	964.74					.00			
AVERAGE			64.58333	91.75	55.83333	.07	1.89	10.04348	0	20.9

METER VOLUME =	65.15 ft3	ABS STACK PRES =	29.79 in. Hg
DRY GAS VOL,SCF =	62.57 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	2.62 ft3	STACK GAS VELO =	14.38 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0007159 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	32385.83 CFM
		DUCT GASFLOW,SCFM=	32454.78 CFM

-------------------------->> ISOKINETIC VARIATION = 85.83 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :22 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 4	Box # : 5	I.D. # : -	I.D. # : 10	I.D. # : -	I.D. # : 5
Run # : 1	Delta H@: 1.8088	Liner :GLASS	Diam : .375	Coeffic: .85	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9996	Length : 7			Leak rt : .004cfm
Source :103-OUT	Heat Set: -	Heater : -			@ : 15in. H2O
Engineer:SUZ/BEL					H2O gain: 34.4ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	62F	Stack gas		length:	64in. dia.
Barometer:	29.9in. Hg	dry wt :	29lb/lb-mol	width:	- in.
Stk Stat:	.15in. H2O	Water vap		area-in2:	3217in.2
		proport:	.02	area-ft2:	22.34028ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	263.16	67	67	66	.26	5.53	7	0	20.9
2	5	70.00	66	87	48	.24	5.31	7	0	20.9
3	10	.00	66	95	50	.22	4.93	7	0	20.9
4	15	283.70	66	96	50	.21	4.72	7	0	20.9
5	20	289.10	66	99	51	.19	4.29	7	0	20.9
6	25	294.62	66	103	51	.09	2.05	3	0	20.9
7	30	298.98	66	99	50	.04	.90	<2	0	20.9
8	35	301.97	66	95	50	.04	.90	<2	0	20.9
9	40	304.70	66	94	49	.07	1.57	3	0	20.9
10	45	308.20	66	99	49	.11	2.48	4	0	20.9
11	50	312.57	66	103	49	.15	3.41	5	0	20.9
12	55	317.78	66	106	50	.21	4.80	6.5	0	20.9
13	60	323.91	65	73	62	.32	6.91	8	0	20.9
14	65	331.13	66	96	49	.36	8.09	10	0	20.9
15	70	338.78	66	107	52	.33	7.56	8	0	20.9
16	75	346.26	66	112	54	.31	7.17	8.5	0	20.9
17	80	353.61	65	113	54	.23	5.34	7	0	20.9
18	85	360.25	65	112	54	.11	2.55	3.5	0	20.9
19	90	364.94	66	103	54	.04	.91	<2	0	20.9
20	95	368.00	65	96	54	.06	1.35	2	0	20.9
21	100	371.41	65	97	52	.10	2.26	3	0	20.9
22	105	375.59	66	97	52	.13	2.93	4	0	20.9
23	110	380.55	65	99	53	.18	4.07	5	0	20.9
24	115	386.12	66	104	54	.23	5.24	7	0	20.9
25	120	392.55					.00			
AVERAGE			65.79167	98	52.375	.16	3.97	5.833333	0	20.9

METER VOLUME =	129.35 ft3	ABS STACK PRES =	29.91 in. Hg
DRY GAS VOL.SCF =	123.46 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.62 ft3	STACK GAS VELO =	22.80 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0007670 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	30009.91 CFM
		DUCT GASFLOW.SCFM=	30126.92 CFM

------------------------->> ISOKINETIC VARIATION = 99.52 %

SOURCE EMISSIONS TESTINE DATA SHEET

Date :22 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 4	Box # : B	I.D. # : -	I.D. # : -	I.D. # : -	I.D. # : 8
Run # : 2	Delta H@: 2.1179	Liner :GLASS	Diam : .3605	Coeffic: .81	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: 1.0263	Length : -			Leak rt : .005cfm
Source :103-IN	Heat Set: -	Heater : -			@ : 20in. H2O
Engineer:SUZ/BEL					H2O gain: 32.6ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	60F	Stack gas		length:	64in.
Barometer:	29.97in. Hg	dry wt :	29lb/lb-mol	width:	86in.
Stk Stat:	-1.50in. H2O	Water vap		area-in2:	5504in.2
		proport:	.03	area-ft2:	38.22222ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	571.30	63	64	62	.00	.00	-	0	20.9
2	5	571.30	63	64	62	.00	.00	-	0	20.9
3	10	571.30	63	64	62	.00	.00	-	0	20.9
4	15	571.30	63	64	62	.13	2.46	2.5	0	20.9
5	20	575.22	63	79	42	.18	3.31	3.5	0	20.9
6	25	580.00	63	92	46	.18	3.59	3.5	0	20.9
7	30	584.43	63	100	49	.18	3.64	3.5	0	20.9
8	35	589.24	63	105	50	.18	3.68	3.5	0	20.9
9	40	594.06	62	85	60	.00	.00	-	0	20.9
10	45	594.06	63	85	60	.00	.00	-	0	20.9
11	50	594.06	63	83	60	.00	.00	-	0	20.9
12	55	594.06	63	80	61	.15	2.93	3.4	0	20.9
13	60	597.72	63	94	45	.17	3.40	3.8	0	20.9
14	65	602.39	63	104	49	.18	3.67	4	0	20.9
15	70	607.26	63	110	51	.18	3.71	4	0	20.9
16	75	612.15	63	112	52	.19	3.93	4	0	20.9
17	80	617.13	62	94	59	.00	.00	-	0	20.9
18	85	617.13	62	92	59	.00	.00	-	0	20.9
19	90	617.13	62	91	60	.00	.00	-	0	20.9
20	95	617.13	62	96	50	.15	3.02	3.5	0	20.9
21	100	620.59	62	103	48	.18	3.67	4	0	20.9
22	105	625.35	62	112	51	.18	3.73	4	0	20.9
23	110	620.28	62	117	52	.18	3.76	4	0	20.9
24	115	635.24	62	118	52	.17	3.56	4	0	20.9
25	120	640.14					.00			
AVERAGE			62.625	92	54.33333	.07	2.18	3.68	0	20.9

METER VOLUME =	70.65 ft3	ABS STACK PRES =	29.86 in. Hg
DRY GAS VOL.SCF =	68.03 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.53 ft3	STACK GAS VELO =	13.98 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0007088 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	31476.25 CFM
		DUCT GASFLOW.SCFM=	31735.86 CFM

------------------------->> ISOKINETIC VARIATION = 96.38 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :22 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 4	Box # : 1	I.D. # : 1	I.D. # : 6.00	I.D. # : 1	I.D. # : 1
Run # : 2	Delta H@: 2.002	Liner :GLASS	Diam : .371	Coeffic: .83	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9963	Length : 7			Leak rt : .005cfm
Source :103-OUT	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:KIRK/FAN					H2O gain: 68.1ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	60F	Stack gas dry wt :	29lb/lb-mol	length:	64in. dia.
Barometer:	29.97in. Hg	Water vap proport:	.02	width:	- in.
Stk Stat:	.15in. H2O			area-in2:	3217in.2
				area-ft2:	22.34028ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	393.64	66	67	61	.27	5.81	9	0	20.9
2	5	400.40	65	86	47	.30	6.71	10	0	20.9
3	10	407.20	66	99	50	.29	6.62	10	0	20.9
4	15	414.26	66	106	51	.26	6.01	9	0	20.9
5	20	421.13	66	110	51	.19	4.42	6	0	20.9
6	25	427.32	66	110	51	.09	2.10	3	0	20.9
7	30	432.02	65	107	51	.05	1.16	2	0	20.9
8	35	435.43	66	103	59	.09	2.07	4	0	20.9
9	40	439.09	66	104	50	.13	3.00	4	0	20.9
10	45	443.81	66	108	50	.19	4.41	6	0	20.9
11	50	449.30	66	110	51	.26	6.05	9	0	20.9
12	55	455.97	66	115	52	.33	7.75	11	0	20.9
13	60	463.33	65	87	39	.26	5.82	9	0	20.9
14	65	470.01	66	103	50	.25	5.75	8	0	20.9
15	70	476.74	65	111	51	.22	5.14	8	0	20.9
16	75	483.26	65	115	52	.19	4.47	7	0	20.9
17	80	489.36	65	113	52	.15	3.52	5	0	20.9
18	85	494.87	65	111	51	.08	1.87	4	0	20.9
19	90	499.16	65	104	52	.03	.69	2	0	20.9
20	95	502.24	65	97	52	.04	.91	3	0	20.9
21	100	504.93	65	98	51	.07	1.60	3	0	20.9
22	105	508.43	65	103	51	.12	2.77	5	0	20.9
23	110	512.78	65	104	51	.17	3.92	6	0	20.9
24	115	518.11	65	112	51	.22	5.15	8	0	20.9
25	120	524.27					.00			
AVERAGE			65.45833	103.4583	51.95833	.16	4.07	6.291667	0	20.9

METER VOLUME =	130.15 ft3	ABS STACK PRES =	29.98 in. Hg
DRY GAS VOL.SCF =	123.33 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	3.21 ft3	STACK GAS VELO =	22.39 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0007507 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	29466.86 CFM
		DUCT GASFLOW,SCFM=	29669.80 CFM

------------------------>> ISOKINETIC VARIATION = 103.14 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :23 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 4	Box # : 3	I.D. # : -	I.D. # : SM-2	I.D. # : -	I.D. # : 3
Run # : 2	Delta H@: 2.1179	Liner :GLASS	Diam : .352	Coeffic: .81	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: 1.0263	Length : 10			Leak rt : .008cfm
Source :103-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:SUZ/BEL					H2O gain: 30.3ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	68F	Stack gas		length:	64in.
Barometer:	29.95in. Hg	dry wt :	29lb/lb-mol	width:	86in.
Stk Stat:	-1.50in. H2O	Water vap		area-in2:	5504in.2
		proport:	.023	area-ft2:	38.22222ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	641.52	69	70	68	.00	.00	-	0	20.9
2	5	641.52	69	70	68	.00	.00	-	0	20.9
3	10	641.52	69	70	68	.00	.00	-	0	20.9
4	15	641.52	69	78	50	.15	2.65	4	0	20.9
5	20	645.52	69	89	47	.19	3.43	5.8	0	20.9
6	25	650.43	69	106	51	.19	3.53	6	0	20.9
7	30	.00	68	116	53	.19	3.60	6	0	20.9
8	35	660.11	68	121	54	.18	3.44	-	0	20.9
9	40	668.25	68	105	64	.00	.00	-	0	20.9
10	45	668.25	68	105	64	.00	.00	-	0	20.9
11	50	668.25	68	105	64	.00	.00	-	0	20.9
12	55	668.25	68	105	64	.16	2.98	5.8	0	20.9
13	60	673.09	68	116	54	.19	3.60	6.3	0	20.9
14	65	678.11	68	125	55	.20	3.85	6.8	0	20.9
15	70	683.09	68	130	56	.20	3.89	6.8	0	20.9
16	75	688.42	68	133	56	.19	3.71	6.8	0	20.9
17	80	693.46	68	105	65	.00	.00	-	0	20.9
18	85	693.46	68	105	65	.00	.00	-	0	20.9
19	90	693.46	68	105	65	.00	.00	-	0	20.9
20	95	693.46	68	105	65	.16	2.98	5.8	0	20.9
21	100	698.24	67	116	54	.19	3.61	6.2	0	20.9
22	105	702.12	66	125	56	.20	3.87	6.6	0	20.9
23	110	708.09	66	129	57	.20	3.89	6.9	0	20.9
24	115	713.49	66	132	57	.19	3.72	-	0	20.9
25	120	718.50					.00			
AVERAGE			67.95833	106.9167	59.16667	.07	2.20	6.138462	0	20.9

METER VOLUME =	79.01 ft3	ABS STACK PRES =	29.84 in. Hg
DRY GAS VOL.SCF =	74.03 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.43 ft3	STACK GAS VELO =	14.59 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0006758 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	32857.14 CFM
		DUCT GASFLOW.SCFM=	32771.52 CFM

------------------------> ISOKINETIC VARIATION = 106.53 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :23 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 4	Box # : 5	I.D. # : 1	I.D. # : 6.00	I.D. # : 1	I.D. # : 5
Run # : 3	Delta H@: 2.0026	Liner :GLASS	Diam : .37075	Coeffic: .83	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9963	Length : 7			Leak rt : .008cfm
Source :103-OUT	Heat Set: -	Heater : -			@ : 29in. H2O
Engineer:KIRK/FAN					H2O gain: 53.6ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	68F	Stack gas dry wt :	29lb/lb-mol	length:	64in. dia.
Barometer:	29.95in. Hg			width:	- in.
Stk Stat:	-.16in. H2O	Water vap proport:	.02	area-in2:	3217in.2
				area-ft2:	22.34028ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	525.13	69	73	69	.22	.00	12	0	20.9
2	5	531.08	69	87	49	.21	.00	12	0	20.9
3	10	537.12	68	99	56	.21	.00	12	0	20.9
4	15	543.21	68	104	58	.18	.00	12	0	20.9
5	20	549.13	68	109	55	.13	.00	8	0	20.9
6	25	554.27	68	107	52	.08	.00	5	0	20.9
7	30	558.36	68	106	51	.03	.00	3	0	20.9
8	35	561.22	68	102	52	.05	.00	4	0	20.9
9	40	564.23	68	102	51	.09	.00	5	0	20.9
10	45	568.06	67	107	49	.16	.00	9	0	20.9
11	50	573.18	68	112	50	.22	.00	13	0	20.9
12	55	579.42	67	121	53	.34	.00	20	0	20.9
13	60	586.31	67	88	67	.28	.00	20	0	20.9
14	65	592.51	67	102	50	.27	.00	21	0	20.9
15	70	598.59	67	114	51	.27	.00	21	0	20.9
16	75	605.07	67	121	52	.23	.00	16	0	20.9
17	80	611.80	67	123	51	.19	.00	11	0	20.9
18	85	617.99	67	121	52	.08	.00	5	0	20.9
19	90	622.47	67	114	52	.05	.00	4	0	20.9
20	95	625.81	67	104	53	.09	.00	5	0	20.9
21	100	629.74	67	105	51	.15	.00	8	0	20.9
22	105	634.83	67	105	51	.22	.00	13	0	20.9
23	110	641.01	67	110	51	.31	.00	20	0	20.9
24	115	648.16	67	113	52	.39	.00	-	0	20.9
25	120	655.40					.00			
AVERAGE			67.5	106.2083	53.25	.17	.00	11.26087	0	20.9

METER VOLUME =	129.79 ft3	ABS STACK PRES =	29.94 in. Hg
DRY GAS VOL.SCF =	121.10 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	2.52 ft3	STACK GAS VELO =	22.96 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0007497 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	30225.49 CFM
		DUCT GASFLOW.SCFM=	30272.58 CFM

------------------------->> ISOKINETIC VARIATION = 99.40 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :23 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 4	Box # : 6	I.D. # : -	I.D. # : GM-2	I.D. # : -	I.D. # : 6
Run # : 4	Delta H@: 2.1179	Liner :GLASS	Diam : .3547	Coeffic: .81	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9926	Length : -			Leak rt : .007cfm
Source :103-IN	Heat Set: -	Heater : -			@ : 22in. H2O
Engineer:SUI/BEL					H2O gain: 31.8ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	59F	Stack gas dry wt :	29lb/lb-mol	length:	64in.
Barometer:	29.91in. Hg	Water vap proport:	.023	width:	86in.
Stk Stat:	-1.50in. H2O			area-in2:	5504in.2
				area-ft2:	38.22222ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	720.40	63	75	61	.00	.00	-	0	20.9
2	5	720.40	63	75	61	.00	.00	-	0	20.9
3	10	720.40	63	75	61	.00	.00	-	0	20.9
4	15	720.40	63	75	61	.15	2.75	3.9	0	20.9
5	20	724.62	63	91	41	.19	3.59	3.6	0	20.9
6	25	729.44	63	104	44	.20	3.87	3.9	0	20.9
7	30	734.28	63	112	46	.21	4.12	3.9	0	20.9
8	35	740.00	63	116	49	.20	3.95	4	0	20.9
9	40	744.90	63	110	55	.00	.00	-	0	20.9
10	45	744.90	63	110	55	.00	.00	-	0	20.9
11	50	744.90	63	110	55	.00	.00	-	0	20.9
12	55	744.90	63	110	55	.18	3.52	3.5	0	20.9
13	60	.00	63	111	48	.18	3.52	3.5	0	20.9
14	65	753.40	63	118	50	.22	4.36	4.2	0	20.9
15	70	759.29	63	123	51	.21	4.20	4.2	0	20.9
16	75	764.69	63	125	52	.21	4.21	4.2	0	20.9
17	80	769.97	63	113	57	.00	.00	-	0	20.9
18	85	769.97	63	109	57	.00	.00	-	0	20.9
19	90	769.97	63	107	58	.00	.00	-	0	20.9
20	95	769.97	63	104	58	.18	3.48	4.6	0	20.9
21	100	774.84	63	115	49	.20	3.94	4	0	20.9
22	105	779.98	63	122	52	.21	4.19	4	0	20.9
23	110	785.37	63	125	53	.20	4.01	4	0	20.9
24	115	790.61	63	127	53	.20	4.02	4	0	20.9
25	120	795.79					.00			
AVERAGE			63	106.75	53.41667	.08	2.41	3.966667	0	20.9

METER VOLUME =	74.83 ft3	ABS STACK PRES =	29.80 in. Hg
DRY GAS VOL.SCF =	70.08 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.50 ft3	STACK GAS VELO =	14.94 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0006862 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	33649.98 CFM
		DUCT GASFLOW,SCFM=	33835.07 CFM

-------------------------> ISOKINETIC VARIATION = 96.19 %

SOURCE EMISSIONS TESTING DATA SHEET

	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Date : 05 MAY 84					
Test # : 4	Box # : 1	I.D. # : 1	I.D. # : 6.00	I.D. # : 1	I.D. # : 1
Run # : 4	Delta H@: 2.0026	Liner : GLASS	Diam : .374	Coeffic: .83	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9963	Length : 7			Leak rt : .002cfm
Source : 103-OUT	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer: KIRK/FAN					H2O gain: 53.6ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	58F	Stack gas		length:	64in. dia.
Barometer:	29.91in. Hg	dry wt :	29lb/lb-mol	width:	- in.
Stk Stat:	.13in. H2O	Water vap		area-in2:	3217in.2
		proport:	.02	area-ft2:	22.34028ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	656.02	66	65	59	.30	6.65	11	0	20.9
2	5	.00	66	87	46	.29	6.69	11	0	20.9
3	10	669.95	66	96	51	.26	6.10	11	0	20.9
4	15	676.85	66	104	54	.21	5.00	9	0	20.9
5	20	683.26	66	105	55	.17	4.05	7	0	20.9
6	25	689.00	66	104	55	.10	2.38	5	0	20.9
7	30	693.67	66	100	54	.03	.71	3	0	20.9
8	35	696.59	66	94	54	.04	.94	3	0	20.9
9	40	699.31	66	93	53	.05	1.17	3	0	20.9
10	45	702.41	66	98	53	.07	1.65	4	0	20.9
11	50	706.00	66	100	53	.09	2.13	5	0	20.9
12	55	709.99	66	100	53	.09	2.13	5	0	20.9
13	60	714.15	65	79	58	.34	7.75	13	0	20.9
14	65	720.08	66	98	49	.35	8.24	14	0	20.9
15	70	729.33	66	113	54	.32	7.74	13	0	20.9
16	75	736.99	66	116	54	.29	7.05	12	0	20.9
17	80	744.40	66	119	55	.20	4.89	8	0	20.9
18	85	750.90	66	116	55	.10	2.43	5	0	20.9
19	90	755.83	66	113	54	.04	.97	3	0	20.9
20	95	759.39	66	107	55	.06	1.44	4	0	20.9
21	100	762.63	66	106	54	.08	1.91	4	0	20.9
22	105	766.49	66	105	53	.10	2.38	5	0	20.9
23	110	770.80	66	105	53	.13	3.10	6	0	20.9
24	115	775.69	66	108	53	.16	3.84	7	0	20.9
25	120	781.04					.00			
AVERAGE			65.95833	101.2917	53.625	.14	3.81	7.125	0	20.9

METER VOLUME =	124.56 ft3	ABS STACK PRES =	29.92 in. Hg
DRY GAS VOL.SCF =	118.18 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	2.52 ft3	STACK GAS VELO =	21.00 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0007629 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	27640.35 CFM
		DUCT GASFLOW.SCFM=	27747.24 CFM

------------------------->> ISOKINETIC VARIATION = 104.00 %

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :23 MAY 84

SCRUBBER:103-IN/IMPACTOR

TEST : 5

RUN : 1

--dP--	--SQRT dP--
0	0
0	0
0	0
.15	.3872983
.17	.4123106
.19	.4358899
.19	.4358899
.19	.4358899
0	0
0	0
.01	.1
.15	.3872983
.17	.4123106
.18	.4242641
.19	.4358899
.19	.4358899
0	0
0	0
.01	.1
.12	.3464102
.18	.4242641
.19	.4358899
.19	.4358899
.19	.4358899
	.2700531

dP AVE = .0729287

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :24 MAY 84

SCRUBBER:103-OUT/IMPACTOR

TEST : 5

RUN : 1

--dP--	--SQRT dP--
.22	.4690416
.26	.5099020
.22	.4690416
.18	.4242641
.15	.3872983
.06	.2449490
.07	.2645751
.12	.3464102
.22	.4690416
.31	.5567764
.37	.6082763
.46	.6782330
.2	.4472136
.2	.4472136
.18	.4242641
.15	.3872983
.13	.3605551
.08	.2828427
.04	.2
.08	.2828427
.14	.3741657
.21	.4582576
.29	.5385165
.36	.6
	.4262908

dP AVE = .1817238

IMPACTOR TESTING DATA SHEET

Date :24 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 5	Box # : 3	I.D. # : 10-2	I.D. # : 3	I.D. # : 10-2	I.D. # : B
Run # : 1	Delta H@: 2.0014	Liner : S-STEEL	Diam : .2445	Coeffic: .78	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9979	Length : 10			Leak rt : .009cfm
Source :107 IN	Heat Set: -	Heater : -			@ : 27in. H2O
Engineer:KIRK/FAN					H2O gain: 32.7ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	63F	Stack gas dry wt :	29lb/lb-mol	length:	86in.
Barometer:	29.86in. Hg	Water vap prcpcnt:	.023	width:	64in.
Stk Stat:	-1.50in. H2O			area-in2:	5504in.2
				area-ft2:	38.222224ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	798.14	70.91	101.27	51.36	.07	.27	2.5	0	20.9
2	240	883.00	70.91	101.27	51.36	.07	.27	2.5	0	20.9
3	-	-	-	-	-	-	-	-	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			70.91	101.27	51.36	.07	.27	2.5	0	20.9

METER VOLUME =	84.68 ft3	ABS STACK PRES =	29.75 in. Hg
DRY GAS VOL,SCF =	79.52 ft3	WETGAS MOLC WT =	28.79 lb/lb-mole
WATER VAPOR VOL =	1.54 ft3	STACK GAS VELO =	14.18 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003261 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	31911.59 CFM
		DUCT GASFLOW,SCFM=	31556.02 CFM

-------------------------> ISOKINETIC VARIATION = 123.17 %

IMPACTOR TESTING DATA SHEET

Date : 24 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 5	Box # : 5	I.D. # : 7-1	I.D. # : -	I.D. # : 7-1	I.D. # : 3
Run # : 1	Delta H@: 1.8088	Liner : SS 316	Diam : .243	Coeffic: .85	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9996	Length : 7			Leak rt : .004cfm
Source : 103-OUT	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer: PDK/BEL					H2O gain: 51.1ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	69F	Stack gas dry wt :	29lb/lb-mol	length:	64in. dia.
Barometer:	29.86in. Hg	Water vap proport:	.021	width:	- in.
Stk Stat:	.00in. H2O			area-in2:	3217in.2
				area-ft2:	22.34028ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	788.22	66.75	89.58	50.67	.18	.71	3	0	20.9
2	240	909.74	66.75	89.58	50.67	.18	.71	3	0	20.9
3	-	-	-	-	-	-	-	-	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
						-	-	-	0	20.9
AVERAGE			66.75	89.58	50.67	.18	.71	3	0	20.9

METER VOLUME =	121.47 ft3	ABS STACK PRES =	29.86 in. Hg
DRY GAS VOL.SCF =	116.62 ft3	WETGAS MOLC WT =	28.77 lb/lb-mole
WATER VAPOR VOL =	2.41 ft3	STACK GAS VELO =	24.28 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003221 ft2
VOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	31955.72 CFM
		DUCT GASFLOW,SCFM=	31867.28 CFM

------------------------> ISOKINETIC VARIATION = 105.84 %

IMPACTOR TESTING DATA SHEET

Date :24 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 5	Box # : 3	I.D. # : 10-2	I.D. # : 2	I.D. # : 10-2	I.D. # : 5
Run # : 2	Delta H@: 2.0014	Liner : STEEL	Diam : .244	Coeffic: .78	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9943	Length : 10			Leak rt : .009cfm
Source :103-IN	Heat Set: -	Heater : -			@ : 27in. H2O
Engineer:KIRK/FAN					H2O gain: ml

ATMOSPHERE

Ambient : 58F
Barometer: 29.86in. Hg
Stk Stat: -1.30in. H2O

ESTIMATE

Stack gas dry wt : 29lb/lb-mol
Water vap proport: .023

DUCT AREA

length: 86in.
width: 64in.
area-in2: 5504in.2
area-ft2: 38.22222ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	883.29	69.42	100.46	49	.07	.27	2	0	20.9
2	240	968.06	69.42	100.46	49	.07	.27	2	0	20.9
3	-	-	-	-	-	-	-	-	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			69.42	100.46	49	.07	.27	2	0	20.9

METER VOLUME = 84.29 ft3
DRY GAS VOL,SCF = 79.27 ft3
WATER VAPOR VOL = .00 ft3
MOIST CONTENT = .02
MOL FRAC DRY GAS= .99

ABS STACK PRES = 29.75 in. Hg
WETGAS MOLC WT = 28.80 lb/lb-mole
STACK GAS VELO = 14.16 ft/sec
NOZZLE AREA = .0003247 ft2
DUCT GASFLOW,ACFM= 31893.18 CFM
DUCT GASFLOW,SCFM= 31626.56 CFM

----------------------------> ISOKINETIC VARIATION = 103.00 %

IMPACTOR TESTING DATA SHEET

Date : 24 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 5	Box # : -	I.D. # : 7-1	I.D. # : 1/4 in.	I.D. # : 7-1	I.D. # : -
Run # : 2	Delta H@: 1.6808	Liner : SS 316	Diam : .245	Coeffic: .85	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9996	Length : 7			Leak rt : .007cfm
Source : 103-OUT	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer: PDW/BEL					H2O gain: 31.7ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 60F	Stack gas	length: 64in. dia.
Barometer: 29.86in. Hg	dry wt : 29lb/lb-mol	width: - in.
Stk Stat: .00in. H2O	Water vap	area-in2: 3217in.2
	proport: .021	area-ft2: 22.34029ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	911.89	66	93.43	53	.18	.77	10	0	20.9
2	156	989.41	66	93.43	53	.18	.77	10	0	20.9
3	-	-	-	-	-	-	-	-	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			66	93.43	53	.18	.77	10	0	20.9

METER VOLUME =	77.49 ft3	ABS STACK PRES =	29.86 in. Hg
DRY GAS VOL.SCF =	73.89 ft3	WETGAS MOLC WT =	28.78 lb/lb-mole
WATER VAPOR VOL =	1.49 ft3	STACK GAS VELO =	24.19 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003274 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	31771.81 CFM
		DUCT GASFLOW.SCFM=	31828.66 CFM

-------------------------->> ISOKINETIC VARIATION = 101.61 %

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :24 MAY 84

SCRUBBER:104-IN

TEST : 6

RUN : 1

--dP--	--SQRT dP--
.23	.4795832
.23	.4795832
.2	.4472136
.19	.4358899
.11	.3316625
0	0
0	0
.24	.4898979
.2	.4472136
.2	.4472136
.17	.4123106
.21	.4582576
.1	.3162278
.05	.2236068
.26	.5099020
.27	.5196152
.2	.4472136
.19	.4358899
.21	.4582576
.28	.5291503
.33	.5744563
.33	.5744563
.33	.5744563
.36	.6
	.4246691

dP AVE = .1803438

SOURCE EMISSIONS TESTING DATA SHEET

Date :25 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 6	Box # : 7	I.D. # : 2	I.D. # : 11	I.D. # : 2	I.D. # : 7
Run # : 1	Delta H@: 2.002	Liner :GLASS	Diam : .374	Coeffic: .8	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9963	Length : 10			Leak rt : .01cfm
Source :104-IN	Heat Set: -	Heater : -			@ : 29in. H2O
Engineer:KIRK/FAN					H2O gain: 34.4ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	58F	Stack gas		length:	43in.
Barometer:	29.82in. Hg	dry wt :	29lb/lb-mol	width:	86in.
Stk Stat:	-1.10in. H2O	Water vap		area-in2:	3698in.2
		proport:	.02	area-ft2:	25.68056ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	.12	65	67	62	.23	4.75	12	0	20.9
2	4	4.77	65	82	68	.21	4.46	12	0	20.9
3	8	9.55	66	93	86	.19	4.11	10	0	20.9
4	12	14.12	65	99	72	.19	4.16	10	0	20.9
5	16	18.66	65	106	62	.10	2.22	6	0	20.9
6	20	22.33	65	105	53	.00	.00	0	0	20.9
7	24	22.70	65	97	57	.00	.00	0	0	20.9
8	28	22.70	65	88	60	.27	5.79	14	0	20.9
9	32	27.92	65	90	55	.21	4.52	11	0	20.9
10	36	32.64	65	101	47	.16	3.51	8	0	20.9
11	40	37.00	65	106	50	.16	3.55	8	0	20.9
12	44	41.24	65	109	51	.20	4.46	11	0	20.9
13	48	45.88	65	113	53	.09	2.02	5	0	20.9
14	52	49.46	65	111	52	.01	.22	2	0	20.9
15	56	51.03	65	102	50	.24	5.28	12	0	20.9
16	60	55.15	65	114	53	.17	3.82	9	0	20.9
17	64	59.83	65	98	59	.17	3.71	9	0	20.9
18	68	64.15	65	106	51	.16	3.55	9	0	20.9
19	72	68.46	65	112	53	.19	4.26	10	0	20.9
20	76	73.01	65	114	55	.25	5.62	13	0	20.9
21	80	78.20	65	121	55	.27	6.14	15	0	20.9
22	84	83.74	65	124	55	.32	7.32	17	0	20.9
23	88	89.64	65	129	56	.33	7.61	18	0	20.9
24	92	95.74	65	132	51	.25	5.79	13	0	20.9
25	96	101.29					.00			
AVERAGE			65.04167	104.9583	56.91667	.16	4.04		0	20.9

METER VOLUME =	100.80 ft3	ABS STACK PRES =	29.74 in. Hg
DRY GAS VOL.SCF =	94.78 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.62 ft3	STACK GAS VELO =	21.33 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0007629 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	32276.82 CFM
		DUCT GASFLOW.SCFM=	32262.43 CFM

-------------------------->> ISOKINETIC VARIATION = 103.07 %

SOURCE EMISSIONS TESTING DATA SHEET

Date : 25 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 6	Box # : 6	I.D. # : 2	I.D. # : 6M-3	I.D. # : 2	I.D. # : 6
Run # : 2	Delta H@: 2.002	Liner : GLASS	Diam : .361	Coeffic: .8	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9963	Length : 10			Leak rt : .003cfm
Source : 104-IN	Heat Set: -	Heater : -			@ : 29in. H20
Engineer: FAN/BEL					H20 gain: 34.3ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	58F	Stack gas		length:	86.5in.
Barometer:	29.82in. Hg	dry wt :	29lb/lb-mol	width:	42in.
Stk Stat:	-1.10in. H20	Water vap		area-in2:	3633in.2
		proport:	.02	area-ft2:	25.22917ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H20)	Orifice Delta H (in H20)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	102.17	64	77	44	.24	4.39	11	0	20.9
2	4	107.93	64	93	40	.24	4.52	11	0	20.9
3	8	111.69	64	104	47	.20	3.84	10	0	20.9
4	12	116.18	64	109	49	.20	3.88	10	0	20.9
5	16	120.63	64	111	51	.11	2.14	6	0	20.9
6	20	124.17	64	110	51	.00	.00	6	0	20.9
7	24	124.17	64	110	51	.00	.00	6	0	20.9
8	28	124.17	64	110	51	.27	5.24	14	0	20.9
9	32	129.05	64	102	56	.22	4.21	10	0	20.9
10	36	133.62	64	106	50	.20	3.85	10	0	20.9
11	40	138.10	64	111	53	.17	3.31	8	0	20.9
12	44	142.30	64	114	55	.21	4.10	10	0	20.9
13	48	.00	64	116	56	.11	2.16	6	0	20.9
14	52	150.52	64	114	54	.03	.59	3	0	20.9
15	56	152.73	64	107	50	.28	5.41	13	0	20.9
16	60	157.03	65	114	52	.08	1.56	5	0	20.9
17	64	161.71	63	98	58	.17	3.24	8	0	20.9
18	68	165.79	64	103	47	.16	3.07	8	0	20.9
19	72	169.82	64	108	50	.19	3.67	9	0	20.9
20	76	174.09	64	113	52	.26	5.07	12	0	20.9
21	80	179.17	64	118	54	.30	5.90	15	0	20.9
22	84	184.52	63	123	55	.33	6.56	17	0	20.9
23	88	190.23	63	125	56	.33	6.59	17	0	20.9
24	92	196.00	63	129	56	.34	6.83	17	0	20.9
25	96	201.79					.00			
AVERAGE			63.875	109.375	51.58333	.17	3.76	10.08333	0	20.9

METER VOLUME =	99.25 ft3	ABS STACK PRES =	29.74 in. Hg
DRY GAS VOL.SCF =	92.54 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.61 ft3	STACK GAS VELO =	21.99 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0007108 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	32687.69 CFM
		DUCT GASFLOW,SCFM=	32745.88 CFM

------------------------->> ISOKINETIC VARIATION = 104.55 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :26 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 6	Box # : 5	I.D. # : 2	I.D. # : GM-3	I.D. # : 2	I.D. # : 5
Run # : 3	Delta H@: 2.002	Liner :GLASS	Diam : .366	Coeffic: .8	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9963	Length : 10			Leak rt : .002cfm
Source :104-IN	Heat Set: -	Heater : -			@ : 26in. H2O
Engineer:PDW/FAN					H2O gain: 38.1ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	70F	Stack gas dry wt :	29lb/lb-mol	length:	86.5in.
Barometer:	29.88in. Hg	Water vap proport:	.017	width:	42in.
Stk Stat:	-1.10in. H2O			area-in2:	3633in.2
				area-ft2:	25.22917ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	202.17	68	70	45	.23	4.37	10	0	20.9
2	4	207.50	69	84	47	.24	4.68	10	0	20.9
3	8	211.71	69	91	51	.19	3.75	11	0	20.9
4	12	216.16	68	94	54	.19	3.79	9	0	20.9
5	16	220.40	69	97	55	.10	1.99	9	0	20.9
6	20	223.60	69	94	55	.00	.00	3	0	20.9
7	24	223.60	69	94	55	.00	.00	3	0	20.9
8	28	224.76	69	90	53	.22	4.33	10	0	20.9
9	32	228.47	67	87	58	.21	4.13	9	0	20.9
10	36	232.98	69	96	54	.20	3.98	9	0	20.9
11	40	237.51	68	100	55	.17	3.42	8	0	20.9
12	44	241.80	69	101	55	.21	4.22	9	0	20.9
13	48	246.30	69	102	57	.11	2.21	6	0	20.9
14	52	249.89	69	95	59	.06	1.19	4	0	20.9
15	56	252.42	69	90	54	.32	6.30	14	0	20.9
16	60	258.00	69	100	55	.08	1.60	5	0	20.9
17	64	261.08	68	85	61	.17	3.32	8	0	20.9
18	68	265.18	69	92	51	.18	3.56	8	0	20.9
19	72	269.41	69	97	54	.20	3.99	9	0	20.9
20	76	273.92	69	101	55	.27	5.42	12	0	20.9
21	80	279.30	69	105	57	.34	6.88	15	0	20.9
22	84	284.99	69	109	58	.40	8.15	15	0	20.9
23	88	290.62	70	114	56	.33	6.77	15	0	20.9
24	92	296.48	70	114	56	.34	6.98	15	0	20.9
25	96	302.47					.00			
AVERAGE			68.83333	95.91667	54.58333	.17	3.96	9.416667	0	20.9

METER VOLUME =	99.93 ft3	ABS STACK PRES =	29.80 in. Hg
DRY GAS VOL.SCF =	95.67 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.79 ft3	STACK GAS VELO =	22.38 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0007306 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	33265.13 CFM
		DUCT GASFLOW,SCFM=	33078.50 CFM

-------------------------->> ISOKINETIC VARIATION = 104.09 %

IMPACTOR TESTING DATA SHEET

Date :26 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 7	Box # : -	I.D. # : 10-2	I.D. # : -	I.D. # : 10-2	I.D. # : -
Run # : 1	Delta H@: 2.002	Liner : SS316	Diam : .367	Coeffic: .78	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9963	Length : 10			Leak rt : .001cfm
Source :104-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:POW/FAN					H2O gain: 61.6ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 74F	Stack gas	length: 86dia.
Barometer: 29.88in. Hg	dry wt : 29lb/lb-mol	width: 43in.
Stk Stat: -1.10in. H2O	Water vap	area-in2: 3698in.2
	proport: .017	area-ft2: 25.68056ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dp (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	303.41	72.7	109.3	55.89	.18	3.50	7	0	20.9
2	180	497.35	72.7	109.3	55.89	.18	3.50	7	0	20.9
3	-	-	-	-	-	-	-	-	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			72.7	109.3	55.89	.18	3.50	7	0	20.9

METER VOLUME = 193.22 ft3	ABS STACK PRES = 29.80 in. Hg
DRY GAS VOL,SCF = 180.44 ft3	WETGAS MOLC WT = 28.84 lb/lb-mole
WATER VAPOR VOL = 2.90 ft3	STACK GAS VELO = 22.28 ft/sec
MOIST CONTENT = .02	NOZZLE AREA = .0007346 ft2
MOL FRAC DRY GAS= .99	DUCT GASFLOW,ACFM= 33807.88 CFM
	DUCT GASFLOW,SCFM= 33374.18 CFM

------------------------->> ISOKINETIC VARIATION = 105.06 %

MPACTOR TESTING DATA SHEET

Date : 26 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 7	Box # : 5	I.D. # : 10-2	I.D. # : -	I.D. # : 10-2	I.D. # : 7
Run # : 2	Delta H@: 2.002	Liner : SS316	Diam : .37	Coeffic: .78	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9963	Length : 10			Leak rt : .016cfm
Source : 104-IN	Heat Set: -	Heater : -			@ : 20in. H2O
Engineer:FAN/POW					H2O gain: 25.2ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	59F	Stack gas dry wt :	29lb/lb-mol	length:	86in.
Barometer:	29.8in. Hg	Water vap proport:	.018	width:	43in.
Stk Stat:	-1.10in. H2O			area-in2:	3698in.2
				area-ft2:	25.68056ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	500.53	66.33	106.67	54.67	.18	3.64	5.7	0	20.9
2	60	568.09	66.33	106.67	54.67	.18	3.64	5.7	0	20.9
3	-	-	-	-	-	-	-	-	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			66.33	106.67	54.67	.18	3.64	5.7	0	20.9

METER VOLUME =	67.31 ft3	ABS STACK PRES =	29.72 in. Hg
DRY GAS VOL.SCF =	63.00 ft3	WETGAS MOLC WT =	28.79 lb/lb-mole
WATER VAPOR VOL =	1.19 ft3	STACK GAS VELO =	22.19 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0007467 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	33539.28 CFM
		DUCT GASFLOW.SCFM=	33419.78 CFM

------------------------->> ISOKINETIC VARIATION = 108.12 %

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE : 1 JUNE 84

SCRUBBER: 105-IN

TEST : 10

RUN : 1

--dP--	--SQRT dP--
.26	.5099020
.35	.5916080
.43	.6557439
.55	.7416198
.34	.5830952
.43	.6557439
.48	.6928203
.57	.7549834
.31	.5567764
.41	.6403124
.49	.7
.56	.7483315
.34	.5830952
.42	.6480741
.47	.6855655
.51	.7141428
.37	.6082763
.43	.6557439
.49	.7
.54	.7348469
.26	.5099020
.36	.6
.42	.6480741
.47	.6855655
	.6501760

dP AVE = .4227288

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE : 1 JUNE 84

SCRUBBER: 105-OUT

TEST : 10

RUN : 1

--dP--	--SQRT dP--
.345	.5873670
.4	.6324555
.39	.6244998
.39	.6244998
.39	.6244998
.36	.6
.3	.5477226
.31	.5567764
.36	.6
.4	.6324555
.45	.6708204
.45	.6708204
.48	.6928203
.48	.6928203
.44	.6633250
.43	.6557439
.42	.6480741
.39	.6244998
.41	.6403124
.44	.6633250
.46	.6782330
.45	.6708204
.44	.6633250
.4	.6324555
	.6374030

dP AVE = .4062926

SOURCE EMISSIONS TESTING DATA SHEET

Date : 31 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 10	Box # : 5	I.D. # : 5	I.D. # : SM-10	I.D. # : 5	I.D. # : 5
Run # : 1	Delta H@: 1.8989	Liner : GLASS	Diam : .245	Coeffic: .82	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9953	Length : 3			Leak rt : 0cfm
Source : 10S-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer: KIRK/FAN					H2O gain: 25.4ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	68F	Stack gas		length:	108in.
Barometer:	29.86in. Hg	dry wt :	29lb/lb-mol	width:	31in.
Stk Stat:	-3.90in. H2O	Water vap		area-in2:	3348in.2
		proport:	.015	area-ft2:	23.25ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	901.60	70	78	70	.27	1.04	4	0	20.9
2	4	904.00	70	84	43	.36	1.40	4	0	20.9
3	8	906.67	70	91	44	.44	1.73	5	0	20.9
4	12	909.61	69	99	47	.54	2.16	6	0	20.9
5	16	912.89	69	81	57	.33	1.27	4	0	20.9
6	20	915.56	68	81	49	.43	1.66	5	0	20.9
7	24	918.42	68	85	50	.49	1.91	5	0	20.9
8	28	921.56	69	87	52	.58	2.27	5	0	20.9
9	32	924.90	69	108	59	.32	1.30	4	0	20.9
10	36	927.59	68	110	52	.42	1.71	5	0	20.9
11	40	930.53	68	114	53	.47	1.93	5	0	20.9
12	44	933.69	68	118	54	.55	2.27	6	0	20.9
13	48	937.03	68	114	59	.33	1.36	4	0	20.9
14	52	939.72	68	113	54	.40	1.64	5	0	20.9
15	56	942.63	68	117	55	.45	1.86	5	0	20.9
16	60	945.76	68	120	52	.52	2.16	6	0	20.9
17	64	949.07	67	117	54	.31	1.28	4	0	20.9
18	68	951.75	67	114	49	.47	1.93	5	0	20.9
19	72	954.84	67	117	49	.52	2.15	6	0	20.9
20	76	958.15	67	118	50	.57	2.36	6	0	20.9
21	80	961.54	67	115	53	.29	1.20	4	0	20.9
22	84	964.28	68	112	50	.37	1.51	5	0	20.9
23	88	967.03	67	112	51	.41	1.68	5	0	20.9
24	92	970.05	67	114	51	.47	1.93	5	0	20.9
25	96	973.23					.00			
AVERAGE			68.125	104.9583	52.375	.42	1.74	4.916667	0	20.9

METER VOLUME =	71.29 ft3	ABS STACK PRES =	29.57 in. Hg
DRY GAS VOL,SCF =	66.75 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.20 ft3	STACK GAS VELO =	35.97 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003274 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	49278.93 CFM
		DUCT GASFLOW,SCFM=	48696.14 CFM

-------------------------->> ISOKINETIC VARIATION = 101.46 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :31 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 10	Box # : 3	I.D. # : 1	I.D. # : 10.00	I.D. # : 1	I.D. # : 3
Run # : 1	Delta H@: 2.01	Liner :GLASS	Diam : .244	Coeffic: .85	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9979	Length : 6			Leak rt : .004cfm
Source :105-OUT	Heat Set: -	Heater : -			@ : 22in. H2O
Engineer:SUZ/BEL					H2O gain: 29.1ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 66F	Stack gas	length: 66in. dia.
Barometer: 29.86in. Hg	dry wt : 29lb/lb-mol	width: - in.
Stk Stat: .17in. H2O	Water vap	area-in2: 3421.2in.2
	proport: .02	area-ft2: 23.75833ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	368.99	67	78	69	.35	1.61	2.8	0	20.9
2	4	371.47	66	87	49	.39	1.72	2.8	0	20.9
3	8	374.19	66	96	50	.41	1.83	2.8	0	20.9
4	12	376.96	65	104	52	.40	1.82	2.8	0	20.9
5	16	379.77	65	110	52	.40	1.84	2.8	0	20.9
6	20	382.57	65	113	52	.37	1.71	2.8	0	20.9
7	24	385.31	65	115	52	.32	1.48	2.8	0	20.9
8	28	387.94	65	116	53	.30	1.39	2.8	0	20.9
9	32	390.39	65	118	53	.33	1.54	3	0	20.9
10	36	393.04	65	119	54	.37	1.73	3	0	20.9
11	40	395.82	65	120	53	.40	1.87	3.4	0	20.9
12	44	398.68	65	122	53	.43	2.02	3.6	0	20.9
13	48	401.63	67	106	64	.46	2.09	3.8	0	20.9
14	52	404.49	65	114	46	.49	2.27	4	0	20.9
15	56	407.00	65	119	47	.47	2.19	4	0	20.9
16	60	410.64	65	122	48	.44	2.07	4	0	20.9
17	64	413.62	64	124	48	.43	2.03	4	0	20.9
18	68	416.62	64	125	48	.38	1.80	4	0	20.9
19	72	419.54	64	125	49	.40	1.89	4	0	20.9
20	76	422.46	64	124	49	.43	2.03	3.8	0	20.9
21	80	425.42	64	124	49	.43	2.03	3.8	0	20.9
22	84	428.41	63	123	49	.44	2.08	3.8	0	20.9
23	88	431.39	64	123	49	.42	1.98	3.8	0	20.9
24	92	434.38	63	123	50	.37	1.75	3.8	0	20.9
25	96	437.26					.00			
AVERAGE			64.83333	114.5833	51.58333	.40	1.86	3.425	0	20.9

METER VOLUME =	68.12 ft3	ABS STACK PRES =	29.87 in. Hg
DRY GAS VOL,SCF =	62.73 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.37 ft3	STACK GAS VELO =	35.89 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003247 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	50239.77 CFM
		DUCT GASFLOW,SCFM=	50462.66 CFM

-------------------------->> ISOKINETIC VARIATION = 94.80 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :31 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 10	Box # : 4	I.D. # : 5	I.D. # : GN-10	I.D. # : 5	I.D. # : 4
Run # : 2	Delta H@: 1.8981	Liner :GLASS	Diam : .239	Coeffic: .82	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9953	Length : 3			Leak rt : 0cfm
Source :105-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:FAN/KIRK					H2O gain: 25.7ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	60F	Stack gas	.	length:	108in.
Barometer:	29.86in. Hg	dry wt :	29lb/lb-mol	width:	31in.
Stk Stat:	-3.90in. H2O	Water vap		area-in2:	3348in.2
		proport:	.015	area-ft2:	23.25ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	2.53	66	83	62	.28	.99	3	0	20.9
2	4	5.51	66	86	39	.37	1.31	3	0	20.9
3	8	8.13	66	92	41	.43	1.54	3	0	20.9
4	12	10.94	66	97	43	.51	1.85	4	0	20.9
5	16	14.02	66	91	53	.32	1.15	3	0	20.9
6	20	16.53	66	95	44	.41	1.48	3	0	20.9
7	24	19.26	66	100	44	.49	1.78	4	0	20.9
8	28	22.27	65	103	46	.58	2.13	4	0	20.9
9	32	25.52	65	96	53	.32	1.16	3	0	20.9
10	36	28.19	65	100	46	.43	1.57	4	0	20.9
11	40	30.85	65	104	47	.49	1.80	4	0	20.9
12	44	33.92	65	105	48	.56	2.06	4	0	20.9
13	48	37.14	65	98	54	.32	1.16	3	0	20.9
14	52	39.71	65	100	48	.43	1.57	4	0	20.9
15	56	42.53	65	104	49	.48	1.76	4	0	20.9
16	60	45.53	65	106	50	.54	1.99	4	0	20.9
17	64	48.73	64	100	55	.32	1.17	3	0	20.9
18	68	51.29	64	101	50	.47	1.72	4	0	20.9
19	72	54.21	64	105	50	.53	1.95	4	0	20.9
20	76	57.38	64	107	51	.57	2.11	4	0	20.9
21	80	60.68	64	102	55	.28	1.03	3	0	20.9
22	84	63.12	64	100	51	.37	1.35	3	0	20.9
23	88	65.77	64	104	51	.42	1.55	3	0	20.9
24	92	68.64	64	106	52	.49	1.81	4	0	20.9
25	96	71.72					.00			
AVERAGE			64.95833	99.375	49.25	.43	1.58	3.541667	0	20.9

METER VOLUME =	68.86 ft3	ABS STACK PRES =	29.57 in. Hg
DRY GAS VOL.SCF =	65.10 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.21 ft3	STACK GAS VELO =	36.03 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003115 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	49360.39 CFM
		DUCT GASFLOW,SCFM=	49070.87 CFM

------------------------>> ISOKINETIC VARIATION = 103.19 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :31 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 10	Box # : 6	I.D. # : 1	I.D. # : 10	I.D. # : 1	I.D. # : 6
Run # : 2	Delta H@: 2.01	Liner :GLASS	Diam : .244	Coeffic: .85	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9979	Length : 6			Leak rt : .003cfm
Source :105-OUT	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:BEL/SUZ					H2O gain: 27.7ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 64F	Stack gas dry wt : 29lb/lb-mol	length: 66in. dia.
Barometer: 29.86in. Hg	Water vap proport: .02	width: - in.
Stk Stat: .00in. H2O		area-in2: 3421.2in.2
		area-ft2: 23.75833ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	436.31	63	77	60	.35	1.52	2	0	20.9
2	4	438.31	63	95	60	.35	1.57	2	0	20.9
3	8	444.00	63	99	43	.41	1.85	2	0	20.9
4	12	447.00	63	105	45	.40	1.83	2	0	20.9
5	16	449.00	63	108	46	.39	1.79	2	0	20.9
6	20	452.00	63	111	47	.36	1.66	2	0	20.9
7	24	455.00	63	112	48	.29	1.34	2	0	20.9
8	28	457.00	62	113	48	.31	1.44	2	0	20.9
9	32	460.00	62	114	48	.33	1.54	2	0	20.9
10	36	462.00	62	115	48	.36	1.68	2	0	20.9
11	40	465.00	63	115	49	.41	1.91	2	0	20.9
12	44	468.00	63	116	49	.41	1.91	2.4	0	20.9
13	48	471.10	63	103	49	.46	2.10	2.5	0	20.9
14	52	474.00	63	109	44	.48	2.21	3	0	20.9
15	56	477.00	63	113	45	.45	2.09	3	0	20.9
16	60	480.00	62	116	46	.44	2.05	3	0	20.9
17	64	483.00	62	117	47	.41	1.92	3	0	20.9
18	68	486.00	62	117	47	.37	1.73	3	0	20.9
19	72	489.00	62	116	48	.40	1.87	3	0	20.9
20	76	492.00	62	117	48	.43	2.01	2.8	0	20.9
21	80	495.00	62	118	48	.43	2.02	2.8	0	20.9
22	84	498.00	62	118	49	.44	2.06	2.8	0	20.9
23	88	501.00	62	119	49	.41	1.92	2.8	0	20.9
24	92	504.00	62	117	49	.37	1.73	2.8	0	20.9
25	96	506.51					.00			
AVERAGE			62.5	110.8333	48.29167	.39	1.82	2.454167	0	20.9

METER VOLUME =	68.06 ft3	ABS STACK PRES =	29.86 in. Hg
DRY GAS VOL,SCF =	63.08 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.30 ft3	STACK GAS VELO =	35.50 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003247 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	49687.94 CFM
		DUCT GASFLOW,SCFM=	50110.28 CFM

-------------------------->> ISOKINETIC VARIATION = 96.00 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :31 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 10	Box # : 8	I.D. # : 5	I.D. # : SM-10	I.D. # : 5	I.D. # : 8
Run # : 3	Delta H@: 1.8989	Liner :GLASS	Diam : .24	Coeffic: .82	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9957	Length : 3			Leak rt : 0cfm
Source :105-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:KIRK/FAN					H2O gain: 25.6ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	59F	Stack gas		length:	108in.
Barometer:	29.88in. Hg	dry wt :	29lb/lb-mol	width:	31in.
Stk Stat:	-3.90in. H2O	Water vap		area-in2:	3348in.2
		proport:	.015	area-ft2:	23.25ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	72.28	65	70	61	.32	1.12	3	0	20.9
2	4	74.78	65	77	44	.35	1.25	3	0	20.9
3	8	77.34	65	84	45	.46	1.66	3	0	20.9
4	12	80.21	65	92	47	.54	1.97	3	0	20.9
5	16	83.32	65	90	53	.29	1.06	3	0	20.9
6	20	85.72	65	94	47	.43	1.58	3	0	20.9
7	24	88.44	65	99	48	.49	1.81	3	0	20.9
8	28	91.46	65	103	49	.57	2.13	3	0	20.9
9	32	94.70	65	102	52	.31	1.15	3	0	20.9
10	36	97.17	65	101	49	.44	1.64	3	0	20.9
11	40	100.02	.65	105	50	.50	1.87	3	0	20.9
12	44	103.08	65	108	50	.55	2.07	3	0	20.9
13	48	106.33	65	100	50	.27	1.00	3	0	20.9
14	52	108.70	65	102	50	.39	1.45	3	0	20.9
15	56	111.35	65	105	49	.46	1.72	3	0	20.9
16	60	114.33	65	109	51	.52	1.96	3	0	20.9
17	64	117.46	65	107	54	.28	1.05	3	0	20.9
18	68	119.90	65	105	50	.48	1.80	3	0	20.9
19	72	122.70	66	109	51	.52	1.96	3	0	20.9
20	76	125.96	66	111	52	.56	2.11	3	0	20.9
21	80	129.26	65	105	50	.31	1.16	3	0	20.9
22	84	131.82	66	106	50	.37	1.38	3	0	20.9
23	88	134.51	65	108	51	.42	1.58	3	0	20.9
24	92	137.37	65	111	52	.47	1.78	3	0	20.9
25	96	140.56					.00			
AVERAGE			65.125	100.125	50.20833	.42	1.59	3	0	20.9

METER VOLUME =	67.96 ft3	ABS STACK PRES =	29.59 in. Hg
DRY GAS VOL.SCF =	64.20 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.20 ft3	STACK GAS VELO =	35.82 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003142 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	49064.22 CFM
		DUCT GASFLOW.SCFM=	48793.93 CFM

------------------------->> ISOKINETIC VARIATION = 101.49 %

SOURCE EMISSIONS TESTING DATA SHEET

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Date :31 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 10	Box # : 3	I.D. # : 10	I.D. # : 10	I.D. # : 10	I.D. # : 3
Run # : 3	Delta H@: 2.101	Liner :GLASS	Diam : .244	Coeffic: .85	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9979	Length : -			Leak rt : .018cfm
Source :105-OUT	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:BEL/SUZ					H2O gain: 27.3ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 58F	Stack gas	length: 66in. dia.
Barometer: 29.86in. Hg	dry wt : 29lb/lb-mol	width: - in.
Stk Stat: .00in. H2O	Water vap	area-in2: 3421.2in.2
	proport: .02	area-ft2: 23.75833ft.2

==

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	507.21	62	80	46	.47	2.15	2.5	0	20.9
2	4	510.00	62	91	44	.47	2.19	2.5	0	20.9
3	8	513.00	62	105	46	.45	2.15	2.5	0	20.9
4	12	516.00	62	114	50	.42	2.04	2.5	0	20.9
5	16	519.00	62	119	51	.40	1.96	2.5	0	20.9
6	20	522.00	62	122	53	.37	1.82	2.4	0	20.9
7	24	525.00	62	124	54	.41	2.03	2.5	0	20.9
8	28	528.00	62	126	55	.42	2.09	2.5	0	20.9
9	32	531.00	62	127	55	.44	2.19	2.5	0	20.9
10	36	534.00	62	127	56	.43	2.14	2.8	0	20.9
11	40	537.00	62	129	56	.41	2.05	2.8	0	20.9
12	44	540.00	62	130	56	.35	1.75	2.8	0	20.9
13	48	543.00	62	109	56	.34	1.64	2.5	0	20.9
14	52	545.00	62	115	53	.39	1.88	2.8	0	20.9
15	56	548.00	62	120	54	.38	1.87	2.8	0	20.9
16	60	551.00	62	124	55	.39	1.91	2.8	0	20.9
17	64	554.00	62	126	51	.38	1.89	2.8	0	20.9
18	68	557.00	62	127	51	.36	1.79	2.8	0	20.9
19	72	560.00	62	127	52	.29	1.44	2.8	0	20.9
20	76	563.00	62	126	51	.29	1.44	2.8	0	20.9
21	80	565.00	62	125	51	.31	1.54	2.5	0	20.9
22	84	568.00	62	125	52	.32	1.56	2.5	0	20.9
23	88	570.00	62	125	52	.40	1.98	2.5	0	20.9
24	92	573.00	62	127	53	.43	2.14	3	0	20.9
25	96	576.38					.00			
AVERAGE			62	119.5833	52.20833	.39	1.90	2.641667	0	20.9

==

METER VOLUME =	69.03 ft3	ABS STACK PRES =	29.86 in. Hg
DRY GAS VOL,SCF =	63.03 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.29 ft3	STACK GAS VELO =	35.17 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003247 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	49234.34 CFM
		DUCT GASFLOW,SCFM=	49700.39 CFM

------------------------->> ISOKINETIC VARIATION = 96.71 %

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INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE : 11 JUNE 84

SCRUBBER:105-IN/IMPACTOR

TEST : 11

RUN : 1

--dP--	--SQRT dP--
.26	.5099020
.35	.5916080
.43	.6557439
.55	.7416198
.34	.5830952
.43	.6557439
.48	.6928203
.57	.7549834
.31	.5567764
.41	.6403124
.49	.7
.56	.7483315
.34	.5830952
.42	.6480741
.47	.6855655
.51	.7141428
.37	.6082763
.43	.6557439
.49	.7
.54	.7348469
.26	.5099020
.36	.6
.42	.6480741
.47	.6855655
	.6501760

dP AVE = .4227288

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE : 1 JUNE 84

SCRUBBER: 105-OUT/IMPACTOR

TEST : 11

RUN : 1

--dP--	--SQRT dP--
.345	.5873670
.4	.6324555
.39	.6244998
.39	.6244998
.39	.6244998
.36	.6
.3	.5477226
.31	.5567764
.36	.6
.4	.6324555
.45	.6708204
.45	.6708204
.48	.6928203
.48	.6928203
.44	.6633250
.43	.6557439
.42	.6480741
.39	.6244998
.41	.6403124
.44	.6633250
.46	.6782330
.45	.6708204
.44	.6633250
.4	.6324555
	.6374030

dP AVE = .4062826

IMPACTOR TESTING DATA SHEET

Date : 11 JUNE 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 11	Box # : 5	I.D. # : -B	I.D. # : -	I.D. # : -B	I.D. # : 6
Run # : 1	Delta H@: 1.8981	Liner : S STEEL	Diam : .247	Coeffic: .75	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9953	Length : 3			Leak rt : .003cfm
Source : 105-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer: FAN/KIRK					H2O gain: 41.8ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	75F	Stack gas		length:	108in.
Barometer:	29.89in. Hg	dry wt :	29lb/lb-mol	width:	31in.
Stk Stat:	-3.90in. H2O	Water vap		area-in2:	3348in.2
		proport:	.015	area-ft2:	23.25ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	141.30	69.1	99.7	52.6	.42	1.46	4	0	20.9
2	90	205.16	69.1	99.7	52.6	.42	1.46	4	0	20.9
3	180	269.37	69.1	99.7	52.6	.42	1.46	4	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
									0	20.9
AVERAGE			69.1	99.7	52.6	.42	1.46	4	0	20.9

METER VOLUME =	127.47 ft3	ABS STACK PRES =	29.60 in. Hg
DRY GAS VOL,SCF =	120.51 ft3	WETGAS MOLC WT =	28.82 lb/lb-mole
WATER VAPOR VOL =	1.97 ft3	STACK GAS VELO =	32.84 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003328 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	45075.32 CFM
		DUCT GASFLOW,SCFM=	44505.27 CFM

-------------------------> ISOKINETIC VARIATION = 105.17 %

MPACTOR TESTING DATA SHEET

Date :: JUNE 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 11	Box # : 3	I.D. # : -	I.D. # : 2	I.D. # : -	I.D. # : -
Run # : 1	Delta H@: 2.175	Liner : -	Diam : .2475	Coeffic: .85	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .994	Length : -			Leak rt : .012cfm
Source :105-OUT	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:BEL/SUZ					H2O gain: 50.5ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 78F	Stack gas	length: 66in. dia.
Barometer: 29.89in. Hg	dry wt : 29lb/lb-mol	width: - in.
Stk Stat: .00in. H2O	Water vap	area-in2: 3421.2in.2
	proport: .02	area-ft2: 23.75833ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	577.17	64.22	114.33	54.44	.41	2.12	4.1		
2	170	707.90	64.22	114.33	54.44	.41	2.12	4.1	0	20.9
3	-	-	-	-	-	-	-	-	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
						-	-	-	0	20.9
AVERAGE			64.22	114.33	54.44	.41	2.12	4.1	0	20.9

METER VOLUME =	129.94 ft3	ABS STACK PRES =	29.89 in. Hg
DRY GAS VOL,SCF =	119.92 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	2.38 ft3	STACK GAS VELO =	36.13 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003341 ft2
VOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	50577.63 CFM
		DUCT GASFLOW,SCFM=	50291.25 CFM

-----------------------------> ISOKINETIC VARIATION = 98.62 %

IMPACTOR TESTING DATA SHEET

Date : 1 JUNE 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 11	Box # : 5	I.D. # : -8	I.D. # : 2	I.D. # : -8	I.D. # : 8
Run # : 2	Delta H@: 1.8088	Liner : S STEEL	Diam : .247	Coeffic: .75	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9996	Length : 3			Leak rt : .014cfm
Source :105-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:KIRK/FAN					H2O gain: 41.4ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	60F	Stack gas		length:	108in.
Barometer:	29.89in. Hg	dry wt :	29lb/lb-mol	width:	31in.
Stk Stat:	-3.90in. H2O	Water vap		area-in2:	3348in.2
		proportn:	.015	area-ft2:	23.25ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	270.13	65.45	108.3	50	.42	1.42	-	0	20.9
2	90	333.31	65.45	108.3	50	.42	1.42	-	0	20.9
3	180	396.81	65.45	108.3	50	.42	1.42	-	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
									0	20.9
AVERAGE			65.45	108.3	50	.42	1.42ERROR		0	20.9

METER VOLUME =	126.63 ft3	ABS STACK PRES =	29.60 in. Hg
DRY GAS VOL,SCF =	117.90 ft3	WETGAS MOLC WT =	28.82 lb/lb-mole
WATER VAPOR VOL =	1.95 ft3	STACK GAS VELO =	32.72 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003328 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	44919.58 CFM
		DUCT GASFLOW,SCFM=	44459.57 CFM

--------------------------> ISOKINETIC VARIATION = 102.53 %

IMPACTOR TESTING DATA SHEET

Date : 1 JUNE 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 11	Box # : 3	I.D. # : -	I.D. # : -	I.D. # : -	I.D. # : 5
Run # : 2	Delta H@: 2.135	Liner : S STEEL	Diam : .246	Coeffic: .85	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .994	Length : -			Leak rt : .003cfm
Source : 105-OUT	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:BEL/SUZ					H2O gain: 50.1ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	59F	Stack gas		length:	66in. dia.
Barometer:	29.89in. Hg	dry wt :	29lb/lb-mol	width:	- in.
Stk Stat:	.00in. H2O	Water vap		area-in2:	3421.2in.2
		proport:	.02	area-ft2:	23.75833ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	708.46	63	114.55	55	.41	2.07	5.1	0	20.9
2	90	774.41	63	114.55	55	.41	2.07	5.1	0	20.9
3	180	841.14	63	114.55	55	.41	2.07	5.1	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			63	114.55	55	.41	2.07	5.1	0	20.9

METER VOLUME =	131.89 ft3	ABS STACK PRES =	29.89 in. Hg
DRY GAS VOL.SCF =	121.65 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	2.36 ft3	STACK GAS VELO =	36.09 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003301 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	50518.74 CFM
		DUCT GASFLOW.SCFM=	50950.58 CFM

-------------------------->> ISOKINETIC VARIATION = 95.54 %

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :15 MAY 84

SCRUBBER:106-IN/IMPACTOR

TEST : 1

RUN : 1

--dP--	--SQRT dP--
.44	.6633250
.53	.7280110
.65	.8062258
.84	.9165151
.98	.9899495
1.2	1.095445
.42	.6480741
.59	.7681146
.75	.8660254
.86	.9273618
.93	.9643651
1.1	1.048809
.41	.6403124
.56	.7483315
.7	.8366600
.91	.9539392
.96	.9797959
1.1	1.048809
.33	.5744563
.41	.6403124
.6	.7745967
.65	.8062258
.73	.8544004
.78	.8831761
	.8401349

dP AVE = .7058266

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE : 15 MAY 84

SCRUBBER: 106-OUT/IMPACTOR

TEST : 1

RUN : 1

-dP--	--SQRT dP--
.5	.7071068
.52	.7211103
.39	.6244998
.3	.5477226
.2	.4472136
.07	.2645751
.12	.3464102
.24	.4898979
.38	.6164414
.5	.7071068
.48	.6928203
.43	.6557439
.14	.3741657
.16	.4
.17	.4123106
.18	.4242641
.12	.3464102
.1	.3162278
.32	.5656854
.54	.7348469
.65	.8062258
.69	.8306624
.63	.7937254
.53	.7280110
	.5647160

dP AVE = .3189042

IMPACTOR TESTING DATA SHEET

Date : 15 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 1	Box # : 2	I.D. # : 8	I.D. # : 4	I.D. # : 8	I.D. # : -
Run # : 1	Delta H@: 1.2548	Liner : S STEEL	Diam : .246	Coeffic: .75	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: 1.0254	Length : 3			Leak rt : .016cfm
Source :106-IN	Heat Set: -	Heater : -			@ : 10in. H2O
Engineer:KIRK/FAN					H2O gain: 23.1ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	58F	Stack gas dry wt :	29lb/lb-mol	length:	33in.
Barometer:	29.9in. Hg	Water vap proport:	.02	width:	75in.
Stk Stat:	-3.30in. H2O			area-in2:	2475in.2
				area-ft2:	17.1875ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	588.80	58.29	93.43	55.86	.71	1.59	10		
2	30	623.99	58.29	93.43	55.86	.71	1.59	10	0	20.9
3	60	655.55	58.29	93.43	55.86	.71	1.59	10	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
									0	20.9
AVERAGE			58.29	93.43	55.86	.71	1.59	10	0	20.9

METER VOLUME =	66.39 ft3	ABS STACK PRES =	29.66 in. Hg
DRY GAS VOL.SCF =	63.52 ft3	WETGAS MOLC WT =	28.81 lb/lb-mole
WATER VAPOR VOL =	1.09 ft3	STACK GAS VELO =	41.95 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003301 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	42527.42 CFM
		DUCT GASFLOW.SCFM=	42954.40 CFM

-------------------------> ISOKINETIC VARIATION = 128.42 %

MPACTOR TESTING DATA SHEET

Date :15 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER	
Test # : 1	Box # : 5	I.D. # : -	I.D. # : -	I.D. # : -	I.D. # :	5
Run # : 1	Delta H@: 1.7484	Liner : -	Diam : .247	Coeffic: .85	Filtr #:	-
Location:LBNSY - Bldg 210	Crct Fac: .9996	Length : 7			Leak rt :	.01cfm
Source :106-OUT	Heat Set: -	Heater : -			@ :	15in. H2O
ngineer:BUA/BEL					H2O gain:	15.7ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	58F	Stack gas dry wt :	29lb/lb-mol	length:	66in. dia.
Barometer:	29.9in. Hg	Water vap proport:	.02	width:	- in.
Stk Stat:	.17in. H2O			area-in2:	3421.2in.2
				area-ft2:	23.75833ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	674.92	59.5	98.33	55.58	.32	1.33	2.4	0	20.9
2	60	718.20	59.5	98.33	55.58	.32	1.33	2.4	0	20.9
3	-	-	-	-	-	-	-	-	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			59.5	98.33	55.58	.32	1.33	2.4	0	20.9

METER VOLUME =	43.26 ft3	ABS STACK PRES =	29.91 in. Hg
DRY GAS VOL.SCF =	41.00 ft3	WETGAS MOLC WT =	28.81 lb/lb-mole
WATER VAPOR VOL =	.74 ft3	STACK GAS VELO =	31.86 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003328 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	44650.10 CFM
		DUCT GASFLOW.SCFM=	45369.29 CFM

-------------------------->> ISOKINETIC VARIATION = 107.61 %

--dP--	--SQRT dP--
.63	.7937254
.72	.8485281
.71	.8426150
.64	.8
.57	.7549834
.35	.5916080
.08	.2828427
.12	.3464102
.18	.4242641
.18	.4242641
.23	.4795832
.14	.3741657
.51	.7141428
.56	.7483315
.48	.6928203
.4	.6324555
.26	.5099020
.1	.3162278
.25	.5
.41	.6403124
.65	.8062258
.83	.9110434
.91	.9539392
.97	.9848858
	.6405572

dP AVE = .4103084

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :15 MAY 84

SCRUBBER:106-OUT/IMPACTOR

TEST : 1

RUN : 2

IMPACTOR TESTING DATA SHEET

Date : 15 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 1	Box # : 5	I.D. # : 7-1	I.D. # : -	I.D. # : 7-1	I.D. # : 5
Run # : 2	Delta H@: 1.8981	Liner : -	Diam : .245	Coeffic: .85	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9953	Length : 7			Leak rt : .016cfm
Source : 106-OUT	Heat Set: -	Heater : -			@ : 15in. H2O
Engineer: GUA/BEL					H2O gain: 13.5ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	62F	Stack gas dry wt :	29lb/lb-mol	length:	66in. dia.
Barometer:	29.9in. Hg	Water vap proport:	.02	width:	- in.
Stk Stat:	.15in. H2O			area-in2:	3421.2in.2
				area-ft2:	23.75833ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	719.66	58.08	97.08	56.25	.41	1.79	2.9	0	20.9
2	30	741.00	58.08	97.08	56.25	.41	1.79	2.9	0	20.9
3	60	764.33	58.08	97.08	56.25	.41	1.79	2.9	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			58.08	97.08	56.25	.41	1.79	2.9	0	20.9

METER VOLUME =	44.46 ft3	ABS STACK PRES =	29.91 in. Hg
DRY GAS VOL.SCF =	42.28 ft3	WETGAS MOLC WT =	28.85 lb/lb-mole
WATER VAPOR VOL =	.64 ft3	STACK GAS VELO =	36.06 ft/sec
MOIST CONTENT =	.01	NOZZLE AREA =	.0003274 ft2
MOL FRAC DRY GAS=	.99	DUCT GASFLOW.ACFM=	50676.92 CFM
		DUCT GASFLOW.SCFM=	51631.78 CFM

-------------------------->> ISOKINETIC VARIATION = 99.10 %

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :15 MAY 84

SCRUBBER:106-IN/IMPACTOR

TEST : 1

RUN : 3

--dP--	--SQRT dP--
.43	.6557439
.58	.7615773
.67	.8185353
.8	.8944272
.95	.9746794
1.2	1.095445
.45	.6708204
.67	.8185353
.79	.8888194
.96	.9797959
1.1	1.048809
1.2	1.095445
.46	.6782330
.63	.7937254
.85	.9219544
.93	.9643651
1	1
.93	.9643651
.32	.5656854
.44	.6633250
.62	.7874008
.77	.8774964
.83	.9110434
.72	.8485281
	.8616148

dP AVE = .7423801

IMPACTOR TESTING DATA SHEET

Date :15 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 1	Box # : 2	I.D. # : 8	I.D. # : -	I.D. # : 8	I.D. # : - -
Run # : 3	Delta H@: 1.2548	Liner : S STEEL	Diam : .245	Coeffic: .75	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: 1.025	Length : 3			Leak rt : .002cfm
Source :106-IN	Heat Set: -	Heater : -			@ : 26in. H2O
Engineer:KIRK/FAN					H2O gain: 13.7ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 62F	Stack gas dry wt : 29lb/lb-mol	length: 33in.
Barometer: 29.9in. Hg	Water vap proport: .014	width: 75in.
Stk Stat: -3.10in. H2O		area-in2: 2475in.2
		area-ft2: 17.1875ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	716.25	63.33	90.5	55.17	.74	1.64	9	0	20.9
2	30	744.44	63.33	90.5	55.17	.74	1.64	9	0	20.9
3	60	772.07	63.33	90.5	55.17	.74	1.64	9	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			63.33	90.5	55.17	.74	1.64	9	0	20.9

METER VOLUME =	57.22 ft3	ABS STACK PRES =	29.67 in. Hg
DRY GAS VOL,SCF =	55.04 ft3	WETGAS MOLC WT =	28.87 lb/lb-mole
WATER VAPOR VOL =	.64 ft3	STACK GAS VELO =	43.17 ft/sec
MOIST CONTENT =	.01	NOZZLE AREA =	.0003274 ft2
MOL FRAC DRY GAS=	.99	DUCT GASFLOW,ACFM=	43985.09 CFM
		DUCT GASFLOW,SCFM=	44009.76 CFM

--------------------------->> ISOKINETIC VARIATION = 109.49 %

IMPACTOR TESTING DATA SHEET

Date :15 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 1	Box # : 5	I.D. # : -	I.D. # : -	I.D. # : -	I.D. # : 5
Run # : 3	Delta H@: 1.8961	Liner : -	Diam : .243	Coeffic: .85	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9953	Length : 7			Leak rt : .01cfm
Source :106-OUT	Heat Set: -	Heater : -			@ : 10in. H2O
Engineer:QUA/BEL					H2O gain: 14ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 63F	Stack gas dry wt : 29lb/lb-mol	length: 66in. dia.
Barometer: 29.9in. Hg	Water vap proport: .014	width: - in.
Stk Stat: .15in. H2O		area-in2: 3421.2in.2
		area-ft2: 23.75833ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	764.92	58.83	102.3	52.57	.41	1.77	2.9	0	20.9
2	30	788.30	58.83	102.3	52.57	.41	1.77	2.9	0	20.9
3	60	811.95	58.83	102.3	52.57	.41	1.77	2.9	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
AVERAGE			58.83	102.3	52.57	.41	1.77	2.9	0	20.9

METER VOLUME =	46.81 ft3	ABS STACK PRES =	29.91 in. Hg
DRY GAS VOL.SCF =	44.10 ft3	WETGAS MOLC WT =	28.84 lb/lb-mole
WATER VAPOR VOL =	.66 ft3	STACK GAS VELO =	36.09 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003221 ft2
MOL FRAC DRY GAS=	.99	DUCT GASFLOW.ACFM=	50671.82 CFM
		DUCT GASFLOW.SCFM=	51551.96 CFM

-------------------------->> ISOKINETIC VARIATION = 105.23 %

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :30 MAY 84

SCRUBBER:106-IN/IMPACTOR

TEST : 9

RUN : 1

--dP--	--SQRT dP--
.37	.6082763
.41	.6403124
.59	.7681146
.66	.8124038
.84	.9165151
.78	.8831761
.46	.6782330
.61	.7810250
.85	.9219544
.9	.9486833
1	1
1.1	1.048809
.45	.6708204
.62	.7874008
.74	.8602325
.97	.9848858
1.1	1.048809
1.2	1.095445
.44	.6633250
.47	.6855655
.66	.8124038
.8	.8944272
1	1
1.2	1.095445
	.8585943

dP AVE = .7371841

INITIAL VELOCITY TRAVERSE DATA AND CALCULATIONS

DATE :30 MAY 84

SCRUBBER:106-OUT/IMPACTOR

TEST : 9

RUN : 1

--dP--	--SQRT dP--
.54	.7348469
.63	.7937254
.64	.8
.6	.7745967
.48	.6928203
.32	.5656854
.08	.2828427
.11	.3316625
.11	.3316625
.14	.3741657
.15	.3872983
.15	.3872983
.42	.6480741
.47	.6855655
.46	.6782330
.4	.6324555
.27	.5196152
.18	.4242641
.21	.4582576
.32	.5656854
.5	.7071068
.69	.8306624
.81	.9
.7	.8366600
	.5976327

dP AVE = .3571648

SOURCE EMISSIONS TESTING DATA SHEET

	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Date : 29 MAY 84					
Test # : 8	Box # : 5	I.D. # : 5	I.D. # : 6M-10	I.D. # : 5	I.D. # : 5
Run # : 1	Delta H@: 2.135	Liner : GLASS	Diam : .242	Coeffic: .82	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .994	Length : 3			Leak rt : .007cfm
Source : 106-IN	Heat Set: -	Heater : -			@ : 28in. H2O
Engineer: KIRK/FAN					H2O gain: 43.7ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	66F	Stack gas dry wt :	29lb/lb-mol	length:	33in.
Barometer:	29.79in. Hg	Water vap proport:	.015	width:	75in.
Stk Stat:	-2.80in. H2O			area-in2:	2475in.2
				area-ft2:	17.1875ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	968.40	66	74	66	.30	1.23	3	0	20.9
2	4	970.74	64	78	48	.38	1.58	4	0	20.9
3	8	973.27	64	85	48	.47	1.98	4	0	20.9
4	12	976.08	64	92	50	.64	2.73	6	0	20.9
5	16	979.35	64	102	51	.70	3.04	6	0	20.9
6	20	982.89	64	111	53	.71	3.14	7	0	20.9
7	24	986.46	65	104	59	.32	1.39	4	0	20.9
8	28	988.95	65	109	54	.49	2.15	5	0	20.9
9	32	991.83	65	114	55	.67	2.97	7	0	20.9
10	36	995.22	70	114	57	.62	2.72	6	0	20.9
11	40	998.82	63	117	58	.75	3.35	7	0	20.9
12	44	1002.39	64	120	59	.82	3.68	8	0	20.9
13	48	1006.28	63	105	62	.37	1.62	5	0	20.9
14	52	1009.00	65	106	57	.64	2.80	6	0	20.9
15	56	1011.71	68	106	57	.75	3.26	7	0	20.9
16	60	1015.30	68	115	58	.84	3.71	8	0	20.9
17	64	1019.24	66	119	61	.91	4.06	9	0	20.9
18	68	1023.36	64	124	63	.97	4.38	10	0	20.9
19	72	1027.63	63	123	64	.37	1.67	4	0	20.9
20	76	1030.34	68	116	60	.44	1.95	5	0	20.9
21	80	1033.24	70	116	60	.52	2.29	5	0	20.9
22	84	1036.33	70	118	60	.66	2.92	7	0	20.9
23	88	1039.81	68	117	60	.82	3.63	8	0	20.9
24	92	1043.71	66	121	61	.89	3.98	9	0	20.9
25	96	1047.73					.00			
AVERAGE			65.79167	108.5833	57.54167	.61	2.76	6.25	0	20.9

ITER VOLUME =	78.86 ft3	ABS STACK PRES =	29.58 in. Hg
DRY GAS VOL.SCF =	73.38 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	2.06 ft3	STACK GAS VELO =	43.04 ft/sec
IST CONTENT =	.02	NOZZLE AREA =	.0003194 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	43581.04 CFM
		DUCT GASFLOW.SCFM=	43272.70 CFM

------------------------->> ISOKINETIC VARIATION = 95.10 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :29 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 5	Box # : 8	I.D. # : -	I.D. # : 8-7	I.D. # : -	I.D. # : 8
Run # : 1	Delta H@: 1.8088	Liner :GLASS	Diam : .2485	Coeffic: .85	Filtr #: -
Location:LBNSY - Bldg 210	Corr Fac: .9996	Length : -			Leak rt : .001cfm
Source :106-OUT	Heat Set: -	Heater : -			@ : 17in. H2O
Engineer:SUI/BEL					H2O gain: 29.7ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	63F	Stack gas		length:	66in. dia.
Barometer:	29.79in. Hg	dry wt :	29lb/lb-mol	width:	- in.
Stk Stat:	.17in. H2O	Water vap		area-in2:	3421.2in.2
		proport:	.02	area-ft2:	23.75833ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	568.34	67	74	65	.53	2.20	3.8	0	20.9
2	4	571.61	67	77	41	.60	2.51	4.2	0	20.9
3	8	575.10	67	83	44	.55	2.32	4.2	0	20.9
4	12	578.59	67	88	45	.52	2.22	3.8	0	20.9
5	16	581.99	67	94	46	.47	2.03	3.8	0	20.9
6	20	585.28	67	99	46	.26	1.13	2.4	0	20.9
7	24	587.38	66	101	47	.08	.35	<2	0	20.9
8	28	589.56	66	98	47	.09	.39	<2	0	20.9
9	32	591.00	66	96	48	.10	.43	<2	0	20.9
10	36	591.00	66	96	47	.07	.30	<2	0	20.9
11	40	593.96	66	94	47	.08	.35	<2	0	20.9
12	44	595.40	66	93	48	.07	.30	<2	0	20.9
13	48	597.06	66	85	60	.42	1.78	3.6	0	20.9
14	52	600.20	66	92	47	.47	2.02	4	0	20.9
15	56	603.44	66	95	48	.41	1.77	3.4	0	20.9
16	60	606.49	66	99	49	.31	1.35	3	0	20.9
17	64	609.30	66	99	49	.07	.30	<2	0	20.9
18	68	610.88	66	96	49	.09	.39	<2	0	20.9
19	72	612.37	66	98	48	.21	.91	2.4	0	20.9
20	76	614.70	65	102	49	.40	1.76	3.4	0	20.9
21	80	617.60	65	107	51	.54	2.39	4.2	0	20.9
22	84	621.02	66	111	50	.68	3.03	4.8	0	20.9
23	88	624.99	66	111	51	.75	3.34	5	0	20.9
24	92	629.20	66	110	52	.69	3.06	4.8	0	20.9
25	96	633.22					.00			
AVERAGE			66.16667	95.75	48.91667	.31	1.53	3.8	0	20.9

METER VOLUME =	64.85 ft3	ABS STACK PRES =	29.80 in. Hg
DRY GAS VOL.SCF =	61.55 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.40 ft3	STACK GAS VELO =	31.56 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003368 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	44181.00 CFM
		DUCT GASFLOW.SCFM=	44160.84 CFM

--------------------------> ISOKINETIC VARIATION = 102.48 %

SOURCE EMISSIONS TESTING DATA SHEET

Date : 29 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 8	ID # : 3	ID # : 5	I.D. # : GM-10	I.D. # : 5	I.D. # : 8
Run # : 2	Delta H@: 2.1179	Liner : GLASS	Diam : .242	Coeffic: .82	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9926	Length : 3			Leak rt : .005cfm
Source : 106-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer: KIRK/FAN					H2O gain: 99.4ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	61F	Stack gas dry wt :	29lb/lb-mol	length:	33in.
Barometer:	29.79in. Hg	Water vap proport:	.015	width:	75in.
Stk Stat:	-2.80in. H2O			area-in2:	2475in.2
				area-ft2:	17.1875ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	48.79	64	70	62	.33	1.34	2	0	20.9
2	4	51.48	64	79	50	.37	1.53	2	0	20.9
3	8	53.73	64	87	51	.45	1.89	2	0	20.9
4	12	56.10	64	95	53	.62	2.64	3	0	20.9
5	16	59.32	64	101	54	.68	2.93	3	0	20.9
6	20	62.83	64	106	55	.71	3.08	3	0	20.9
7	24	66.49	64	107	56	.37	1.61	2	0	20.9
8	28	69.07	64	103	55	.47	2.03	3	0	20.9
9	32	71.92	64	106	55	.63	2.74	3	0	20.9
10	36	75.26	64	111	55	.75	3.29	4	0	20.9
11	40	79.55	64	114	56	.83	3.66	4	0	20.9
12	44	82.86	64	117	56	.90	3.99	4	0	20.9
13	48	86.95	63	111	56	.42	1.84	3	0	20.9
14	52	89.83	65	111	56	.61	2.67	3	0	20.9
15	56	93.14	65	114	56	.76	3.32	4	0	20.9
16	60	96.57	68	118	57	.84	3.70	4	0	20.9
17	64	100.84	66	119	57	.90	3.98	4	0	20.9
18	68	104.96	64	121	57	.95	4.24	5	0	20.9
19	72	109.19	64	109	57	.34	1.48	2	0	20.9
20	76	111.82	65	110	52	.43	1.88	3	0	20.9
21	80	114.63	66	112	52	.53	2.32	3	0	20.9
22	84	117.71	66	114	52	.66	2.90	4	0	20.9
23	88	121.16	65	118	51	.75	3.32	4	0	20.9
24	92	124.89	64	120	51	.86	3.83	4	0	20.9
25	96	128.90					.00			
AVERAGE			64.66667	107.2083	54.75	.62	2.76	3.25	0	20.9

TER VOLUME =	79.91 ft3	ABS STACK PRES =	29.58 in. Hg
RY GAS VOL.SCF =	74.54 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	4.68 ft3	STACK GAS VELO =	43.17 ft/sec
OIST CONTENT =	.02	NOZZLE AREA =	.0003194 ft2
L FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	43717.81 CFM
		DUCT GASFLOW.SCFM=	43501.58 CFM

-------------------------> ISOKINETIC VARIATION = 96.10 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :29 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 8	Box # : 6	I.D. # : -	I.D. # :	I.D. # : -	I.D. # : 7
Run # : 2	Delta H@: 1.8086	Liner :GLASS	Dias : .247	Coeffic: .85	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9996	Length : -			Leak rt : .002cfm
Source :106-OUT	Heat Set: -	Heater : -			@ : 17in. H2O
Engineer:SUZ/BEL					H2O gain: 26.3ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	62F	Stack gas		length:	66in. dia.
Barometer:	29.51in. Hg	dry wt :	29lb/lb-mol	width:	- in.
Stk Stat:	.17in. H2O	Water vap		area-in2:	3421.2in.2
		proport:	.02	area-ft2:	23.75833ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	633.95	65	69	63	.53	2.14	4	0	20.9
2	4	636.99	66	75	41	.57	2.32	4	0	20.9
3	8	640.52	65	84	57	.57	2.36	4	0	20.9
4	12	643.92	65	91	47	.52	2.18	4	0	20.9
5	16	647.24	65	94	48	.42	1.77	3	0	20.9
6	20	650.34	65	96	49	.24	1.02	3	0	20.9
7	24	652.84	65	96	49	.07	.30	2	0	20.9
8	28	654.36	65	92	50	.08	.34	2	0	20.9
9	32	655.67	65	91	50	.09	.38	2	0	20.9
10	36	657.10	65	92	48	.11	.46	2	0	20.9
11	40	658.68	65	92	48	.09	.38	2	0	20.9
12	44	660.16	65	92	49	.06	.25	3	0	20.9
13	48	661.38	65	85	58	.45	1.87	3	0	20.9
14	52	664.45	65	97	46	.49	2.08	4	0	20.9
15	56	667.79	65	101	46	.42	1.80	3	0	20.9
16	60	670.83	65	103	50	.28	1.20	3	0	20.9
17	64	673.39	65	99	50	.16	.68	2	0	20.9
18	68	675.42	65	98	51	.07	.30	2	0	20.9
19	72	676.77	56	96	50	.21	.91	3	0	20.9
20	76	678.93	65	99	49	.37	1.58	3	0	20.9
21	80	681.84	65	103	50	.51	2.19	4	0	20.9
22	84	685.26	65	106	51	.64	2.76	5	0	20.9
23	88	689.11	65	109	52	.74	3.21	5	0	20.9
24	92	693.10	65	111	52	.72	3.13	5	0	20.9
25	96	697.12					.00			
AVERAGE			64.66667	94.625	50.16667	.31	1.48	3.208333	0	20.9

METER VOLUME =	63.24 ft3	ABS STACK PRES =	29.82 in. Hg
DRY GAS VOL.SCF =	60.18 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.33 ft3	STACK GAS VELO =	31.53 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003328 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW.ACFM=	44133.35 CFM
		DUCT GASFLOW.SCFM=	44269.01 CFM

-------------------------> ISOKINETIC VARIATION = 101.17 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :25 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 6	ID # : 3	ID # : 5	I.D. # : SM-10	I.D. # : 5	I.D. # : 6
Run # : 3	Delta H@: 2.1179	Liner : GLASS	Diam : .24	Coeffic: .82	Filtr #: -
Location: LBNSY - Bldg 210	Crct Fac: .9926	Length : 3			Leak rt : .005cfm
Source : 106-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer: KIRK/FAN					H2O gain: 39.7ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	60F	Stack gas dry wt :	29lb/lb-mol	length:	33in.
Barometer:	29.84in. Hg	Water vap proport:	.015	width:	75in.
Stl Stat:	-2.40in. H2O			area-in2:	2475in.2
				area-ft2:	17.1875ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	129.64	64	73	63	.25	.99	2	0	20.9
2	4	131.83	64	92	64	.34	1.37	2	0	20.9
3	8	134.18	64	92	56	.46	1.89	3	0	20.9
4	12	136.90	64	99	56	.59	2.45	3	0	20.9
5	16	140.04	64	104	53	.65	2.72	3	0	20.9
6	20	143.44	64	109	51	.73	3.09	4	0	20.9
7	24	146.97	64	102	54	.35	1.46	2	0	20.9
8	28	149.49	64	105	49	.49	2.06	3	0	20.9
9	32	152.33	64	110	49	.66	2.80	4	0	20.9
10	36	155.80	64	114	54	.80	3.41	4	0	20.9
11	40	159.33	64	117	51	.85	3.64	4	0	20.9
12	44	163.24	64	120	53	.90	3.88	5	0	20.9
13	48	167.28	63	111	56	.34	1.45	2	0	20.9
14	52	169.85	64	110	52	.61	2.58	3	0	20.9
15	56	173.02	64	114	52	.87	3.71	4	0	20.9
16	60	176.84	64	119	54	.93	4.00	5	0	20.9
17	64	180.91	64	120	56	.95	4.09	5	0	20.9
18	68	185.10	64	122	58	.97	4.19	5	0	20.9
19	72	189.28	63	115	59	.35	1.50	3	0	20.9
20	76	191.85	65	113	55	.50	2.12	3	0	20.9
21	80	194.80	66	115	51	.55	2.34	3	0	20.9
22	84	197.96	66	116	48	.67	2.86	4	0	20.9
23	88	201.41	65	118	49	.83	3.56	4	0	20.9
24	92	205.21	64	120	50	.93	4.01	5	0	20.9
25	96	209.22					.00			
AVERAGE			64.16667	109.1667	53.875	.63	2.76	3.541667	0	20.9

METER VOLUME =	79.09 ft3	ABS STACK PRES =	29.66 in. Hg
DRY GAS VOL,SCF =	77.64 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.87 ft3	STACK GAS VELO =	43.50 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003142 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	44053.87 CFM
		DUCT GASFLOW,SCFM=	43995.58 CFM

------------------------>> ISOKINETIC VARIATION = 95.44 %

SOURCE EMISSIONS TESTING DATA SHEET

Date :29 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 8	Box # : 5	I.D. # : 0	I.D. # : 0	I.D. # : 0	I.D. # : 3
Run # : 3	Delta H@: 1.8088	Liner :GLASS	Diam : .246	Coeffic: .85	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9996	Length : 0			Leak rt : .001cfm
Source :106-D	Heat Set: -	Heater : -			@ : 17in. H2O
Engineer:SUZ/BEL					H2O gain: 29.1ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 61F	Stack gas dry wt : 29lb/lb-mol	length: 66in.(dia)
Barometer: 29.84in. Hg	Water vap proport: .02	width: in.
Stk Stat: .17in. H2O		area-in2: 3421.2in.2
		area-ft2: 23.75833ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	698.92	65	72	61	.53	2.11	3	0	20.9
2	4	702.14	65	85	47	.65	2.66	4	0	20.9
3	8	705.77	65	94	49	.55	2.28	3	0	20.9
4	12	709.20	65	99	51	.52	2.18	3	0	20.9
5	16	712.44	66	101	52	.42	1.76	3	0	20.9
6	20	715.60	66	102	52	.28	1.18	2	0	20.9
7	24	718.20	66	100	52	.08	.34	2	0	20.9
8	28	719.67	66	97	51	.07	.29	2	0	20.9
9	32	721.01	65	95	51	.08	.33	2	0	20.9
10	36	722.56	65	96	50	.09	.38	0	0	20.9
11	40	723.89	65	97	50	.08	.33	2	0	20.9
12	44	725.30	65	97	50	.07	.29	2	0	20.9
13	48	726.62	65	89	59	.42	1.73	3	0	20.9
14	52	729.62	65	98	50	.51	2.13	3	0	20.9
15	56	732.89	65	103	51	.47	1.98	3	0	20.9
16	60	735.90	65	105	52	.33	1.40	3	0	20.9
17	64	738.94	65	106	52	.22	.93	2	0	20.9
18	68	741.25	65	105	52	.09	.38	2	0	20.9
19	72	742.85	65	102	53	.24	1.01	3	0	20.9
20	76	745.15	65	105	52	.39	1.65	3	0	20.9
21	80	748.12	65	110	52	.52	2.22	3	0	20.9
22	84	751.38	65	112	53	.65	2.79	4	0	20.9
23	88	755.24	65	113	55	.74	3.18	4	0	20.9
24	92	759.33	65	115	55	.70	3.02	4	0	20.9
25	96	763.45								
							.00			
AVERAGE			65.16667	99.875	52.16667	.32	1.52	2.708333	0	20.9

METER VOLUME =	64.51 ft3	ABS STACK PRES =	29.85 in. Hg
DRY GAS VOL.SCF =	60.88 ft3	WETGAS MOLC WT =	28.80 lb/lb-mole
WATER VAPOR VOL =	1.33 ft3	STACK GAS VELO =	32.14 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003301 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	44988.88 CFM
		DUCT GASFLOW,SCFM=	45129.56 CFM

------------------------> ISOKINETIC VARIATION = 101.20 %

MPACTOR TESTING DATA SHEET

Date :30 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 9	Box # : 3	I.D. # : -8	I.D. # : -	I.D. # : -8	I.D. # : - 8
Run # : 1	Delta H@: 2.1179	Liner : S STEEL	Diam : .245	Coeffic: .75	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9926	Length : 3			Leak rt : .005cfm
Source :106-IN	Heat Set: -	Heater : -			@ : 25in. H2O
Engineer:FAN/KIRK					H2O gain: 59.6ml

ATMOSPHERE	ESTIMATE	DUCT AREA
Ambient : 67F	Stack gas	length: 33in.
Barometer: 29.29in. Hg	dry wt : 29lb/lb-mol	width: 75in.
Stk Stat: -2.80in. H2O	Water vap	area-in2: 2475in.2
	proport: .015	area-ft2: 17.1875ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	210.09	72.1	113.1	54.4	.74	2.80	5	0	20.9
2	90	289.30	72.1	113.1	54.4	.74	2.80	5	0	20.9
3	180	366.54	72.1	113.1	54.4	.74	2.80	5	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
									0	20.9
AVERAGE			72.1	113.1	54.4	.74	2.80	5	0	20.9

METER VOLUME =	157.26 ft3	ABS STACK PRES =	29.08 in. Hg
DRY GAS VOL.SCF =	142.79 ft3	WETGAS MOLC WT =	28.79 lb/lb-mole
WATER VAPOR VOL =	2.81 ft3	STACK GAS VELO =	43.88 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003274 ft2
VOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	44389.89 CFM
		DUCT GASFLOW,SCFM=	42817.19 CFM

------------------------->> ISOKINETIC VARIATION = 97.32 %

IMPACTOR TESTING DATA SHEET

Date :30 MAY 84	CONTROL	PROBE	NOZZLE	PITOT	IMPINGER
Test # : 9	Box # : 5	I.D. # : -	I.D. # : -	I.D. # : -	I.D. # : 4
Run # : 1	Delta H@: 1.8089	Liner : -	Diam : .247	Coeffic: .85	Filtr #: -
Location:LBNSY - Bldg 210	Crct Fac: .9996	Length : 7			Leak rt : - cfm
Source :106-OUT	Heat Set: -	Heater : -			@ : - in. H2O
Engineer:SUZ/BEL					H2O gain: 55.7ml

ATMOSPHERE		ESTIMATE		DUCT AREA	
Ambient :	69F	Stack gas dry wt :	29lb/lb-mol	length:	66in. dia.
Barometer:	29.79in. Hg	Water vap proport:	.02	width:	- in.
Stk Stat:	.17in. H2O			area-in2:	3421.2in.2
				area-ft2:	23.75833ft.2

Port & Point Number	Sample Time (min)	Gas Meter (ft3)	Stack Temp (F)	Meter Inlet Temp (F)	Impinger Temp (F)	Velocity Head dP (in H2O)	Orifice Delta H (in H2O)	Sample Vacuum (in Hg)	CO2 (%)	O2 (%)
1	0	765.14	66	103.3	56.7	.36	1.53	4		
2	90	833.58	66	103.3	56.7	.36	1.53	4	0	20.9
3	180	901.00	66	103.3	56.7	.36	1.53	4	0	20.9
4	-	-	-	-	-	-	-	-	0	20.9
5	-	-	-	-	-	-	-	-	0	20.9
									0	20.9
AVERAGE			66	103.3	56.7	.36	1.53	4	0	20.9

METER VOLUME =	135.80 ft3	ABS STACK PRES =	29.80 in. Hg
DRY GAS VOL,SCF =	127.17 ft3	WETGAS MOLC WT =	28.78 lb/lb-mole
WATER VAPOR VOL =	2.62 ft3	STACK GAS VELO =	34.00 ft/sec
MOIST CONTENT =	.02	NOZZLE AREA =	.0003328 ft2
MOL FRAC DRY GAS=	.98	DUCT GASFLOW,ACFM=	47498.81 CFM
		DUCT GASFLOW,SCFM=	47492.18 CFM

------------------------->> ISOKINETIC VARIATION = 106.28 %

APPENDIX C
TRUESDAIL REPORT

REPORT

TRUESDAIL LABORATORIES, INC.

CHEMISTS - MICROBIOLOGISTS - ENGINEERS
ESEARCH - DEVELOPMENT - TESTING

14201 FRANKLIN AVE
TUSTIN, CALIFORNIA 9_
AREA CODE 714 • 730-6__.
AREA CODE 213 • 225-1564
CABLE: TRUELABS

CLIENT U.S. Navy NEESA
NCBC, Code 111C
Port Hueneme, California 93043
Attention: Mr. Bill Powers

DATE June 26, 1984

RECEIVED May 22-31, 1984

LABORATORY NO. 01014- (14,15, 68,69)

SAMPLE Blank solutions

P.O. No. N62583/84M P935

INVESTIGATION

As requested

RESULTS

Parameter	0.1N KOH Blank	DI #1	DI #2	DI #3
Chloride (Cl)	<0.1	<0.1	<0.1	<0.1
Cyanide (CN)	<0.01	<0.01	<0.01	<0.01
Carbonate (CO_3)	830.	<1.	<1.	<1.
Chromium (VI)	<0.1	<0.05	<0.05	<0.05
Chromium (III)	<0.1	<0.02	<0.02	<0.02
Fluoride (F)	<0.1	<0.01	<0.01	<0.01
Phosphate (P)	1.3	<0.1	<0.1	<0.1
Sulfate (SO_4)	<1.	<1.	<1.	<1.
Silver (Ag)	<0.01	<0.01	<0.01	<0.01
Aluminum (Al)	0.34	<0.3	---	---
Cadmium (Cd)	<0.004	<0.004	<0.004	<0.004
Copper (Cu)	<0.02	<0.02	<0.02	0.03
Potassium (K)	3300	<0.03	0.18	<0.03
Sodium (Na)	3.2	<0.04	<0.04	<0.04
Nickel (Ni)	0.26	<0.02	<0.02	<0.02

(Results expressed in milligrams per Liter)

Misc. samples for scrubber #102, Bldg 210 LongBeach Naval Ship Yard
(Results expressed in milligrams per Liter)

Sample	Chloride	Sulfate	Aluminum	Sodium	Nickel	pH	Boiling
Bottle 1	0.7	<1	0.22	1.11	0.043	---	---
Bottle 2	<0.1	<1	0.18	1.54	0.029	---	---
Bottle 3	1.5	<1	0.36	1.46	<0.02	---	---
Bottle 4	<0.1	<1	0.18	1.48	0.039	---	---
Bottle 5	1.4	<1	0.27	1.07	0.036	---	---
Bottle 6	1.5	<1	0.22	1.15	0.158	---	---
Bottle 7	0.9	<1	0.27	1.23	<0.02	---	---
Bottle 8	1.2	<1	<0.2	0.31	<0.02	---	---
Petri Dish A(stage 1)	---	---	290ug	289ug	38.9ug	---	---
Petri Dish B(stage 5)	---	---	802ug	80.9ug	229ug	---	---
Tank 4	---	---	----	146,000	---	13.1	---
Tank 33	23,800	108,000	----	----	129,000	4.4	94.
Tank 50	---	---	----	421,000	---	13.5	---
Scrubber H_2O	---	---	----	----	---	7.21	---

*The initial boiling point was 94°C. Shortly after the low boiling species boiled away, the boiling point stabilizied at 100°C.

Misc. samples for scrubber #103, Bldg 210, LongBeach Naval Ship Yard

Sample	Chromium VI,ppm	Chromium III,ppm	Sulfate,ppm	pH,units
crubber Water 5/24)	<0.05	0.39	<1	7.5
Bottle 9	0.30	<0.02	<1	---
ottle 10	<0.05	0.03	<1	---
ottle 11	0.07	0.13	<1	---
Bottle 12	<0.05	0.04	<1	---
Bottle 13	1.05	<0.02	<1	---
ottle 14	<0.05	0.02	<1	---
ottle 15	0.25	0.10	<1	---
Bottle 16	<0.05	0.04	<1	---
ank 41	94,600	13,200	---	<1
ank 42	112,200	6,100	---	<1
Tank 43	106,000	7,600	---	<1
ank 44	10,040	2,400	---	<1

Filters-Run No. 1 Test 5 (Results expressed in micrograms per filter)

nlet,Stage 1	4.0	7.2	---	---
Inlet, Stage 2	0.8	<1.	---	---
Inlet,Stage 3	<1.ug	48.2	---	---
Inlet,Stage 5	20.8	3.3	---	---
Inlet,Backup	<1.	5.2	---	---
Outlet,Stage 1	<1.	1.3	---	---
Outlet,Stage 2	<1.	<1.	---	---
Outlet,Stage 3	<1.	<1.	---	---
Outlet,Stage 5	<1.	3.5	---	---
Outlet,Backup	<1.	4.3	---	---

Sample	Chromium VI,ug	Chromium III,ug
Filters-Run 2, Test 5		
let,Stage 1	<1	9.9
nlet,Stage 2	<1	4.7
Inlet,Stage 3	20.0	15.9
let,Stage 5	17.6	3.2
nlet,Backup	<1.	3.0
Outlet,Stage 1	<1.	1.3
utlet,Stage 2	<1.	<1.
tlet,Stage 3	<1.	<1.
Outlet,Stage 5	<1.	1.7
utlet,Backup	<1.	<1.

Misc. Samples for scrubber #104, Bldg 210, LongBeach Naval Ship yard

Sample	Chloride ppm	Chromium VI ppm	Chromium III ppm	Sulfate ppm	Potassium ppm	Fluoride ppm	pH Units
Bottle 18	57.4	1.98	0.32	<1	420	---	---
Bottle 19	53.9	<0.05	4.44	<1	649	---	---
Bottle 20	69.3	<0.05	3.42	<1	529	---	
Wash Water	3.7	<0.05	0.14	<1	0.15	---	
Tank 3 (HCl)	283,000	----	----	--	----	---	<1
Tank 6 (HCl)	255,000	----	----	--	----	---	<1
Tank 5 (H_2SO_4)	---	----	----	12,400	----	---	
Tank 15	---	----	----	--	----	0.20	2.4

	Total Phenols
Tank 15	9,640

Misc. samples for scrubber #105, Bldg 210, LongBeach Naval Ship Yard
(Results expressed in milligrams per Liter)

Sample	Cl	CN	CO_3	Ag	Cd	Cu	K	Na	Ni	pH, units
bottle 27	1.6	0.097	832	<0.01	<0.004	0.01	688	2.47	0.17	---
Bottle 28	0.4	0.39	1030	<0.01	0.020	0.12	1106	4.83	0.04	---
tle 29	0.9	0.082	895	<0.01	<0.004	<0.01	522	1.07	0.09	---
cle 30	1.2	0.38	1090	<0.01	<0.004	0.01	783	1.34	0.07	---
Bottle 31	<0.1	0.15	823	<0.01	<0.004	0.01	603	1.52	0.08	---
P tle 32	3.0	0.29	1110	<0.01	<0.004	0.05	654	2.25	0.10	---
ibber H_2O	56.8	<0.01	----	----	0.73	0.06	---	----	0.89	7.55
Tank 1	----	62,500	382,000	----	25,100	----	---	137,000	----	13.6
Tank 11	----	62,500	331,000	----	27,200	----	---	158,800	----	13.4
: 20	114,000	-----	-------	----	------	----	---	-------	67,300	<1.
Tank 21	----	53,800	233,000	449	------	----	91,100	------	----	13.5
Tank 22	----	9,630	6,450	354	------	----	68,800	------	----	13.4
k 29	----	39,000	-------	----	------	49,100	884	------	----	>13.6

Filters, Test 11 (Results expressed in micrograms per filter pad)

Sample	Cl	CN	CO_3	Ag	Cd	Cu	K	Na	Ni	pH, units
1 Inlet	<100	0.2	---	<0.6	<0.3	1.9	---	---	<1	---
Run 1 Outlet	600	<0.1	---	<0.6	5.8	5.9	---	---	11.4	---
Run 2 Inlet	340	<0.1	---	<0.6	1.6	<1.	---	---	6.3	---
2 Outlet	<100	0.8	---	1.7	1.2	4.6	---	---	4.2	---

Misc. samples for scrubber #106, Bldg 210, LongBeach Naval Ship Yard
(Results expressed in milligrams per Liter)

Sample	Chloride	Chromium VI	Chromium III	Fluoride	Phosphate	Potassium	ι	s
Bottle 21	<0.1	<0.05	<0.02	<0.05	----	70,400	---	
Bottle 22	0.4	<0.05	0.07	<0.05	----	768		
Bottle 23	0.8	<0.05	0.07	<0.05	----	654	- -	
Bottle 24	1.5	<0.05	0.02	<0.05	----	1,370	---	
Bottle 25	0.2	<0.05	<0.02	<0.05	----	541		
Bottle 26	0.4	<0.05	0.03	<0.05	----	719		
Scrubber Water	---	0.095	0.12	----	----	---	7.4	
Tank 16	66.2	0.09	0.01	----	----	8.02	<	
Tank 28A	<500	5630.	2670.	----	----	8.64		
Tank 28B	<500	7100.	8900.	----	----	2.37	<1.	
Tank 35	<500	6130.	1970.	----	----	580.	<1	
Tank 36	<500	9950.	120.	----	----	2.77		
Tank 45	<500	398	4700.	----	----	577.	<1.	
Tank 47	<500	2900.	5000.	----	----	13.2	<1.	
Tank 19	-----	----	----	----	272,000	----		8

Impactor Filter (Results expressed in micrograms per filter pad)

Test 9 Run) In	4200	<1	<1	---	---	---	
Out	300	<1	<1	---	---	---	---

Respectfully submitted,

TRUESDAIL LABORATORIES, INC.

Richard D. Reid
Chief Water Chemist

TELEPHONE CONVERSATION RECORD
11ND-GEN-2305/11 (REV. 3-74) S/N 0190-LF-009-7901

☐ INCOMING	☒ OUTGOING	DATE: 20 Jul 1984
PERSON CALLING: SUSAN J. SUZUKI	PHONE NUMBER: x4747	ACTIVITY: NEESA
PERSON CALLED: RICHARD REID	PHONE NUMBER: (213) 225-1564	ACTIVITY: TRUESDAIL LABORATORIES INC

GENERAL SUBJECT: CHEMICAL ANALYSIS of LBNSY PLATING SHOP SAMPLES

TOPICS DISCUSSED AND ACTION TAKEN

The lab report from Truesdail Laboratories INC. indicated chemical concentrations in units of both milligrams per liter and parts per million (ppm). I called Dick Reid to get an explanation of these units and how to equate them.

PPM is the concentration by volume. In order to convert PPM to mg/L one must take into account the density of the chemical being identified. An easy way to do this is to multiply the concentration (in ppm) by the molecular weight of the chemical and divide by 18 (the molecular weight of water).

Assuming perfect gas..... $\frac{\rho_{sample}}{\rho_{H_2O}} \approx \left(\frac{PM}{R_u T}\right)_{sample} \left(\frac{R_u T}{PM}\right)_{H_2O} \approx \frac{M_{sample}}{M_{H_2O}}$

FILE:

DISTRIBUTION (Interested codes):

SIGNATURE: Susan J Suzuki 7/20/

APPENDIX D
IMPACTOR DISCUSSION

TELEPHONE CONVERSATION RECORD
11ND-GEN-2305/11 (REV. 3-74) S/N 0190-LF-009-7901

☐ INCOMING	☒ OUTGOING	DATE: 3 APR 84
PERSON CALLING: Bill Powers	PHONE NUMBER:	ACTIVITY: NEESA 111C
PERSON CALLED: Joe McCain	PHONE NUMBER: (205) 323-6592	ACTIVITY: Southern Research Institute

GENERAL SUBJECT: Use of Mark III U/W impactors for particle sizing acid mists.

TOPICS DISCUSSED AND ACTION TAKEN

(1) Joe thought that in order to make a gravimetric analysis of impactor filter stages as valid as possible the filter stages should be weighed immed. following the test without dessication. Filters should be weighed at regular intervals for 2 to 3 hours. Plot weights on log paper to determine evaporative loss rate (over time). Extrapolate back to time at end of test to get approx. weight of collected liquid at time test ended.

(2) I mentioned that we really only needed 2 to 3 stages in the impactor for our purposes, not the 6 stages normally found in the Mark III. Joe said that is not a problem, simply remove the unnecessary stages and replace with spacers. Cutpoints for the impactor stages do not change significantly and the problem of increased particle bounce is a minor concern with liquid droplets.

FILE	DISTRIBUTION (Interested codes)	SIGNATURE
2116 LBN54		Bill Powers

APPENDIX E
SAMPLE CALCULATIONS

MASS EMISSIONS CALCULATIONS

SQS - 8/6

$DI_{mg/l}$ = DEIONIZED WATER BLANK CONCENTRATION (mg/l)
$KOH_{mg/l}$ = POTASSIUM HYDROXIDE BLANK CONCENTRATION (mg/l)
X = SAMPLE WEIGHT (grams)
MW = MOLECULAR WEIGHT
18 = MOLECULAR WEIGHT
DSCF = VOLUME of AIR SAMPLED
CF1 = CONVERSION FACTOR for KOH SAMPLE BLANK
= (100ml SAMPLE / 1L lab basis)(1L / 1000 ml)
CF2 = CONVERSION FACTOR for DI SAMPLE BLANK
= (X - 100ml / 1L lab basis)(1L / 1000ml)
CF3 = CONVERSION FACTOR for CONCENTRATION
= (X / 1000 ml)
CF4 = CORRECTION FACTOR for PPM
= (MW / 18)

BLANK CONCENTRATION ...

$$mg/l_B = (KOH_{mg/l})(CF1) + (DI_{mg/l})(CF2)$$

SAMPLE CONCENTRATION

$$mg/m^3 = [(mg/L)(CF3) - (mg/l_B)](X/DSCF)(35.3147\ ft^3/m^3)$$

$$mg/m^3 = [(ppm)(CF3)(CF4) - (mg/l_B)](X/DSCF)(35.3147\ ft^3/m^3)$$

FAN POWER COST SAVINGS CALCULATIONS

WEJ 20AUG06

NOTE: ALL STATIC PRESSURES (SP) ARE FOUND IN TABLE 13

ASSUMPTIONS: a. STATIC PRESSURE DROP ACROSS SCRUBBERS WILL BE ELIMINATED BY REMOVING SCRUBBER INTERNALS

b. EXHAUST VOLUME WILL REMAIN THE SAME FOR EACH SCRUBBER

1. FAN 101: BHP DETERMINED FROM FAN CHART ON PG. D-4

$Q = 28130$ SCFM

BHP REQUIRED AT -6.8" SP = 41.2 BHP

BHP REQUIRED AT - 1.9" SP = 14.2 BHP

REDUCTION IN BHP: 27. BHP

FAN POWER COST REDUCTION:

ASSUME: a. 90% FAN AVAILABILITY PER YEAR (7860 HRS.)

b. ELECTRICITY COST OF \$.07 PER KW-HR

$$27 \text{ BHP} \times .746 \frac{\text{KW}}{\text{BHP}} \times 7860 \text{ HRS.} \times \frac{\$.07}{\text{KW-HRS}} \cong \$11,100/\text{YR.}$$

2. FAN 102:

$Q = 30970$ CFM

BHP REQUIRED AT - 6.4" SP = 42.8 BHP

BHP REQUIRED AT - 3.3" SP = 24.2 BHP

REDUCTION IN BHP 18.6 BHP

FAN POWER COST REDUCTION:

$$18.6 \text{ BHP} \times .746 \frac{\text{KW}}{\text{BHP}} \times 7860 \text{ HRS.} \times \frac{\$.07}{\text{KW-HRS}} \cong \$7,600/\text{YR.}$$

3. FAN 105: BHP DETERMINED FROM GRAPH ON PG.

Q = 50090 SCFM

BHP REQUIRED AT −5.1" SP = 72. BHP

BHP REQUIRED AT −3.8" SP = 60. BHP

REDUCTION IN BHP 12 BHP

FAN POWER COST REDUCTION:

$$12 \text{ BHP} \times .746 \frac{\text{KW}}{\text{BHP}} \times 7860 \text{ HRS.} \times \frac{\$.07}{\text{KW-HR}} \cong \underline{\underline{\$4900}}/\text{YR.}$$

4. FAN 106: THIS FAN WAS NOT OPERATIONAL ON DAY STATIC PRESSURE MEASUREMENTS WERE MADE. FANS 105 AND 106 HAVE THE SAME VOLUME AND STATIC PRESSURE RATINGS, AND IT IS ASSUMED THAT A SIMILAR HORSEPOWER REDUCTION WOULD OCCUR WITH THE REMOVAL OF SCRUBBER 106 INTERNALS.

ESTIMATED REDUCTION IN BHP = 12 BHP

ESTIMATED FAN POWER COST REDUCTION:

$$12 \text{ BHP} \times .746 \frac{\text{KW}}{\text{BHP}} \times 7860 \text{ HRS.} \times \frac{\$.07}{\text{KW-HR}} \cong \underline{\underline{\$4900}}/\text{YR.}$$

5. TOTAL FAN POWER COST SAVINGS:

$$\$11,100 + \$7,600 + \$4,900 + \$4,900 = \underline{\underline{\$28,500}}/\text{YR.}$$

N-LINE

PERFORMANCE DATA

SIZE 445
SIZE 490

SIZE 445

WHEEL SIZE ... DIAMETER ... CIRCUMFERENCE ... INLET and OUTLET ... 60" DIAMETER ... 20.26 SQ. FT. AREA ... MAXIMUM BHP = 36.10 × [rpm/1000]

CFM	Outlet Velocity	1/4" SP RPM	1/4" SP BHP	1/2" SP RPM	1/2" SP BHP	3/4" SP RPM	3/4" SP BHP	1" SP RPM	1" SP BHP	1½" SP RPM	1½" SP BHP	2" SP RPM	2" SP BHP	2½" SP RPM	2½" SP BHP
10125	500	281	0.78	322	1.21	361	1.67	**398**	**2.19**	469	3.30	535	4.59	596	6.05
12150	600	320	1.14	357	1.63	391	2.16	423	2.71	**485**	**3.93**	**545**	**5.24**	601	6.72
14175	700	362	1.62	395	2.17	425	2.75	454	3.38	509	4.67	562	6.12	**613**	**7.63**
16200	800	403	2.23	433	2.85	461	3.49	487	4.16	538	5.61	585	7.10	632	8.75
18225	900	445	2.99	474	3.69	500	4.39	523	5.12	569	6.68	614	8.32	655	10.0
20250	1000	488	3.91	515	4.70	539	5.46	562	6.27	604	7.92	645	9.71	684	11.5
22275	1100	531	5.01	557	5.89	580	6.74	601	7.60	641	9.38	678	11.2	715	13.2
24300	1200	574	6.31	600	7.29	621	8.23	641	9.15	678	11.1	714	13.0	748	15.1
26325	1300	618	7.82	641	8.91	663	9.94	682	10.9	717	13.0	751	15.1	783	17.2
28350	1400	661	9.56	684	10.8	705	11.9	723	13.0	756	15.1	789	17.4	819	19.7
30375	1500	705	11.6	727	12.9	746	14.1	764	15.3	798	17.6	828	19.9	858	22.4
32400	1600	748	13.8	770	15.3	789	16.6	806	17.8	838	20.3	867	22.8	896	25.4
34425	1700	791	16.4	814	17.9	832	19.3	849	20.7	880	23.4	907	26.0	934	28.6
36450	1800	835	19.2	856	20.9	875	22.4	892	23.9	921	26.7	949	29.5	974	32.3
38475	1900	879	22.4	900	24.2	918	25.8	933	27.4	963	30.4	990	33.3	1015	36.3
40500	2000	923	25.8	943	27.8	960	29.6	977	31.3	1005	34.4	1031	37.6	1056	40.6
44550	2200	1013	34.0	1030	36.1	1047	38.2	1062	40.1	1089	43.6	1115	47.1	1138	50.6
48600	2400	1102	43.7	1118	46.0	1134	48.3	1148	50.4	1175	54.5	1199	58.3	1221	62.1
52650	2600	1188	54.9	1206	57.6	1221	60.2	1235	62.6	1261	67.0	1284	71.3	1305	75.4
56700	2800	1279	68.1	1293	71.0	1310	74.0	1322	76.5	1347	81.4	1370	86.1	1389	90.6

CFM	Outlet Velocity	3" SP RPM	3" SP BHP	3½" SP RPM	3½" SP BHP	4" SP RPM	4" SP BHP	5" SP RPM	5" SP BHP	6" SP RPM	6" SP BHP	7" SP RPM	7" SP BHP	8" SP RPM	8" SP BHP	9" SP RPM	9" SP BHP	10" SP RPM	10" SP BHP	11" SP RPM	11" SP BHP
10125	500																				
12150	600	655	8.33	705	10.1	755	11.9														
14175	700	664	9.26	711	11.0	756	12.9	844	17.0												
16200	800	**677**	**10.5**	**722**	**12.2**	765	14.1	847	18.3	924	22.8	999	27.7								
18225	900	696	11.8	738	13.7	**778**	**15.7**	856	19.9	930	24.4	1000	29.4	1067	34.7						
20250	1000	722	13.4	759	15.4	796	17.5	**869**	**21.8**	939	26.4	1006	31.4	1070	36.7	1133	42.4	1193	48.4		
22275	1100	751	15.2	786	17.3	819	19.4	887	24.0	**952**	**28.7**	1017	33.8	1079	39.2	1138	44.8	1196	50.8	1252	57.1
24300	1200	782	17.3	815	19.5	846	21.7	908	26.4	970	31.5	**1031**	**36.6**	1090	42.0	1147	47.7	1203	53.8	1257	60.1
26325	1300	814	19.5	846	21.9	877	24.2	935	29.1	992	34.2	1049	39.8	**1105**	**45.3**	**1159**	**51.0**	1214	57.1	1266	63.5
28350	1400	850	22.0	878	24.5	908	27.1	964	32.1	1017	37.4	1070	43.0	1124	49.0	1175	54.9	**1226**	**61.0**	1277	67.4
30375	1500	886	24.8	913	27.4	940	30.0	994	35.5	1046	41.0	1096	46.6	1145	52.7	1195	59.0	1241	65.4	**1291**	**71.9**
32400	1600	923	27.9	949	30.6	974	33.3	1026	39.1	1076	44.9	1124	50.7	1170	56.8	1216	63.3	1263	70.0	1309	76.8
34425	1700	960	31.4	986	34.1	1010	37.0	1059	42.9	1107	49.1	1153	55.2	1198	61.5	1242	68.0	1285	74.8	1330	81.9
36450	1800	1000	35.1	1024	38.1	1047	41.0	1094	47.1	1139	53.5	1184	60.0	1228	66.5	1270	73.2	1311	80.0	1353	87.2
38475	1900	1039	39.3	1063	42.3	1086	45.4	1129	51.6	1173	58.2	1216	65.1	1259	72.0	1300	78.9	1339	85.9	1379	93.1
40500	2000	1078	43.7	1100	46.9	1124	50.1	1167	56.6	1209	63.4	1249	70.4	1290	77.7	1330	84.9	1369	92.2	1407	99.5
44550	2200	1161	53.9	1180	57.3	1202	60.8	1243	67.8	1281	75.0	1320	82.4	1357	90.0	1394	97.9	1431	106.	1467	114.
48600	2400	1243	65.8	1263	69.5	1282	73.2	1320	80.7	1357	88.4	1393	96.3	1428	104.	1462	112.	1497	121.		
52650	2600	1325	79.5	1346	83.5	1364	87.5	1398	95.5	1435	104.	1469	112.	1503	121.						
56700	2800	1410	95.1	1429	99.5	1447	104.	1481	112.	1513	121.	1628	130.								

CLASS I—Max. RPM = 1974 **CLASS II—Max. RPM = 1262** **CLASS III—Max. RPM = 1585** **Max. Static Efficiency—Bold face type**

SIZE 490

WHEEL SIZE ... DIAMETER ... CIRCUMFERENCE ... INLET and OUTLET ... 67" DIAMETER ... SQ. FT. AREA ... MAXIMUM BHP = 58.43 × [rpm/1000]

CFM	Outlet Velocity	1/4" SP RPM	1/4" SP BHP	1/2" SP RPM	1/2" SP BHP	3/4" SP RPM	3/4" SP BHP	1" SP RPM	1" SP BHP	1½" SP RPM	1½" SP BHP	2" SP RPM	2" SP BHP	2½" SP RPM	2½" SP BHP
12290	500	255	0.95	294	1.47	328	2.03	361	2.65	426	4.00	486	5.56	542	7.33
14748	600	291	1.39	324	1.98	355	2.62	384	3.29	**440**	**4.77**	**495**	**6.36**	546	8.15
17206	700	329	1.97	358	2.63	386	3.34	412	4.10	462	5.67	510	7.42	**556**	**9.25**
19664	800	366	2.70	393	3.46	419	4.24	442	5.05	489	6.80	531	8.61	574	10.6
22122	900	404	3.62	431	4.47	454	5.33	475	6.21	517	8.10	557	10.1	595	12.1
24580	1000	443	4.74	468	5.70	489	6.63	510	7.60	549	9.60	585	11.8	621	14.0
27038	1100	482	6.07	506	7.14	527	8.17	546	9.22	582	11.4	616	13.6	650	16.1
29496	1200	521	7.65	545	8.84	564	9.98	582	11.1	616	13.4	648	15.8	679	18.3
31954	1300	561	9.49	583	10.8	602	12.0	619	13.3	651	15.7	682	18.3	711	20.9
34412	1400	600	11.6	621	13.1	640	14.4	657	15.7	687	18.3	717	21.1	744	23.8
36870	1500	640	14.0	660	15.6	678	17.1	694	18.5	725	21.3	752	24.2	779	27.1
39328	1600	679	16.8	699	18.5	717	20.1	732	21.6	761	24.6	787	27.6	814	30.7
41786	1700	719	19.8	739	21.7	755	23.4	771	25.1	799	28.3	824	31.5	848	34.7
44244	1800	758	23.2	778	25.3	795	27.2	810	29.0	837	32.4	862	35.8	884	39.1
46702	1900	799	27.1	618	29.3	834	31.3	848	33.2	875	36.9	899	40.4	921	44.0
49180	2000	838	31.3	857	33.7	872	35.8	887	37.9	913	41.8	936	45.5	959	49.3
54076	2200	920	41.2	936	43.8	951	46.3	965	48.6	992	52.9	1012	57.1	1034	61.3
58992	2400	1000	52.9	1023	55.8	1030	58.6	1043	61.2	1067	66.0	1089	70.7	1109	75.3
63908	2600	1079	66.5	1095	69.9	1109	73.0	1122	75.9	1145	81.2	1166	86.4	1185	91.4
68824	2800	1161	82.6	1173	86.0	1190	89.8	1200	92.8	1223	98.7	1243	104	1262	110.

CFM	Outlet Velocity	3" SP RPM	3" SP BHP	3½" SP RPM	3½" SP BHP	4" SP RPM	4" SP BHP	5" SP RPM	5" SP BHP	6" SP RPM	6" SP BHP	7" SP RPM	7" SP BHP	8" SP RPM	8" SP BHP	9" SP RPM	9" SP BHP	10" SP RPM	10" SP BHP	11" SP RPM	11" SP BHP
12290	500																				
14748	600	594	10.1	641	12.2	686	14.4														
17206	700	603	11.2	646	13.4	687	15.6	767	20.6												
19664	800	**615**	**12.7**	**656**	**14.8**	695	17.1	769	22.2	840	27.7	907	33.6								
22122	900	632	14.3	670	16.7	**706**	**19.0**	778	24.1	845	29.6	908	35.6	969	42.1						
24580	1000	656	16.2	689	18.7	723	21.2	**789**	**26.4**	853	32.0	914	38.1	972	44.5	1029	51.4	1083	58.7		
27038	1100	682	18.5	714	20.9	744	23.5	805	29.1	**865**	**34.9**	924	40.9	980	47.5	1034	54.4	1086	61.1	1137	69.3
29496	1200	711	21.0	740	23.6	769	26.3	825	32.0	881	38.1	**936**	**44.4**	990	50.9	1042	57.9	1093	65.2	1142	72.8
31954	1300	740	23.7	769	26.5	796	29.4	849	35.2	901	41.5	953	48.2	**1003**	**55.0**	**1053**	**61.9**	1107	69.2	1150	77.0
34412	1400	772	26.7	798	29.7	825	32.8	875	39.0	924	45.3	972	52.0	1021	59.4	1067	66.6	**1114**	**74.0**	1160	81.7
36870	1500	804	30.1	829	33.2	853	36.4	903	43.0	950	49.7	995	56.6	1040	63.9	1085	71.6	1129	79.3	1172	87.1
39328	1600	838	33.9	862	37.1	885	40.4	932	47.4	977	54.4	1021	61.5	1063	68.9	1105	78.5	1147	84.9	1189	91.2
41786	1700	872	38.0	895	41.4	918	44.8	962	52.0	1006	59.5	1047	66.9	1088	74.5	1128	82.4	1167	90.7	1207	99.3
44244	1800	908	42.6	930	46.1	951	49.7	994	57.1	1035	64.8	1076	72.8	1115	80.7	1153	88.7	1191	97.1	1228	106.
46702	1900	944	47.6	965	53.1	989	55.0	1026	62.6	1065	70.5	1105	78.9	1143	87.2	1181	95.6	1216	104.	1252	113.
49180	2000	979	53.0	1000	56.9	1021	60.8	1060	68.7	1098	76.8	1134	85.3	1172	94.2	1208	103.	1243	112.	1278	121.
54076	2200	1054	65.4	1072	69.5	1092	73.7	1129	82.2	1164	90.9	1199	99.9	1253	109.	1266	119.	1300	128.	1333	138.
58992	2400	1129	79.8	1147	84.2	1164	88.7	1199	97.9	1233	107.	1265	117.	1297	126.	1328	136.	1359	147.		
63908	2600	1204	96.4	1222	101.	1239	106.	1270	116.	1303	126.	1334	136.	1365	146.						
68824	2800	1280	115.	1298	121.	1314	126.	1345	136.	1374	147.	1404	158.								

CLASS I—Max. RPM = 884 **CLASS II—Max. RPM = 1146** **CLASS III—Max. RPM = 1439** **Max. Static Efficiency—Bold face type**

ALAD– Co

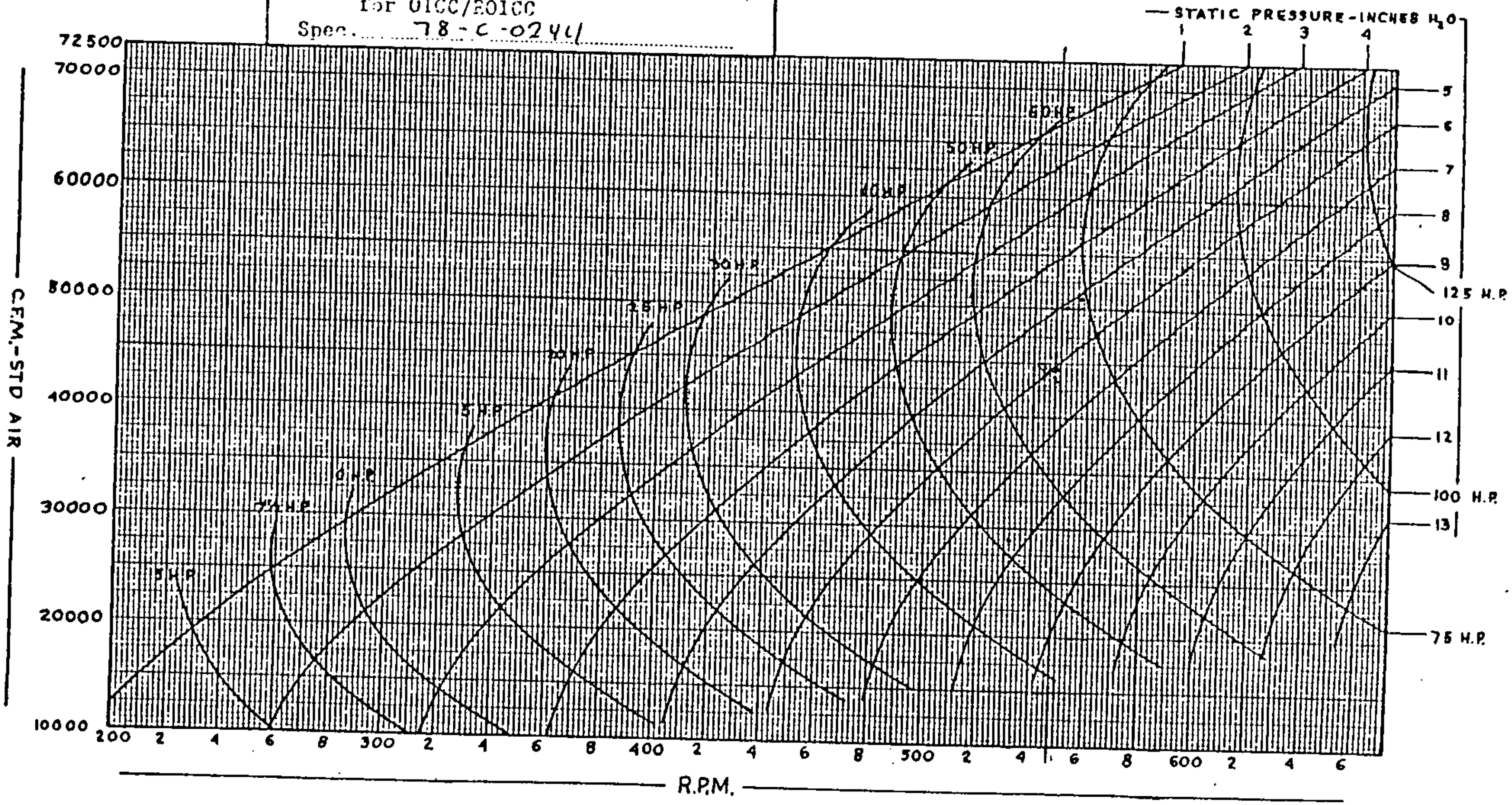
..HP does ..t incluc.. ..ve loss.

Perfo...ance sh... .. is for .. ..ne fans .... outlet . ..t.

CMHB-48

WEST DIVISION
Naval Facilities Engineering Command
San Bruno, Calif. [illegible]
X APPROVED
..... [illegible]
[illegible] with
no change [illegible] or time.
... DISAPPROVED [illegible] required
By CFW Date 5-21-79
for OICC/ROICC
Spec. 78-C-0241

FAN CURVE FOR FAN 105 &
FAN 106



APPENDIX F
TARE WEIGHT DATA

A	B	C	D	E	F	G	H

DONUT179 TARE WEIGHT ANALYSIS SHEET

Start Date:05/02/84

Finish Date:05/04/84

Weighing Interval:~ 24 hours Engineer:Darrow Kirkpatrick

Filter Number	Tare Weight (grams) 1	2	3	AVERAGE	Max Diff (mg)
100	1.2099	1.2099	1.2099	1.2099	0
101	1.2327	1.2329	1.2329	1.2328	.2
102	1.2009	1.2011	1.2012	1.2011	.3
103	1.2285	1.2287	1.2288	1.2287	.3
104	1.2261	1.2261	1.2262	1.2261	.1
105	1.1999	1.1999	1.1999	1.1999	0
106	1.1858	1.1858	1.1858	1.1858	0
107	1.2383	1.238	1.2381	1.2381	.3
108	1.2369	1.2368	1.2369	1.2369	.1
109	1.2171	1.2172	1.2172	1.2172	.1
110	1.2297	1.2297	1.2298	1.2297	.1
111	1.1868	1.1869	1.1871	1.1869	.3
112	1.2265	1.2268	1.2267	1.2267	.3
113	1.2246	1.2249	1.225	1.2248	.4
114	1.2107	1.2108	1.2109	1.2108	.2
115	1.2272	1.2273	1.2274	1.2273	.2
116	1.2267	1.2268	1.2266	1.2267	.2
117	1.2179	1.2181	1.2178	1.2179	.3
118	1.2167	1.2167	1.2166	1.2167	.1
119	1.2109	1.2109	1.2109	1.2109	0
120	1.2192	1.2192	1.2191	1.2192	.1
121		1.2379	1.2377	1.2378	1237.9
122	1.2347	1.2349	1.2346	1.2347	.3
123	1.218	1.2182	1.2182	1.2181	.2
124	1.1988	1.1988	1.1989	1.1988	.1
125	1.1923	1.1927	1.1926	1.1925	.4
126	1.2226	1.2228	1.2228	1.2227	.2
127	1.2041	1.2043	1.2043	1.2042	.2
128	1.2055	1.2058	1.2059	1.2057	.4
129	1.1972	1.1974	1.1976	1.1974	.4
130	1.2048	1.2048	1.2049	1.2048	.1
131	1.2262	1.2263	1.2265	1.2263	.3
132	1.2341	1.234	1.2341	1.2341	.1
133	1.2316	1.2319	1.2317	1.2317	.3
134	1.2328	1.2332	1.2328	1.2329	.4
135	1.2327	1.2331	1.2327	1.2329	.4
136	1.2354	1.2354	1.2352	1.2353	.2
137	1.2085	1.2085	1.2083	1.2084	.2
138	1.2352	1.235	1.235	1.2351	.2
139	1.1958	1.1956	1.1955	1.1956	.3
140	1.2217	1.2216	1.2218	1.2217	.2
141	1.2274	1.2273	1.2274	1.2274	.1
142	1.2304	1.2305	1.2305	1.2305	.1
143	1.2292	1.2295	1.2295	1.2294	.3
144	1.2309	1.2311	1.2312	1.2311	.3
145	1.2025	1.2028	1.2029	1.2027	.4
146	1.1945	1.1946	1.1948	1.1946	.3
147	1.2004	1.2006	1.2007	1.2006	.3
148	1.1995	1.1994	1.1996	1.1995	.2
149	1.2316	1.2315	1.2316	1.2316	.1
150	1.2322	1.2321	1.2322	1.2322	.1
151	1.2277	1.2277	1.2278	1.2277	.1
152	1.1929	1.1927	1.1929	1.1928	.1
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

156	1.2101	1.2101	1.2101	1.2101	0
157	1.2008	1.2006	1.2007	1.2007	.2
158	1.2107	1.2107	1.2107	1.2107	0
159	1.1899	1.1898	1.1898	1.1898	.1
160	1.186	1.186	1.186	1.186	0
161	1.2041	1.204	1.204	1.204	.1
162	1.1919	1.1919	1.1919	1.1919	0
163	1.2063	1.2061	1.2061	1.2062	.2
164	1.2021	1.2025	1.2024	1.2023	.4
165	1.2188	1.219	1.2191	1.219	.3
166	1.2037	1.2038	1.2038	1.2038	.1
167	1.1982	1.1981	1.1984	1.1982	.3
168	1.2282	1.2282	1.2283	1.2282	.1
169	1.1962	1.1964	1.1965	1.1964	.3
170	1.2054	1.2055	1.2056	1.2055	.2
171	1.2014	1.2014	1.2015	1.2014	.1
172	1.1989	1.1991	1.1991	1.199	.2
173	1.1992	1.1995	1.1994	1.1994	.3
174	1.1961	1.1964	1.1963	1.1963	.3
175	1.2258	1.2259	1.2259	1.2259	.1
176	1.2271	1.2272	1.2271	1.2271	.1
177	1.1906	1.1907	1.1907	1.1907	.1
178	1.2215	1.2215	1.2216	1.2215	.1
179	1.1877	1.1878	1.1879	1.1878	.2

Date:	05/02/84	05/03/84	05/04/84
Time:	0930	1500	1300
Temp:	61 F	69 F	67 F
Humid:	37%	33%	31%

* -Mettler AK160 (No. 40750) calibration checked w/ Christian Becker Class S weights before all weighing sessions.

DONUT269 TARE WEIGHT ANALYSIS SHEET

Start Date:05/02/84

Finish Date:05/05/84

Weighing Interval:~ 24 hours Engineer:Darrow Kirkpatrick

Filter Number	Tare Weight (grams) 1	2	3	AVERAGE	Max Diff (mg)
180	1.2087	1.2086	1.2087	1.2087	.1
181	1.2411	1.2409	1.2409	1.241	.2
182	1.23	1.2297	1.2299	1.2299	.3
183	1.2506	1.2505	1.2506	1.2506	.1
184	1.2106	1.2105	1.2107	1.2106	.2
185	1.2029	1.2028	1.2031	1.2029	.3
186	1.2554	1.2553	1.2555	1.2554	.2
187	1.2233	1.2234	1.2235	1.2234	.2
188	1.206	1.206	1.206	1.206	0
189	1.1969	1.197	1.1969	1.1969	.1
190	1.2095	1.2096	1.2096	1.2096	.1
191	1.2306	1.2307	1.2306	1.2306	.1
192	1.1943	1.1945	1.1944	1.1944	.2
193	1.2267	1.2268	1.2268	1.2268	.1
194	1.2159	1.2161	1.2162	1.2161	.3
195	1.2396	1.2397	1.2397	1.2397	.1
196	1.2402	1.2402	1.2402	1.2402	0
197	1.2008	1.2007	1.2008	1.2008	.1
198	1.2385	1.2385	1.2385	1.2385	0
199	1.2326	1.2326	1.2325	1.2326	.1
200	1.2043	1.2043	1.2043	1.2043	0
201	1.2041	1.2042	1.2042	1.2042	.1
202	1.2087	1.2089	1.209	1.2089	.3
203	1.2157	1.2157	1.2158	1.2157	.1
204	1.2038	1.2039	1.2039	1.2039	.1
205	1.2158	1.2159	1.2157	1.2158	.2
206	1.1989	1.199	1.199	1.199	.1
207	1.2119	1.212	1.212	1.212	.1
208	1.2237	1.2236	1.2238	1.2237	.2
209	1.2169	1.2169	1.2169	1.2169	0
210	1.2075	1.2073	1.2074	1.2074	.2
211	1.2092	1.2092	1.2093	1.2092	.1
212	1.2063	1.2063	1.2063	1.2063	0
213	1.1936	1.1937	1.1939	1.1937	.3
214	1.2392	1.2393	1.2393	1.2393	.1
215	1.2156	1.2158	1.2156	1.2157	.2
216	1.2033	1.2033	1.2033	1.2033	0
217	1.2039	1.2036	1.2037	1.2037	.3
218	1.2217	1.2214	1.2215	1.2215	.3
219	1.1917	1.1913	1.1916	1.1915	.4
220	1.2431	1.2432	1.2431	1.2431	.1
221	1.2292	1.2294	1.2292	1.2293	.2
222	1.2429	1.243	1.2428	1.2429	.2
223	1.2635	1.2636	1.2634	1.2635	.2
224	1.2391	1.2393	1.2393	1.2392	.2
225	1.2442	1.2443	1.2441	1.2442	.2
226	1.2316	1.2317	1.2315	1.2316	.2
227	1.2521	1.2522	1.2522	1.2522	.1
228	1.215	1.2151	1.215	1.215	.1
229	1.2417	1.2417	1.2417	1.2417	0
230	1.2314	1.2315	1.2314	1.2314	.1
231	1.2412	1.2413	1.2411	1.2412	.2
232	1.2154	1.2158	1.2155	1.2156	.3

64	235	1.2369	1.237	1.2369	1.2369	.1
65	236	1.2344	1.2343	1.2343	1.2343	.1
66	237	1.2434	1.2436	1.2433	1.2434	.3
67	238	1.2299	1.23	1.23	1.23	.1
68	239	1.1942	1.1944	1.1942	1.1943	.2
69	240	1.2237	1.2237	1.2236	1.2237	.1
70	241	1.2247	1.2249	1.2246	1.2247	.3
71	242	1.2289	1.229	1.2289	1.2289	.1
72	243	1.2158	1.2161	1.2159	1.2159	.3
73	244	1.2102	1.2099	1.21	1.21	.3
74	245	1.2063	1.2061	1.2061	1.2062	.2
75	246	1.2125	1.2123	1.2121	1.2123	.4
76	247	1.2069	1.2067	1.2068	1.2068	.2
77	248	1.1935	1.1936	1.1934	1.1935	.2
78	249	1.2106	1.2106	1.2106	1.2106	0
79	250	1.2105	1.2105	1.2104	1.2105	.1
80	251	1.2195	1.2194	1.2193	1.2194	.2
81	252	1.2347	1.2347	1.2348	1.2347	.1
82	253	1.2118	1.2117	1.2117	1.2117	.1
83	254	1.2091	1.209	1.2091	1.2091	.1
84	255	1.2312	1.2312	1.2314	1.2313	.2
85	256	1.2248	1.2249	1.225	1.2249	.2
86	257	1.2407	1.2406	1.2407	1.2407	.1
87	258	1.2269	1.227	1.227	1.227	.1
88	259	1.223	1.2231	1.223	1.223	.1
89	260	1.234	1.2339	1.234	1.234	.1
90	261	1.2181	1.2182	1.2182	1.2182	.1
91	262	1.2338	1.2336	1.2336	1.2337	.2
92	263	1.2283	1.2284	1.2283	1.2283	.1
93	264	1.2368	1.2369	1.2369	1.2369	.1
94	265	1.2057	1.2056	1.2057	1.2057	.1
95	266	1.231	1.231	1.231	1.231	0
96	267	1.2204	1.2202	1.2204	1.2203	.2
97	268	1.2274	1.2271	1.2275	1.2273	.4
98	269	1.2297	1.2296	1.2298	1.2297	.2
99						
100	Date:	05/03/84	05/04/84	05/05/84		
101	Time:	0830	0830	1130		
102	Temp:	65 F	66 F	68 F		
103	Humid:	32%	32%	28%		

104

105 * -Mettler AK160 (No. 40750) calibration checked w/ Christian Becker
106 Class S weights before all weighing sessions.

HOLES

TARE WEIGHT ANALYSIS SHEET

Start Date:05/02/84

Finish Date:05/06/84

Weighing Interval:~ 24 hours

Engineer:Darrow Kirkpatrick

Filter Number	Tare Weight (grams) 1	2	3	Average	Max Diff (mg)
1	.1201	.12	.1201	.1201	.1
2	.1222	.1222	.1219	.1221	.3
3	.1218	.1218	.1218	.1218	0
4	.123	.1229	.1231	.123	.2
5	.1179	.1178	.118	.1179	.2
6	.1189	.1186	.1189	.1188	.3
7	.1213	.121	.1213	.1212	.3
8	.1175	.1173	.1176	.1175	.3
9	.1212	.1209	.121	.121	.3
10	.1206	.1204	.1204	.1205	.2
11	.1219	.1218	.1218	.1218	.1
12	.1198	.1197	.1197	.1197	.1
13	.1201	.1201	.1201	.1201	0
14	.1204	.1204	.1202	.1203	.2
15	.1209	.1208	.1207	.1208	.2
16	.1171	.117	.1169	.117	.2
17	.119	.1188	.1188	.1189	.2
18	.1191	.1191	.1191	.1191	0
19	.1181	.118	.1181	.1181	.1
20	.1203	.1203	.1202	.1203	.1
21	.1223	.1224	.1223	.1223	.1
22	.1217	.1216	.1215	.1216	.2
23	.1194	.1196	.1195	.1195	.2
24	.1188	.1187	.1187	.1187	.1
25	.1181	.118	.1182	.1181	.2
26	.1181	.1179	.1181	.118	.2
27	.121	.121	.121	.121	0
28	.1196	.1196	.1198	.1197	.2
29	.1195	.1195	.1194	.1195	.1
30	.1196	.1197	.1195	.1196	.2
31	.1208	.121	.1208	.1209	.2
32	.1217	.1218	.1218	.1218	.1
33	.1196	.1196	.1196	.1196	0
34	.1213	.1213	.1213	.1213	0
35	.1188	.1188	.1188	.1188	0
36	.1223	.1223	.1222	.1223	.1
37	.1217	.1219	.1217	.1218	.2
38	.1196	.1196	.1196	.1196	0
39	.1229	.1231	.1228	.1229	.3
40	.1182	.1182	.1181	.1182	.1
41	.122	.1219	.1219	.1219	.1
42	.119	.1186	.119	.1189	.4
43	.119	.1186	.1189	.1188	.4
44	.1207	.1203	.1206	.1205	.4
45	.1188	.1186	.119	.1188	.4
46	.1174	.1171	.1174	.1173	.3
47	.1184	.118	.1183	.1182	.4
48	.1207	.1203	.1207	.1206	.4
49	.1196	.1192	.1196	.1195	.4
50	.1202	.1199	.1202	.1201	.3
51	.1224	.1224	.1224	.1224	0
52	.1225	.1227	.1226	.1226	.2
53	.1194	.1195	.1194	.1194	.1

64	56	.1216	.1214	.1213	.1214	.3
65	57	.1214	.1213	.1212	.1213	.2
66	58	.1215	.1216	.1211	.1214	.5
67	59	.1232	.1231	.1231	.1231	.1
68						
69	Date:	05/03/84	05/05/84	05/05/84		
70	Time:	1300	1100	1800		
71	Temp:	67 F	67 F	67 F		
72	Humid:	33 %	28%	29%		
73						
74	300				ERROR	0
75	301				ERROR	0
76	302				ERROR	0
77	303				ERROR	0
78	304				ERROR	0
79	305				ERROR	0
80	306				ERROR	0
81	307				ERROR	0
82	308				ERROR	0
83	309				ERROR	0
84	310				ERROR	0
85	311				ERROR	0
86	312				ERROR	0
87	313				ERROR	0
88	314				ERROR	0
89	315	.8626	.8628	.8628	.8627	.2
90	316	.861	.8611	.8612	.8611	.2
91	317	.8526	.8528	.8529	.8528	.3
92	318	.8589	.859	.8591	.859	.2
93	319	.8688	.8689	.8689	.8689	.1
94	320	.8457	.8458	.8457	.8457	.1
95	321	.8539	.8538	.854	.8539	.2
96	322	.8578	.858	.858	.8579	.2
97	323	.8655	.8655	.8657	.8656	.2
98	324	.8619	.862	.862	.862	.1
99	325	.8462	.8463	.8462	.8462	.1
100	326	.8705	.8705	.8706	.8705	.1
101	327	.8672	.8673	.8674	.8673	.2
102	328	.8782	.8784	.8783	.8783	.2
103	329	.8666	.8667	.8668	.8667	.2
104	330	.8458	.8456	.8459	.8458	.3
105	331	.8614	.8614	.8614	.8614	0
106	332	.8489	.8487	.8489	.8488	.2
107	333	.8612	.8613	.8612	.8612	.1
108	334	.8559	.8559	.8559	.8559	0
109	335	.8593	.8592	.8594	.8593	.2
110	336	.858	.858	.858	.858	0
111	337	.879	.879	.879	.879	0
112	338	.8827	.8827	.8827	.8827	0
113	339	.828	.8279	.8279	.8279	.1
114	340	.8582	.8583	.8582	.8582	.1
115	341	.864	.8639	.8642	.864	.3
116	342	.8584	.8584	.8584	.8584	0
117	343	.8559	.856	.856	.856	.1
118	344	.8461	.8462	.8462	.8462	.1
119	345	.8573	.8575	.8574	.8574	.2
120	346	.8495	.8496	.8496	.8496	.1
121	347	.8689	.869	.869	.869	.1
122	348	.8532	.8533	.8534	.8533	.2
123	349	.8588	.8588	.8588	.8588	0
124	350	.8554	.8556	.8554	.8555	.2
125	351	.8782	.8784	.8784	.8783	.2
126	352	.8651	.8651	.8652	.8651	.1
127	353	.8477	.8478	.8478	.8478	.1
128	354	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

[illegible]	.8675	.8675	.8674	.8674	.2
358	.8558	.856	.8559	.8559	.2
359	.8569	.857	.8569	.8569	.1
Date:	05/05/84	05/05/84	05/06/84		
Time:	0930	1945	1430		
Temp:	65 F	68 F	68 F		
Humid:	31%	27%	28%		

* -Mettler AK160 (No. 40750) calibration checked w/ Christian Becker Class S weights before all weighing sessions.

RECOVERY ANALYSIS WORKSHEET

TEST LOCATION: Alum Filter Holders TEST DATE 21 MAY 1989

DATE ______ TIME ______ TEMP. ______ HUMID. 58

N	PETRI NO.	FILTER NO.	~~PETRI~~ WEIGHTS 1	2	3	AVE.	TARE WT. FILTER	TARE WT. PETRI	COMB. TARE	SAM… WT
			1615	1715	1815					
		1	0.4994	0.4994	0.4995	0.4994				
		2	0.5116	0.5119	0.5117	0.5117				
		3	0.5391	0.5392	0.5392	0.5392				
		4	0.5651	0.5651	0.5651	0.5651				
		5	0.4986	0.4986	0.4984	0.4985				
		6	0.5585	0.5586	0.5586	0.5586				
			1645	1745	1845					
		7	~~0.6756~~	0.6757	0.6758	0.6757				
		8	0.6896	0.6896	0.6895	0.6896				
		9	0.5796	0.5797	0.5796	0.5796				
		10	0.5235	0.5235	0.5236	0.5235				
		11	0.5146	0.5146	0.5145	0.5146				
		12	0.6413	0.6407	0.6406	0.6407				
		13	0.6240	0.6240	0.6240	0.6240				
		14	0.6417	0.6418	0.6420	0.6418				
		15	0.6460	0.6460	0.6461	0.6460				
		16	0.6541	0.6543	0.6544	0.6543				
		17	0.6151	0.6151	0.6152	0.6151				
		18	0.6096	0.6096	0.6096	0.6096				
		19	0.5847	0.5848	0.5849	0.5848				
		20	0.6173	0.6175	0.6175	0.6174				

RUN NO.	BEAKER NO.	FILTER NO.	BEAKER SPECIMEN 1	2	3	AVE.	TARE WT. BEAKER	SAMPLE WT. #1	SAMPLE WT. #2	SAM… 1…
		21	0.5598	0.5600	0.5599	0.5599				
		22	0.5080	0.5081	0.5081	0.5081				
		23	0.6241	0.6241	0.6242	0.6241				
		24	0.6583	0.6582	0.6581	0.6582				
		25	0.6564	0.6563	0.6565	0.6564				
		26	0.5618	0.5617	0.6618	0.6618				
		27	0.5633	0.5633	0.5634	0.5633				
		28	0.5715	0.5716	0.5715	0.5715				
		29	0.5361	0.5360	0.5361	0.5361				
		30	0.4831	0.4831	0.4832	0.4831				

RECOVERY ANALYSIS WORKSHEET IMPACTOR

TEST LOCATION: #106 BLDG. 210 TEST DATE 11 MAY 1984

DATE ______ TIME ______ TEMP. 77°F HUMID. 65%

~~PETRI NO.~~	FILTER NO.	FILTER ~~PETRI~~ WEIGHTS 1	2	3	AVE.	TARE WT. FILTER	~~TARE WT. PETRI~~	~~COMB. TARE~~	~~SAMPLE~~ Δ WT.
		10:15	11:15	12:15					
Nozzle #1	318	0.8597	0.8597	0.8595		0.8590			
IMPACTOR #4	115	1.2274	1.2275	1.2272		1.2248			
	114	1.2110	1.2111	1.2108		1.2108			
	113	1.2249	1.2249	1.2250		1.2248			
[illegible]	4	0.1223	0.1141	0.1152		0.1230			
Nozzle #2	315	0.8629	0.8629	0.8628		0.8627			
IMPACTOR #1	C1	1.2330	1.2330	1.2329		1.2328			
	C2	1.2012	1.2011	1.2012		1.2011			
	C3	1.2288	1.2288	1.2288		1.2287			
[illegible]	1	0.1082	0.1077	0.1072		0.1201			
[illegible] 1		0.0104							
[illegible]		17.2521	17.2497	17.2499					
		4:30		6:30					
Nozzle ?	316	0.8612	0.8613	0.8611		0.8611			
IMPACTOR 2	105	1.1999	1.2002	1.2000		1.1999			
	106	1.1860	1.1560	1.1859		1.1858			
	107	1.2383	1.2383	1.2380		1.2381			
[illegible]	2	17.3687	17.3683	17.3690		0.1221			
Nozzle ?	357	0.8677	0.8676	0.8677		0.8674			
IMPACTOR 3	109	1.2174	1.2173	1.2172		1.2172			
	110	1.2299	1.2298	1.2299		1.2297			
	111	1.1870	1.1870	1.1869		1.1869			
[illegible] 4	3	16.1677	16.1664	16.1650		0.1215			

BEAKER NO.	FILTER NO.	BEAKER SPECIMEN 1	2	3	AVE.	TARE WT. BEAKER	SAMPLE WT. #1	SAMPLE WT. #2	SAMPLE 1+2

RECOVERY ANALYSIS WORKSHEET

TEST LOCATION: LBNSY Bldg 210 #102 TEST DATE 21 MAY 84

DATE 21 May 84 TIME 2020 TEMP. 75°F HUMID. 58

PETRI NO.	FILTER NO.	PETRI WEIGHTS 1	2	3	AVE.	TARE WT. FILTER	TARE WT. PETRI	COMB. TARE	SAMPLE WT
		2045	2130						
IMPACTOR		TEST 3	RUN 1		INLET #102	21 May 84			
									Δ wt.
INLET	326	0.8707	0.8707			.8705			[illegible]
	146	1.1949	1.1947			1.1946			[illegible]
	145	1.2030	1.2034			1.2027			[illegible]
	144	1.2311	1.2312			1.2311			[illegible]
	12	1.7854	1.7854			1.7851			[illegible]
	[+F1]								Σ [illegible]
	(.4994 + 1.2857) = 1.7851								
OUTLET	325	~~0.3[illegible]~~	0.8466			.8462			[illegible]
	142	1.2304	1.2307			1.2305			[illegible]
	141	1.2273	1.2275			1.2274			[illegible]
	140	1.2217	1.2218			1.2217			[illegible]
	11	1.7440	1.7442			1.7439			[illegible]
	[+A 2]								Σ [illegible]
	(.5117 + 1.2322) =		1.7439						

RUN NO.	BEAKER NO.	FILTER NO.	BEAKER SPECIMEN 1	2	3	AVE.	TARE WT. BEAKER	SAMPLE WT. #1	SAMPLE WT. #2	SAMPLE 1+2

RECOVERY ANALYSIS WORKSHEET

TEST LOCATION: DB/SY BLDG. 210 #102 TEST DATE 21 MAY 84

DATE 22 MAY TIME 0115 TEMP. 74 °F HUMID. 62 %

PETRI NO.	FILTER NO.	PETRI WEIGHTS 1 0125	2 0155	3 0210	AVE.	TARE WT. FILTER	TARE WT. PETRI	COMB. TARE	SAMPLE WT.
	IMPACTOR TEST 3 RUN 2 2205 → 0105								
INLET	327	0.8688	0.8684	0.8685	0.8686	0.8673			.0013
	150	1.2322	1.2324	1.2324	1.2323	1.2322			.0001
	149	1.2318	1.2316	1.2317	1.2317	1.2316			.0001
	148	1.1996	1.1996	1.1997	1.1996	1.1995			.0001
	13	1.6066	1.6066	1.6067	1.6066	1.6063			.0003
	[G.A. 3]								Σ .0019
OUTLET	328	0.8785	0.8786	0.8788	0.8786	0.8783			[illegible]
	154	1.2206	1.2203	1.2206	1.2205	1.2203			0.00[illegible]
	153	1.2219	1.2218	1.2219	1.2219	1.2217			.0002
	152	1.1928	1.1930	1.1930	1.1929	1.1928			.0001
	14	1.6682	1.6683	1.6683	1.6683	1.6679			.0004
									Σ 0.0013

BEAKER NO.	FILTER NO.	BEAKER SPECIMEN 1	2	3	AVE.	TARE WT. BEAKER	SAMPLE WT. #1	SAMPLE WT. #2	SAMPLE 1+2

RECOVERY ANALYSIS WORKSHEET

TEST LOCATION: LBNSY 210 #103 TEST DATE 21 MAY 84

DATE 24 MAY 84 TIME 2230 TEMP. 75 F HUMID. 62

PETRI NO.	FILTER NO.	PETRI WEIGHTS 1	2	3	AVE.	TARE WT. FILTER	TARE WT. PETRI	COMB. TARE	SAMPLE WT
		2242	2315	2345					
	TEST 5	RUN 1		IMPACTOR		INLET/OUT #103			
						TEST TIME: 1742-2142			
INLET	329	0.8669	0.8671	0.8669	0.8669	0.8667			.0002
	158	1.2105	1.2109	1.2107	1.2107	1.2107			.0000
	157	1.2010	1.2012	1.2010	1.2011	1.2007			.0[illegible]
	156	1.2104	1.2105	1.2105	1.2105	1.2101			.0004
	15	1.2901	1.2900	1.2902	1.2901	1.2897			.0004
	[AL #7]								
OUTLET	330	0.8459	0.8459	0.8461	0.8460	0.8458			.0002
	162	1.1918	1.1919	1.1918	1.1918	1.1919			-.0[illegible]
	161	1.2039	1.2042	1.2041	1.2041	1.2040			.0[illegible]
	160	1.1860	1.1861	1.1862	1.1861	1.1860			.0001
	16	1.0294	1.0295	1.0295	1.0295	1.0293			.0002
	[AL #5]								
	.4995								
	.5300								
	1.0293								

METTLER CHECKED (W) CALIBRATION WEIGHTS 0120

RUN NO.	BEAKER NO.	FILTER NO.	BEAKER SPECIMEN 1	2	3	AVE.	TARE WT. BEAKER	SAMPLE WT. #1	SAMPLE WT. #2	SAMPLE 1+
			0315	0335	0					
		TEST 5	RUN 2		IMPACTOR		#103			
							TEST TIME: 2300-0156			
	INLET	331	0.8617	0.8615	0.8616	0.8616	0.8614			.0002
		166	1.2035	1.2036	1.2039	1.2037	1.2038			-.00
		165	1.2195	1.2193	1.2192	1.2193	1.2190			.00[illegible]
		164	1.2024	1.2024	1.2025	1.2024	1.2023			.0001
		17	1.8315	1.8319	1.8319	1.8318	1.8315			.00[illegible]
		[AL #9]								
		1.2519 + .5796								
			TIME: 0204	0254	0305					
	OUTLET	332	0.8491	0.8488	0.8490	0.8490	0.8488			.0[illegible]
		170	1.2054	1.2057	1.2055	1.2055	1.2055			.0000
		169	1.1964	1.1965	1.1964	1.1964	1.1964			.0000
		163	1.2283	1.2285	1.2284	1.2284	1.2282			.0[illegible]
		18	1.2726	1.2724	1.2724	1.2725	1.2723			.0[illegible]
		[AL #8]								
		.6996								
		.5727								
		1.2723								

RECOVERY ANALYSIS WORKSHEET

TEST LOCATION: LBNSY BLDG. 210 #104 TEST DATE 26 MAY 84

DATE 26 May 84 TIME 2115 TEMP. 75 HUMID. 63%

TEST: 1610-1910

N	PETRI NO.	FILTER NO.	PETRI WEIGHTS 1	2	3	AVE.	TARE WT. FILTER	TARE WT. PETRI	COMB. TARE	SAMPLE WT.
			2115	2145	2215					
		TEST 7	RUN 1		#104		INLET	TEST TIME: 1610-1910		
		333	0.9034	0.9029	0.9025	0.9029	0.8612			.0417
		174	1.2649	1.2643	1.2641	1.2644	1.1963			.0681
		173	1.2466	1.2448	1.2447	1.2454	1.1994			.0460
		172	1.2145	1.2145	1.2145	1.2145	1.1990			.0155
		19	1.4716	1.4716	1.4716	1.4716	1.4688			.0028
		[AL #10] .5235 .9453 1.4688								

LARGE VOLUMES OF LIQUID COLLECTED ON EACH STAGE OF THE IMPACTOR IN ADDITION TO LIQUID COLLECTED ON THE FILTER STAGES. THE ABOVE FILTER WEIGHTS DO NOT ACCURATELY REFLECT PARTICLE SIZE DISTRIBUTION ON THIS RUN.

-POWERS
2235
26 MAY 84

SEE FRAMES 1 & 2 OF FILM ROLL

ON	BEAKER NO.	FILTER NO.	BEAKER SPECIMEN 1	2	3	AVE.	TARE WT. BEAKER	SAMPLE WT. #1	SAMPLE WT. #2	SAMPLE 1+2
			2230	2250	2320					
		TEST 7	RUN 2		#104		INLET	TEST TIME: 2105-2205		
		334	0.8709	0.8697	0.8695	0.8701	0.8559			.0142
		178	1.2379	1.2370	1.2366	1.2372	1.2215			.0157
		177	1.1919	1.1919	1.1919	1.1919	1.1907			.0012
		176	1.2281	1.2282	1.2282	1.2282	1.2271			.0011
		20	1.0822	1.0824	1.0824	1.0823	1.0824			-.0001
		[AL #11] 0.5146 .5678 1.0824								

MAJORITY OF MIST COLLECTED ON UNDERSIDE OF FILTER SUPPORT PLATES. AVERAGE SAMPLE WEIGHTS ABOVE DO NOT ACCURATELY SIZE DISTRIBUTION ON THIS RUN

-POWERS
2250
26 MAY 84

SEE FRAME 3 ON FILM ROLL

RECOVERY ANALYSIS WORKSHEET

TEST LOCATION: [illegible] Beach, [illegible] TEST DATE 1 June

DATE [illegible] TIME [illegible] TEMP. 74°F HUMID.

N.	PETRI NO.	FILTER NO.	PETRI WEIGHTS 1	2	3	AVE.	TARE WT. FILTER	TARE WT. PETRI	COMB. TARE	SAMPLE WT
		[illegible]								
			2105							
							0.8790			[illegible]
							1.2096			
							1.1969			
							1.2060			

ON NO.	BEAKER NO.	FILTER NO.	BEAKER SPECIMEN 1	2	3	AVE.	TARE WT. BEAKER	SAMPLE WT. #1	SAMPLE WT. #2	SAMPLE 1+
		Test	11		Run 1		Outlet			
			2105	[illegible]	2257					
			[illegible]	[illegible]	0.8830		0.8827			[illegible]
			[illegible]	62	1.2163		1.2161			[illegible]
			[illegible]	[illegible]	1.2271		1.2268			[illegible]
			[illegible]	[illegible]	1.1946		1.1944			[illegible]
		24	[illegible]	[illegible]	0.6069					[illegible]

RECOVERY ANALYSIS WORKSHEET

TEST LOCATION: ______________________ TEST DATE __________

DATE __________ TIME __________ TEMP. __________ HUMID. ______

N	PETRI NO.	FILTER NO.	PETRI WEIGHTS 1	2	3	AVE.	TARE WT. FILTER	TARE WT. PETRI	COMB. TARE	SA... WT.
		TEST 11		RUN 2		INLET		#105	Scrubber	
			Time 0110	0139						
		339	0.8284	0.8286				0.8279		0.0006
		198	1.2387	1.2390				1.2385		0.000[illegible]
		197	1.2012	1.2013				1.2008		0.000[illegible]
		196	1.2403	1.2405				1.2402		0.000[illegible]
		25	1.1508	1.1506				1.1501		[illegible]
										Σ 0.00[illegible]

UN	BEAKER NO.	FILTER NO.	BEAKER SPECIMEN 1	2	3	AVE.	TARE WT. BEAKER	SAMPLE WT. #1	SAMPLE WT. #2	SAMPLE 1+2
		Test 11		Run 2		Outlet		#105	Scrubber	
			Time 0114	0143						
		340	0.8583	0.8583				0.8582		0.0001
		202	1.2088	1.2088				1.2089		-0.0001
		201	1.2043	1.2043				1.2042		0.0001
		200	1.2044	1.2046				1.2043		0.000[illegible]
		26	0.7771	0.7770				0.7766		0.000[illegible]
										Σ 0.0005

TEST #1 RUN #1

RECOVERY ANALYSIS WORKSHEET

TEST LOCATION: #106 BLDG 210 [illegible] TEST DATE 15 MAY 84

DATE 15 MAY 84 TIME 11:50 AM TEMP. 81 °F HUMID. 52

TEST COMPLETED 9:45 AM

RUN NO.	PETRI NO.	FILTER NO.	PETRI WEIGHTS 1 12:15 PM	2 3:15 PM	3 4:30 PM	AVE.	TARE WT. FILTER	TARE WT. PETRI	COMB. TARE	SAMPLE WT
	IMPACTOR #3	1/4" NOZZLE								
OUTLET		324	0.8627	0.8628	0.8628	0.8628	0.8559			0.0069
		138	1.2353	1.2352	1.2354	1.2353	1.2351			0.00[illegible]
		137	1.2085	1.2085	1.2086	1.2085	1.2084			0.[illegible]
		136	1.2353	1.2352	1.2354	1.2353	1.2353			0.0[illegible]
	16.0574	10	16.7374	16.7350	16.7366	16.7363	16.7362			0.00[illegible]
	.6788								Σ	0.0[illegible]
	IMPACTOR #2	1/4" NOZZLE								
		322	0.8581	0.8581	0.8581	0.8581	0.8579			0.0[illegible]
INLET		129	1.1974	1.1974	1.1975	1.1974	1.1974			0.0000
		130	1.2048	1.2049	1.2049	1.2049	1.2048			0.00[illegible]1
		131	1.2264	1.2263	1.2264	1.2264	1.2263			0.0[illegible]1
	15.8344	8	~~16.5622~~	16.5530	16.5517	16.5523	16.5511			0.0012
	.7167								Σ	[illegible]

[illegible] CALIBRATED + CHECKED [illegible] 15 MAY 84

RUN NO.	BEAKER NO.	FILTER NO.	BEAKER SPECIMEN 1 3:30 PM	2 4:20 PM	3 4:45 PM	AVE.	TARE WT. BEAKER	SAMPLE WT. #1	SAMPLE WT. #2	SAMPLE 1+
							TEST #1		RUN #2	
	IMPACTOR #1	1/4 NOZZLE								
INLET		319	0.8691	0.8691	0.8692	0.8691	0.8689			0.0002
		118	1.2167	1.2167	1.2168	1.2167	1.2167			0.0[illegible]
		117	1.2181	1.2180	1.2181	1.2181	1.2179			0.0[illegible]
		116	1.2267	1.2268	1.2269	1.2268	1.2267			0.0001
	17.1671	5	~~17.8554~~	17.8452	17.8446	17.8449	17.8525			-0.0[illegible]76
	+.6154									Σ [illegible]
	IMPACTOR #4	1/4 NOZZLE								
OUTLET		320	0.8458	0.8457	0.8460	0.8458	0.8457			0.0001
		122	1.2349	1.2348	1.2349	1.2349	1.2347			0.0002
		121	1.2376	1.2378	1.2379	1.2378	1.2378			0.0[illegible]
		120	1.2192	1.2192	1.2191	1.2192	1.2192			0.0[illegible]
	16.0912	6	16.8070	16.8074	16.8085	16.8076	16.8084			-0.0008
	.7172									Σ -0.0[illegible]5

END OF TEST 1:20 PM

TEST 1 RUN 5 IMPACTOR

RECOVERY ANALYSIS WORKSHEET

TEST LOCATION: LBNSY BLDG 210 #106 TEST DATE 15 MAY 84

DATE 15 MAY 84 TIME 3:45 – 4:45 PM TEMP. 78°F HUMID. 43%

N	PETRI NO.	FILTER NO.	PETRI WEIGHTS 1 5:15PM	PETRI WEIGHTS 2 5:45PM	PETRI WEIGHTS 3 6:20PM	AVE.	TARE WT. FILTER	TARE WT. PETRI	COMB. TARE	SAM. WT.
IMPACTOR # 2, NOZZLE 1/4"										
ET		321	0.8542	0.8540	0.8541	0.8541	0.8539			0.0002
		126	1.2228	1.2228	1.2227	1.2228	1.2227			0.0001
		125	1.1927	1.1925	1.1928	1.1927	1.1926			0.0001
		124	1.1989	1.1990	1.1990	1.1990	1.1988			0.000[illegible]
	16.0256	7	16.6349	16.6330	16.6324	16.6334	16.6421			-0.008[illegible]
	.6165									
IMPACTOR # 3, NOZZLE 1/4"										
ILET		323	0.8658	0.8658	0.8659	0.8658	0.8656			0.000[illegible]
		134	1.2329	1.2330	1.2330	1.2330	1.2329			0.000[illegible]
		133	1.2318	1.2318	1.2319	1.2318	1.2317			0.000
		132	1.2342	1.2343	1.2343	1.2343	1.2341			0.000[illegible]
	16.0377	6	16.6513	16.6510	16.6503	16.6509	16.6463			0.0046
	.6086									0.00[illegible]

UN	BEAKER NO.	FILTER NO.	BEAKER SPECIMEN 1	BEAKER SPECIMEN 2	BEAKER SPECIMEN 3	AVE.	TARE WT. BEAKER	SAMPLE WT. #1	SAMPLE WT. #2	SAMPLE 1+2

RECOVERY ANALYSIS WORKSHEET

TEST LOCATION: L.B NSY TEST DATE 30 MAY 84

DATE 30 MAY 84 TIME 2200 TEMP. 75°F HUMID.

RUN NO.	PETRI NO.	FILTER NO.	PETRI WEIGHTS 1	2	3	AVE.	TARE WT. FILTER	TARE WT. PETRI	COMB. TARE	SAMPLE WT
	TEST 9 RUN 1 INLET #106 30 MAY 84									
INLET		336	0.8581	0.8581			0.8580			0.0001
		186	1.2556	1.2556			1.2554			0.0002
		185	1.2030	1.2030			1.2029			0.0001
		184	1.2107	1.2107			1.2106			0.0001
		22	1.1830	1.1830			1.1829			0.0001
		[Al #12]								Σ 0.0006
		.6407								
		[illegible]								
		[illegible]								
OUTLET		335	0.8594	0.8594			0.8593			0.0001
		182	1.2300	1.2299			1.2299			[illegible]
		181	1.2411	1.2411			1.2410			0.0001
		180	1.2086	1.2086			1.2087			−0.0001
		21	~~1.7364~~							0.0003
		Al #13	1.2512	1.2512			1.2509			Σ 0.0[illegible]
		.6664								
		.6240								
		[illegible]								

RUN NO.	BEAKER NO.	FILTER NO.	BEAKER SPECIMEN 1	2	3	AVE.	TARE WT. BEAKER	SAMPLE WT. #1	SAMPLE WT. #2	SAMPLE 1+.

APPENDIX G
EQUIPMENT CALIBRATION SHEETS

METER CALIBRATION

Barometric Pressure 30.105

METER # RAC # 1

DONE BY JAG

DATE 3-5-84

NEW CALIBRATION

$\Delta H = 0.3$

Vd initial 640.800 ft³

Start test and record temperatures every cubic ft.

1240

Vw	Tw(°F)	Tdin (°F)
0	63.0	80
1		80
2		80
3		80
4		80
5	63.0	80

END TEST

Actual Vw 5.000 ft³

Vd final 645.942 ft³

Tt 16.290 (min).(sec)

RUN PROGRAM

γ 1.0033

H@ 1.7390 "H_2O

$\Delta H = 0.5$

Vd initial 646.200 ft³

Start test and record temperatures every Cf.

1300

Vw	Tw(°F)	Tdin (°F)
0	63.0	80
1		81
2		81
3		81
4		82
5	63.0	82

END TEST

Actual Vw 5.000 ft³

Vd final 651.342 ft³

Tt 12.555 (min).(sec)

RUN PROGRAM

γ 1.0049

H@ 1.7782 "H_2O

$\Delta H = 0.8$

Vd initial 651.700 ft³

Start test and record temperatures every Cf.

Vw	Tw(°F)	Tdin (°F
0	63	82
1		83
2		83
3		84
4		84
5	63	84

END TEST

Actual Vw 5.100 ft³

Vd final 656.838 ft³

Tt 10.256 (min).(sec)

RUN PROGRAM

γ 1.0090

H@ 1.8442 "H_2O

AVERAGE:

γ = 1.0070

H@ = 1.8627

2 Worksheet of 2

METER CALIBRATION

Barometric Pressure 30.105

METER # #1

DONE BY JAG & NAVA

DATE 3-5-84

ΔH = ~~0.3~~ 1.0

Vd initial 657.800 ft³

Start test and record temperatures every cubic ft.

Vw	Tw(°F)	Tdin (°F)
0	63.5	84
1		84
2		85
3		85
4		85
5	63.5	85

END TEST

Actual Vw 5.000 ft³

Vd final 662.946 ft³

Tt 9.242 (min).(sec)

RUN PROGRAM

γ 1.0035

H@ 1.8739 "H_2O

ΔH = ~~3.5~~ 2.0

Vd initial 668.800 ft³

Start test and record temperatures every Cf.

Vw	Tw(°F)	Tdin (°F)
0	63.5	85
1		86
2		86
3		86
4		87
5	63.5	87

END TEST

Actual Vw 5.000 ft³

Vd final 673.948 ft³

Tt 6.486 (min).(sec)

RUN PROGRAM

γ 1.0084

H@ 1.9603 "H_2O

673.948
668.8
5.148

ΔH = ~~0.8~~ 3.0

Vd initial 675.200 ft³

Start test and record temperatures every Cf.

Vw	Tw(°F)	Tdin (°F)
0	64	86
1		86
2		87
3		87
4		87
5	64	87

END TEST

Actual Vw 5.000 ft³

Vd final 680.338 ft³

Tt 5.352 (min).(sec)

RUN PROGRAM

γ 1.0079

H@ 1.9808 "H_2O

Pump SER# 26345

Worksheet 1 of 2

METER CALIBRATION

Barometric Pressure 30.080

METER # RAC # 2

DONE BY M. L. P.

DATE 2-10-84

ΔH = 0.3

Vd initial 373.300 ft³

Start test and record temperatures every cubic ft.

10:05

Vw	Tw (°F)	Tdin (°F)
0	61.5	76
1	↓	77
2	↓	77
3	↓	78
4	↓	79
5	61.5	80

END TEST

Actual Vw 5.000 ft³

Vd final 378.496 ft³

Tt 13.418 (min).(sec)

RUN PROGRAM

γ 0.9917

H@ 1.1996 "H_2O

2-[illegible]-84

γ = 0.9969 H@ = 1.1874

γ = 0.9935 H@ = 1.1837

AVERAGE (THREE RUNS)

γ = 0.9940 H@ = 1.1902

ΔH = 0.5

Vd initial 378.900 ft³

Start test and record temperatures every Cf.

10:25

Vw	Tw (°F)	Tdin (°F)
0	62	78
1	↓	79
2	↓	80
3	↓	81
4	↓	82
5	62	82

END TEST

Actual Vw 5.000 ft³

Vd final 384.105 ft³

Tt 10.500 (min).(sec)

RUN PROGRAM

γ 0.9941

H@ 1.2450 "H_2O

2-14-84

γ = 1.0006 H@ = 1.2312

γ = 0.9963 H@ = 1.2332

AVERAGE (THREE RUNS)

γ = 0.9970 H@ = 1.2364

ΔH = 0.8

Vd initial 384.400 ft³

Start test and record temperatures every Cf.

10:40

Vw	Tw (°F)	Tdin (°F)
0	62	81
1	↓	82
2	↓	83
3	↓	84
4	↓	85
5	62	85

END TEST

Actual Vw 5.000 ft³

Vd final 389.600 ft³

Tt 8.402 (min).(sec)

RUN PROGRAM

γ 0.9989

H@ 1.2713 "H_2O

2-14-84

γ = 1.0003 H@ = 1.2800

γ = 1.0058 H@ = 1.2516

AVERAGE (Three Runs)

γ = 1.0016 H@ = 1.2676

Final γ = 1.0123 Final H@ = 1.2373

Pump SER# 26345

Worksheet 2 of 2

METER CALIBRATION

Barometric Pressure 30.080

METER # PAC#2

DONE BY JAG

DATE 2-10-84

ΔH = 1.0

Vd initial 389.900 ft³

Start test and record temperatures every cubic ft.

10:55

Vw	Tw(°F)	Tdin (°F)
0	62.0	81
1	|	83
2	|	84
3	|	84
4	|	85
5	62.0	86

END TEST

Actual Vw 5.000 ft^3

Vd final 395.190 ft^3

Tt 7.456 (min).(sec)

RUN PROGRAM

γ 0.9823

H@ 1.2719 "H_2O

2-14-84

γ = 0.9997 H@ = 1.2745

γ = 1.0068 H@ = 1.2744

AVERAGE (THREE RUNS)

γ = 0.9962

H@ = 1.2736

ΔH = 2.0

Vd initial 395.400 ft³

Start test and record temperatures every Cf.

11:05

Vw	Tw(°F)	Tdin (°F)
0	62.0	83
1	|	85
2	|	86
3	|	86
4	|	87
5	62.0	88

END TEST

Actual Vw 5.000 ft^3

Vd final 400.485 ft^3

Tt 5.270 (min).(sec)

RUN PROGRAM

γ 1.0232

H@ 1.2501 "H_2O

2-15-84

γ = 1.0247 H@ = 1.2679

γ = 1.0285 H@ = 1.2466

AVERAGE (THREE RUNS)

γ = 1.0254

H@ = 1.2548

ΔH = 3.0

Vd initial 400.485 ft³

Start test and record temperatures every Cf.

12:15

Vw	Tw(°F)	Tdin (°F)
0	62.0	85
1	|	87
2	|	88
3	|	89
4	↓	90
5	62.0	91

END TEST

Actual Vw 5.000 ft^3

Vd final 405.423 ft^3

Tt 4.250 (min).(sec)

RUN PROGRAM

γ 1.0559

H@ 1.2259 "H_2O

2-15-84

γ = 1.0655 H@ = 1.1990

γ = 1.0677 H@ = 1.1794

AVERAGE (THREE RUNS)

γ = 1.0630

H@ = 1.2014

Touch

Worksheet

METER CALIBRATION

Barometric Pressure 30.040

METER # Box #3

DONE BY MLD

DATE Feb /23/84

ΔH = 1.0

Vd initial 548.700 ft³

Start test and record temperatures every cubic ft.

15.50

Vw	Tw(°F)	Tdin (°F)
0	62	84
1	↓	84
2	↓	84
3	↓	84
4	↓	85
5	62	85

END TEST

Actual Vw 5.000 ft^3

Vd final 553.912 ft^3

Tt 9.452 (min).(sec)

RUN PROGRAM

γ 0.9977

H@ 2.0100 "H_2O

ΔH = 2.0

Vd initial 554.100 ft³

Start test and record temperatures every Cf.

16.05

Vw	Tw(°F)	Tdin (°F)
0	62	84
1	↓	85
2	↓	85
3	↓	85
4	↓	86
5	62	86

END TEST

Actual Vw 5.000 ft^3

Vd final 559.328 ft^3

Tt 7.068 (min).(sec)

RUN PROGRAM

γ 0.9940

H@ 2.1350 "H_2O

ΔH = 3.0

Vd initial 559.500 ft³

Start test and record temperatures every Cf.

16.12

Vw	Tw(°F)	Tdin (°F)
0	62	85
1	↓	86
2	↓	86
3	↓	86
4	↓	87
5	62	87

END TEST

Actual Vw 5.000 ft^3

Vd final 564.732 ft^3

Tt 5.474 (min).(sec)

RUN PROGRAM

γ 0.9926

H@ 2.1179 "H_2O

Worksheet

METER CALIBRATION

Barometric Pressure 30.040

METER # Box #3

DONE BY M & D

DATE Feb /23/84

NEW CALIBRATION

ΔH = 0.3

Vd initial 532.400 ft³

Start test and record temperatures every cubic ft.

15:00

Vw	Tw(°F)	Tdin (°F)
0	62	79
1		81
2		81
3		81
4		81
5	62	81

END TEST

Actual Vw 5.000 ft^3

Vd final 537.622 ft^3

Tt 17.224 (min).(sec)

RUN PROGRAM

γ 0.9910

H@ 1.9221 "H_2O

AVE γ 0.9943

AVE H@ 2.0299

ΔH = 0.5

Vd initial 537.900 ft³

Start test and record temperatures every Cf.

15.22

Vw	Tw(°F)	Tdin (°F)
0	62	81
1		81
2		82
3		82
4		82
5	62	82

END TEST

Actual Vw 5.000 ft^3

Vd final 543.112 ft^3

Tt 13.438 (min).(sec)

RUN PROGRAM

γ 0.9943

H@ 2.0014 "H_2O

ΔH = 0.8

Vd initial 543.300 ft³

Start test and record temperatures every Cf.

15.40

Vw	Tw(°F)	Tdin (°F)
0	62	82
1		83
2		83
3		83
4		84
5	62	84

END TEST

Actual Vw 5.000 ft^3

Vd final 548.512 ft^3

Tt 10.499 (min).(sec)

RUN PROGRAM

γ 0.9963

H@ 1.9275 "H_2O

Worksheet

METER CALIBRATION

Barometric Pressure 30.120

METER # RAC # 5

DONE BY JAC

DATE 1-25-84

NEW CALIBRATION

ΔH = 0.3

Vd initial 586,400 ft³

Start test and record temperatures every cubic ft.

1355 — VAC=0

Vw	Tw (°F)	Tdin (°F)
0	63.5	97
1		99
2		102
3		105
4		107
5	63.5	109

END TEST

Actual Vw 5 ft^3

Vd final 591.749 ft^3

Tt 16.520 (min).(sec)

RUN PROGRAM

γ 1.0045

Hθ 1.7484 "H_2O

ΔH = 0.5

Vd initial 592,000 ft³

Start test and record temperatures every Cf.

1415 — VAC=0

Vw	Tw (°F)	Tdin (°F)
0	64	104
1		108
2		110
3		112
4		114
5	64	115

END TEST

Actual Vw 5 ft^3

Vd final 597.421 ft^3

Tt 13.212 (min).(sec

RUN PROGRAM

γ 1.0030

Hθ 1.3064 "H_2O

ΔH = 0.8

Vd initial 597.800 ft³

Start test and record temperatures every Cf.

1437 — VAC=0

Vw	Tw (°F)	Tdin (°F)
0	64	105
1		107
2		110
3		112
4		114
5	64	115

END TEST

Actual Vw 5 ft^3

Vd final 603.267 ft^3

Tt 10.325 (min).(sec)

RUN PROGRAM

γ .9938

Hθ 1.8013 "H_2O

CHECK CAL — WITH WET TEST METER AFTER CAL —

Worksheet

METER CALIBRATION

Barometric Pressure 30.120

METER # 5 (RAC)

SER # 2562

DONE BY J AGARCIA

DATE 25 JAN. 1984

ΔH = ~~0.3~~ 1.0

Vd initial 603.500 ft³

Start test and record temperatures every cubic ft.

1450 — VAC = 0

Vw	Tw(°F)	Tdin (°F)
0	64	109
1		112
2		114
3		116
4		117
5	64	118

END TEST

Actual Vw 5 ft³

Vd final 608.969 ft³

Tt 9.288 (min).(sec)

RUN PROGRAM

γ 0.9996

Hθ 1.8088 "H_2O

ΔH = ~~1.0~~ 2.0

Vd initial 609.300 ft³

Start test and record temperatures every Cf.

1505 — VAC = 0

Vw	Tw(°F)	Tdin (°F)
0	64	109
1		112
2		114
3		116
4		118
5	64	120

END TEST

Actual Vw 5 ft³

Vd final 614.784 ft³

Tt 6.522 (min).(sec

RUN PROGRAM

γ 0.9953

Hθ 1.8981 "H_2O

ΔH = ~~5.0~~ 3.0

Vd initial 615.100 ft³

Start test and record temperatures every Cf.

1515 — VAC = 0

Vw	Tw(°F)	Tdin (°F)
0	64	114
1		116
2		118
3		120
4		121
5	64	122

END TEST

Actual Vw 5 ft³

Vd final 620.600 ft³

Tt 5.468 (min).(sec)

RUN PROGRAM

γ 0.9963

Hθ 2.0026 "H_2O

PITOT TUBE IDENTIFICATION NUMBER: 1 DATE: 27APRIL84

CALIBRATED BY: T. BELANGER

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
	1/4" NOZZLE			
1	.945	1.34	.840	-.002
2	.948	1.35	.838	-.004
3	.943	1.31	.848	.006
		$\bar{C}_p$ (SIDE A)	.842	

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1				
2				
3				
		$\bar{C}_p$ (SIDE B)		

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 1 DATE: 27 APR 8[illegible]

CALIBRATED BY: T. BELANGER

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
	1/4" NOZZLE			
1	.190	.278	.827	
2	.188	.278	.822	
3	.190	.278	.827	
		$\bar{C}_p$ (SIDE A)		

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
	1/4" NOZZLE			
1	.492	.720	.827	.001
2	.492	.720	.827	.001
3	.490	.720	.825	-.001
		$\bar{C}_p$ (SIDE B)	.826	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_p(s) - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 1 DATE: 26 APRIL 94
CALIBRATED BY: T. BELANGER

3/8" NOZZLE

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.520	.770	.822	-.002
2	.522	.773	.822	-.002
3	.525	.765	.828	.004
		$\bar{C}_p$ (SIDE A)	.824	

3/8" NOZZLE

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.191	.283	.822	.002
2	.188	.283	.815	-.005
3	.190	.280	.824	.004
		$\bar{C}_p$ (SIDE B)	.820	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \quad \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 1 DATE: 26 APRIL 84

CALIBRATED BY: T. BELANGER

	½" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.942	1.32	.845	0.0
2	.945	1.33	.843	-.002
3	.930	1.30	.846	.001
		$\bar{C}_p$ (SIDE A)	.845	

	3/8" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.945	1.33	.843	-.002
2	.945	1.32	.846	.001
3	.942	1.32	.845	0.0
		$\bar{C}_p$ (SIDE B)	.845	

$$\text{AVERAGE DEVIATION} = \sigma\,(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_p(s) - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p\,(\text{SIDE A}) - \bar{C}_p\,(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 1 DATE: 26 APR 84

CALIBRATED BY: T. BELANGER

RUN NO.	½" NOZZLE Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.208	.305	.826	-.005
2	.210	.305	.830	-.001
3	.212	.302	.838	.007
		$\bar{C}_p$ (SIDE A)	.831	

RUN NO.	½" NOZZLE Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.505	.720	.838	.004
2	.495	.723	.827	-.007
3	.505	.720	.838	.004
		$\bar{C}_p$ (SIDE B)	.834	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 2 DATE: 25APR84

CALIBRATED BY: T. Belanger

	1/4" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.960	1.37	.837	.007
2	.945	1.40	.822	-.008
3	.950	1.38	.830	0.0
		$\bar{C}_p$ (SIDE A)	.830	

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1				
2				
3				
		$\bar{C}_p$ (SIDE B)		

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2-9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 2 DATE: 19APR84

CALIBRATED BY: T. BELANGER

	1/4" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p(s)$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	0.195	0.300	.806	.005
2	0.195	0.305	.800	-.001
3	0.190	0.300	.796	-.005
		$\bar{C}_p$ (SIDE A)	.801	

	1/4" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p(s)$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.490	0.722	.824	-.001
2	.490	0.720	.825	0.0
3	.492	0.720	.827	.002
		$\bar{C}_p$ (SIDE B)	.825	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_p(s) - \bar{C}_p(\text{A OR B}) \right|}{3} \leftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \leftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 2 DATE: 19 APR 84

CALIBRATED BY: T. RELANGER

3/8" TUBE

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	0.481	0.745	.804	.001
2	0.475	0.735	.804	.001
3	0.475	0.740	.801	-.002
		$\bar{C}_p$ (SIDE A)	.803	

3/8" NOZZLE

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	0.190	0.300	.796	-.001
2	0.190	0.300	.796	-.001
3	0.192	0.300	.800	.003
		$\bar{C}_p$ (SIDE B)	.797	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 2 DATE: 19 APR 84

CALIBRATED BY: T. BEIANGER

	½" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	0.970	1.50	.804	.005
2	0.990	1.55	.799	0.0
3	0.975	1.55	.793	-.006
		$\bar{C}_p$ (SIDE A)	.799	

	3/8" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	0.960	1.45	.814	.005
2	0.975	1.50	.806	-.003
3	0.975	1.50	.806	-.003
		$\bar{C}_p$ (SIDE B)	.809	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_p(s) - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p\,(\text{SIDE A}) - \bar{C}_p\,(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 2 DATE: 19APR84

CALIBRATED BY: T. BELANGER

	½" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	0.210	0.330	.798	-.003
2	0.210	0.330	.798	-.003
3	0.212	0.325	.808	.007
		$\bar{C}_p$ (SIDE A)	.801	

	½" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	0.515	0.800	.802	-.002
2	0.525	0.805	.808	.004
3	0.515	0.800	.802	-.002
		$\bar{C}_p$ (SIDE B)	.804	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 5 DATE: 27 APR 84

CALIBRATED BY: T. BELANGER

RUN NO.	1/4" NOZZLE Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.950	1.37	.833	.001
2	.945	1.35	.837	.005
3	.940	1.38	.825	-.007
		$\bar{C}_p$ (SIDE A)	.832	

RUN NO.	1/4" NOZZLE Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.540	.800	.822	.001
2	.542	.812	.817	-.004
3	.545	.800	.825	.004
		$\bar{C}_p$ (SIDE B)	.821	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_p(s) - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 5 DATE: 27APR84

CALIBRATED BY: T. BELANGER

	1/4" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.182	.270	.821	-.001
2	.182	.270	.821	-.001
3	.183	.270	.823	.001
		$\bar{C}_p$ (SIDE A)	.822	

	3/8" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.181	.270	.819	0.0
2	.182	.270	.821	.002
3	.180	.270	.816	-.003
		$\bar{C}_p$ (SIDE B)	.819	

$$\text{AVERAGE DEVIATION} = \sigma\,(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_p(s) - \bar{C}_p(\text{A OR B}) \right|}{3} \leftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p\,(\text{SIDE A}) - \bar{C}_p\,(\text{SIDE B}) \right| \leftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 5 DATE: 27APR84

CALIBRATED BY: T. BELANGER

	3/8" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.491	.730	.820	.001
2	.490	.730	.819	0.0
3	.490	.730	.819	0.0
		$\bar{C}_p$ (SIDE A)	.819	

	3/8" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.952	1.40	.825	.003
2	.955	1.43	.817	-.005
3	.950	1.40	.824	.002
		$\bar{C}_p$ (SIDE B)	.822	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 5 DATE: 27APR84

CALIBRATED BY: T. BELANGER

RUN NO.	½" NOZZLE Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.960	1.42	.822	-.002
2	.960	1.38	.834	.010
3	.955	1.43	.817	-.007
		$\bar{C}_p$ (SIDE A)	.824	

RUN NO.	½" NOZZLE Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.520	.780	.816	-.005
2	.522	.775	.821	0
3	.530	.775	827	.006
		$\bar{C}_p$ (SIDE B)	.821	

$$\text{AVERAGE DEVIATION} = \sigma\,(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p\,(\text{SIDE A}) - \bar{C}_p\,(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 5 DATE: 27APR84

CALIBRATED BY: T. BELANGER

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
	½" NOZZLE			
1	.210	.310	.823	0
2	.210	.310	.823	0
3	.210	.310	.823	0
		$\bar{C}_p$ (SIDE A)	.823	

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1				
2				
3				
		$\bar{C}_p$ (SIDE B)		

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2-9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 8 DATE: 27APR84

CALIBRATED BY: T. BELANGER

	1/4" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.980	1.32	.862	.003
2	.980	1.32	.862	.003
3	.985	1.35	.854	-.005
		$\bar{C}_p$ (SIDE A)	.859	

	1/4" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.490	.705	.834	.002
2	.490	.702	.835	.003
3	.482	.705	.827	-.005
		$\bar{C}_p$ (SIDE B)	.832	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 8 DATE: 27APR94

CALIBRATED BY: T. BELANGER

1/4" NOZZLE

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.210	.310	.823	.004
2	.212	.312	.812	-.007
3	.210	.310	.823	.004
		$\bar{C}_p$ (SIDE A)	.819	

3/8" NOZZLE

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.210	.320	.810	0.0
2	.210	.320	.810	0.0
3	.210	.320	.810	0.0
		$\bar{C}_p$ (SIDE B)	.810	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p (\text{SIDE A}) - \bar{C}_p (\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 8 DATE: 27APR84
CALIBRATED BY: T. BELANGER

RUN NO.	3/8" NOZZLE Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.515	.785	.810	-.003
2	.518	.782	.814	.001
3	.520	.780	.816	.003
		$\bar{C}_p$ (SIDE A)	.813	

RUN NO.	3/8" NOZZLE Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.965	1.38	.845	.006
2	.975	1.40	.835	-.004
3	.983	1.40	.838	-.001
		$\bar{C}_p$ (SIDE B)	.839	

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_p(s) - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2-9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 8 DATE: 27 APR 84

CALIBRATED BY: T. BELANGER

RUN NO.	Δp_{std} cm H_2O (in. H_2O) ½" NOZZLE	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.985	1.38	.845	.004
2	.987	1.42	.834	-.007
3	.980	1.38	.843	.002
		$\bar{C}_p$ (SIDE A)	.841	

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1	.528	.775	.825	0.0
2	.530	.780	.824	-.001
3	.530	.778	.825	0.0
		$\bar{C}_p$ (SIDE B)	.825	

$$\text{AVERAGE DEVIATION} = \sigma\,(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \longleftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \longleftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.

PITOT TUBE IDENTIFICATION NUMBER: 8 DATE: 27APR84

CALIBRATED BY: T. BELANGER

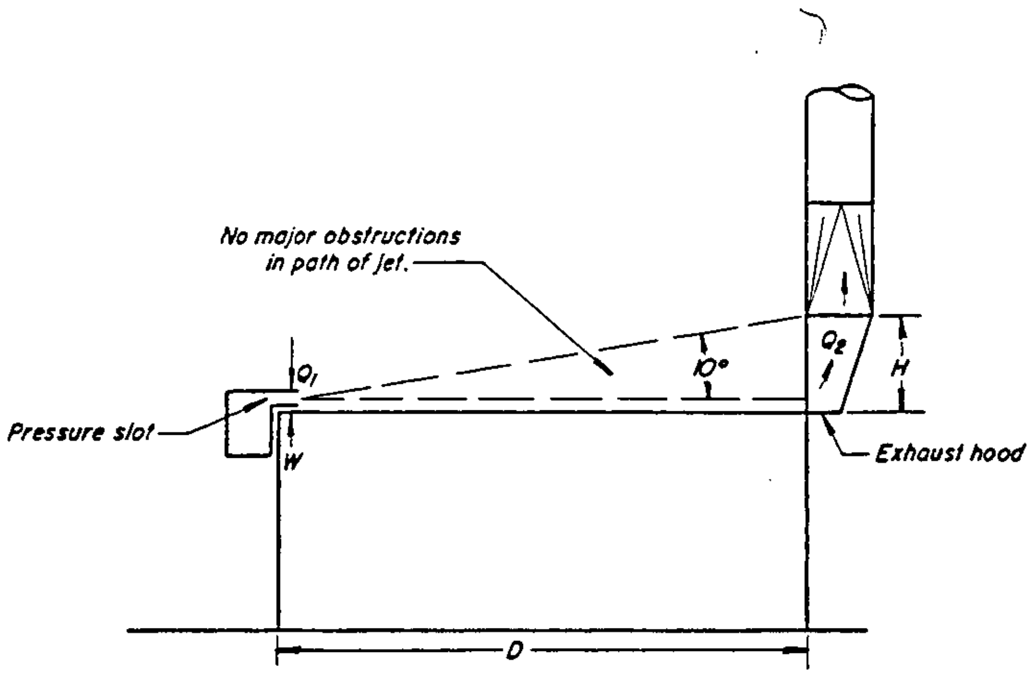
	1/2" NOZZLE			
RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(A)$
1	.205	.305	.820	.005
2	.200	.305	.810	-.005
3	.203	.305	.816	.001
		$\bar{C}_p$ (SIDE A)	.815	

RUN NO.	Δp_{std} cm H_2O (in. H_2O)	$\Delta p_{(s)}$ cm H_2O (in. H_2O)	$C_{p(s)}$	DEVIATION $C_{p(s)} - \bar{C}_p(B)$
1				
2				
3				
		$\bar{C}_p$ (SIDE B)		

$$\text{AVERAGE DEVIATION} = \sigma(\text{A OR B}) = \frac{\sum_{1}^{3} \left| C_{p(s)} - \bar{C}_p(\text{A OR B}) \right|}{3} \leftarrow \text{MUST BE} \leq 0.01$$

$$\left| \bar{C}_p(\text{SIDE A}) - \bar{C}_p(\text{SIDE B}) \right| \leftarrow \text{MUST BE} \leq 0.01$$

Figure 2.9. Pitot tube calibration data.



PUSH PULL HOODS

Exhaust Hood

Quantity of air exhausted,
Q_2 = 100 to 150 cfm /sq. ft. of tank area, depending on temperature of liquid, cross drafts, agitation, etc.

Hood height should be,
$H = D \times \tan 10°$.
$= 0.18D$

Pressure Slot

Quantity of air supplied,

$$Q_1 = \frac{1}{D \times E} \times Q_2$$

where; D = length of throw, feet
E = entrainment factor.

Throw length, D, feet	Entrainment factor, E
0 - 8	2.0
8 - 16	1.4
16 - 24	1.0
over 24	0.7

Slot width W should be designed for a velocity of 1000 to 2000 fpm.

Design such systems so they can be easily modified or adjusted to obtain desired results.

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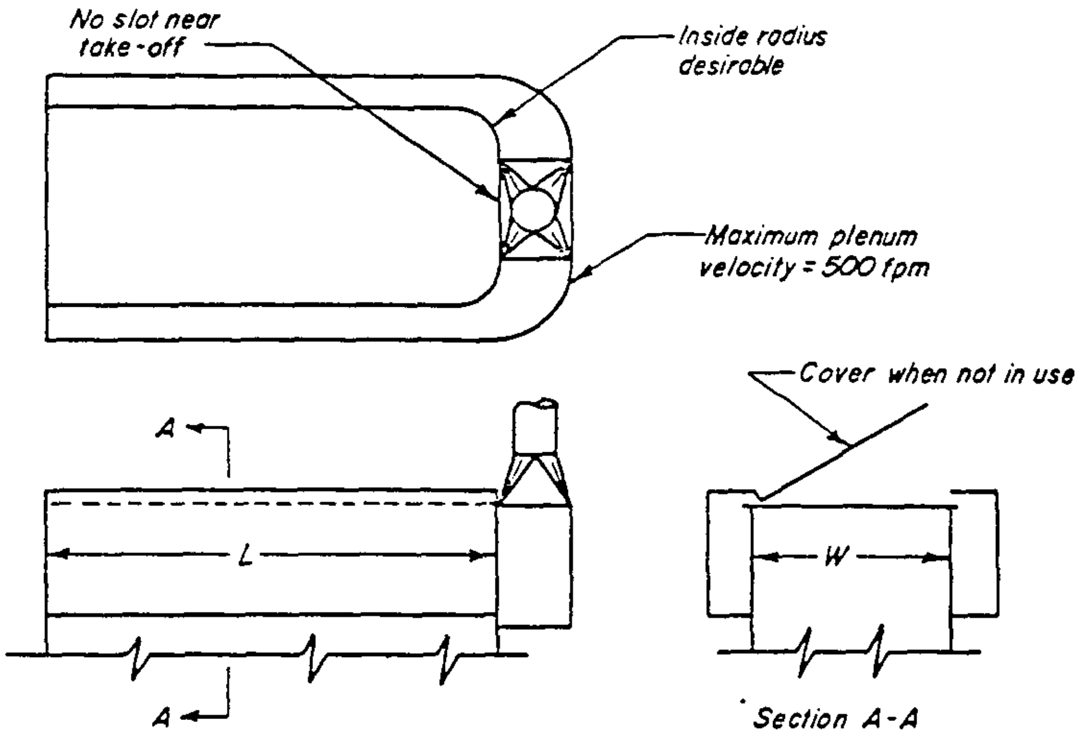
HOOD DESIGN DATA

DATE 1-64 | Fig. 4-17



$Q = 50LW$
Slot velocity = 1000 fpm maximum
Entry loss = 1.78 slot VP + 0.25 duct VP
Duct velocity = 2500-3000 fpm

Also provide: 1. Separate flue for combustion products if direct-fired unit.
2. For cleaning operation, an air-line respirator is necessary.
3. For pit units, the pit should be mechanically ventilated.
4. For further safe guards, see VS-501.1
NOTE: Provide downdraft grille for parts that cannot be removed dry; Q = 50 cfm/sq ft grille area.

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SOLVENT DEGREASING TANKS

DATE 1-78	VS-501

Solvent vapor degreasing refers to boiling liquid cleaning systems utilizing trichloroethylene, perchloroethylene, methylene chloride, freons (R) or other halogenated hydrocarbons. Cleaning action is accomplished by the condensation of the solvent vapors in contact with the work surface producing a continuous liquid rinsing action. Cleaning ceases when the temperature of the work reaches the temperature of the surrounding solvent vapors. Since halogenated hydrocarbons are somewhat similar in their physical, chemical and toxic characteristics, the following safeguards should be provided to prevent the creation of a health or life hazard:

1. Vapor degreasing tanks should be equipped with a condenser or vapor level thermostat to keep the vapor level below the top edge of the tank by a distance equal to one-half the tank width or 36 inches, whichever is shorter.

2. Where water type condensers are used, inlet water temperatures should not be less than 80 F (27 C) and the outlet temperature should not exceed 110 F (43 C).

3. Degreasers should be equipped with a boiling liquid thermostat to regulate the rate of vapor generation, and with a safety control at an appropriate height above the vapor line to prevent the escape of solvent in case of a malfunction.

4. Tanks or machines of more than 4 square feet of vapor area should be equipped with suitable gasketed cleanout or sludge doors, located near the bottom, to facilitate cleaning.

5. Work should be placed in and removed slowly from the degreaser, at a rate no greater than 11 feet/minute (0.055 m/s), to prevent sudden disturbances of the vapor level.

6. CARE MUST BE TAKEN TO PREVENT DIRECT SOLVENT CARRYOUT DUE TO THE SHAPE OF THE PART. Maximum rated workloads as determined by the rate of heat transfer (surface area and specific heat) should not be exceeded.

7. Special precautions should be taken where natural gas or other open flames are used to heat the solvent to prevent vapors* from entering the combusion air supply.

8. Heating elements should be designed and maintained so that their surface temperature will not cause the solvent or mixture to breakdown* or produce excessive vapors.

9. Degreasers should be located in such a manner that vapors* will not reach or be drawn into atmospheres used for gas or electric arc welding, high temperature heat treating, combustion air or open electric motors.

10. Whenever spray or other mechanical means are used to disperse solvent liquids, sufficient enclosure or baffling should be provided to prevent direct release of airborne vapor above the top of the tank.

11. An emergency quick-drenching facility should be located in near proximity to the degreaser for use in the event of accidental eye contact with the degreasing liquid.

- Electric arcs, open flames and hot surfaces will thermally decompose halogenated hydrocarbons to toxic and corrosive substances (such as hydrochloric and/or hydrofluoric acid). Under some circumstances, phosgene may be formed.

AMERICAN CONFERENCE OF GOVERNMENTAL INDUSTRIAL HYGIENISTS

SOLVENT VAPOR DEGREASING

DATE 1-78 | VS-501.1

APPENDIX H
VENTILATION DATA

RECOMMENDED TANK EXHAUST FLOWRATES

Scrubber: #101 REW 9/20/84

Tanks Exhausted #	Type	Haz Cat	Recommended Cfm / □'	Tank Surface Area □'	Calc Cfm / Tank
8	PP	C-1	150	31.5	4725
9	PP	C-2	150	31.5	4725
18	PP	A-3	150	31.5	4725
23	PP	C-2	150	31.5	4725
25	Zs Lot	C-2	110	24	2640
26	Zs Lot	C-1	150	24	3600
				Total	= 25,140

Minimum Exhaust Required to meet Recommended Tank Exhaust Volumes: 25140 cfm

Total Exhaust by Scrubbers 101 - 106 = 182975 cfm

Measured Q (STD COND)	Scrubber #	Recommended Min CFM	Quant. of Tanks / PP	
25293	101	25140	6/4	110222 cfm
[illegible]	102	22785	4/1	≈ 58 % supplied
[illegible]	103	37625	4/0	
[illegible]	104	23625	5/5	
[illegible]	105	28350	6/6	
32010	106	45450	8/2	
[illegible]		182975	33/18	

Scrubber: #102

Tanks Exhausted		Haz Cat	Recommended Cfm/□'	Tank Surface Area	Calc. Cfm/Tank
				□'	
4	Lot	C-2	110	96	10560
33	PP	B-2	150	31.5	4725
40	None	NA	—	31.5	—
* 48	2s Lot	D-2	100	25	2500
50	2s Lot	C-1	200	25	5000
				Total =	2271

Minimum Exhaust Required to meet Recommended Tank Exhaust Volumes: 22785 cfm

* Is not needed could be blanked off if fan requires greater capacity.

Scrubber: #103

Tanks Exhausted #	Type	Haz Cat	Recommended Cfm/□'	Tank Surface Area □'	Calc. Cfm/Tank
41	2s Lot	A-1	250	56	14000
42	2s Lot	A-1	250	31.5	7875
43	2s Lot	A-1	250	31.5	7875
44	2s Lot	A-1	250	31.5	7875
				Total =	37,625

Minimum Exhaust Required to meet Recommended Tank Exhaust Volumes: 37625 cfm

Scrubber: #104

Tanks Exhausted #	Type	Haz Cat	Recommended Cfm/□'	Tank Surface Area □'	Calc. Cfm/Tank
3	PP	A-2	150	31.5	4725
5	PP	B-2	150	31.5	4725
6	PP	A-2	150	31.5	4725
14	PP	A-2	150	31.5	4725
15	PP	A-3	150	31.5	4725
				total	23,6 . 5

Minimum Exhaust Required to meet Recommended Tank Exhaust Volumes: 23625 cfm

Scrubber: #105

Tanks Exhausted		Haz Cat	Recommended Cfm / □'	Tank Surface Area □'	Calc. Cfm/Tank
1	PP	C-3	150	31.5	4725
11	PP	C-3	150	31.5	4725
20	PP	A-2	150	31.5	4725
* 21	PP	(D-4) C-2	150	31.5	4725
22	PP	C-2	150	31.5	4725
* 29	PP	(D-4) C-2	150	31.5	4725
				Total =	28,350

Minimum Exhaust Required to meet Recommended Tank Exhaust Volumes: 28350 cfm

* Is not needed, hood could be blanked off if fan requires increased capacity.

Scrubber: #106

Tanks Exhausted #	Type	Haz Cat	Recommended Cfm / □'	Tank Surface Area □'	Calc. Cfm / Tank
16	PP	A-2	150	31.5	4725
19	PP	C-2	150	31.5	4725
28A	2s Lat	A-2	250	24	6000
28B	2s Lat	A-2	250	24	6000
35	2s Lat	A-2	250	24	6000
36	2s Lat	A-2	250	24	6000
45	2s Lat	A-2	250	25	6000
47	2s Lat	A-2	250	25	6000
				Total =	45,450

Minimum Exhaust Required to meet Recommended Tank Exhaust Volumes: 45450 cfm

Pitot Traverse Measurements
(See Figure 8 for Location Matchup)

Location		1		2		3		4	REL
		VP	Vel.	VP	Vel.	VP	Vel.	VP	Vel.
				0				(20 pt traverse)	
1		.02	566	0	0	.20	1791	.16	1602
2		.02	566	0	0	.20	1791	.14	1499
3		.03	694	0	0	.20	1791	.12	1397
4		.02	566	0	0	.20	1791	.17	1651
5		.03	694	0	0	.18	1699	.21	1835
6		.04	801	.02	566	.21	1835	.14	1499
7		.04	801	.02	566	.14	1499	.20	1791
8		.05	896	.02	566	.10	1266	.16	1602
9		.05	896	.02	566	.08	1133	.08	1133
10		.05	896	.01	401	.18	1699	0	0
11		.04	801	.04	801	.14	1499	.19	1746
12		.05	896	.09	1202	.10	1266	.21	1835
13		.05	896	.07	1060	.02	566	.21	1835
14		.05	896	.05	896	.01	401	.23	1921
15		.04	801	.07	1060	.08	1133	.24	1962
16		.04	801	.13	1444	.05	896	0	0
17		.04	801	.17	1651	.01	401	0	0
18		.05	896	.14	1499	0	0	0	0
19		.05	896	.14	1499	0	0	0	0
20		.05	896	.16	1602	.03	694	0	0
21		.04	801	.19	1746	0	0		
22		.04	801	.24	1962	0	0		
23		.05	896	.22	1879	0	0		
24		.05	896	.23	1921	0	0		
25		.04	801	.24	1962	0	0		
	Average Velocity (fpm)	—							
	Duct Cross-Sectional Area (ft^2)	—							
	Calculated Flow Rate (cfm)	—							

Pitot Traverse Measurements
(See Figure 8 for Location Matchup)

Location		5		6		7 & 10		8	
Pt		VP	Vel	VP	Vel	VP	Vel	VP	Vel
1		.11	1328	.02	566	.06	981		
2		.18	1699	.02	566	.07	1060		
3		.21	1835	0	0	.11	1328		
4		.26	2042	0	0	.12	1387		
5		.26	2042	.02	566	.16	1602		
6		.15	1551	.05	896	.06	981		
7		.15	1551	.02	566	.07	1060		
8		.14	1499	.03	694	.12	1387		
9		.20	1791	.02	566	.14	1499		
10		.22	1879	.02	566	.15	1551		
11		.11	1328	.14	1499	.08	1133		
12		.09	1202	.09	1202	.09	1202		
13		.12	1387	.08	1133	.10	1266		
14		.03	694	.06	981	.12	1387		
15		.08	1133	.12	1387	.14	1499		
16		.02	566	.20	1791	.10	1266		
17		0	0	.18	1699	.08	1133		
18		0	0	.17	1651	.09	1202		
19		0	0	.16	1602	.11	1328		
20		.05	896	.17	1651	.10	1266		
21		0	0	.20	1791	.12	1387		
22		0	0	.24	1962	.09	1202		
23		0	0	.24	1962	.08	1133		
24		0	0	.24	1962	.07	1060		
25		0	0	.25	2003	.07	1060		
26						.10	1266		
27						.10	1266		
28						.09	1202		
29						.08	1133		
30						.06	981		
	Average Velocity (fpm)	—							
	Duct Cross-Sectional Area (ft²)	—							
	Calculated Flow Rate (cfm)	—							

Pitot Traverse Measurements
(See Figure 8 for Location Match-ups)

Location		9		7 & 10		11		12	
Pt		VP	Vel	VP	Vel	VP	Vel	VP	Vel
				(see 7&10 previous page)					
	Average Velocity (fpm)								
	Duct								

Pitot Traverse Measurements
(See Figure 8 for Locations Matchups)

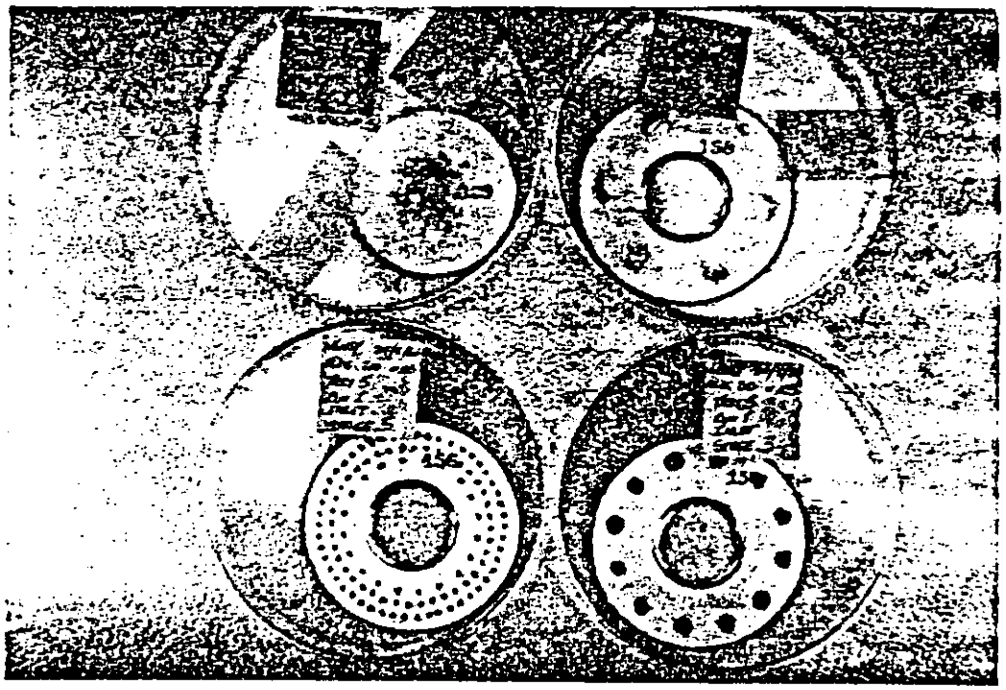
Location	13		13 & 14		15 & 16				
Pt	VP	Vel	VP	Vel	VP	Vel			
1	.05	896	.03	694	.01	401			
2	.05	896	0	0	0	0			
3	.03	694	0	0	0	0			
4	.03	694	.20	1791	0	0			
5	.03	694	.32	2260	.01	401			
6	.05	896	0	0	0	0			
7	.05	896	0	0	0	0			
8	.03	694	.01	401	0	0			
9	.02	566	0	0	0	0			
10	.03	694	0	0	0	0			
11	.07	1060	.10	1266	.19	1746			
12	.05	896	.04	801	.18	1699			
13	.04	801	0	0	.38	2469			
14	.04	801	.12	1387	.47	2746			
15	.04	801	.90	3800	.32	2266			
16	.08	1133	.38	2469	.18	1699			
17	.07	1060	.12	1387	.20	1791			
18	.06	981	.10	1266	.18	1699			
19	.06	981	0	0	.17	1651			
20	.06	981	.15	1551	.21	1835			
21	.08	1133	.01	401	.14	1499			
22	.09	1201	.02	566	.15	1551			
23	.07	1060	.02	566	.01	401			
24	.03	1133	.02	566	0	0			
25	.06	981	0	0	.08	1133			
Average Velocity (fpm) —									
Duct Cross-Sectional Area (ft^2) —									
Calculated Flow Rate (cfm) —									

APPENDIX I
PHOTOGRAPHS OF IMPACTOR FILTER STAGES

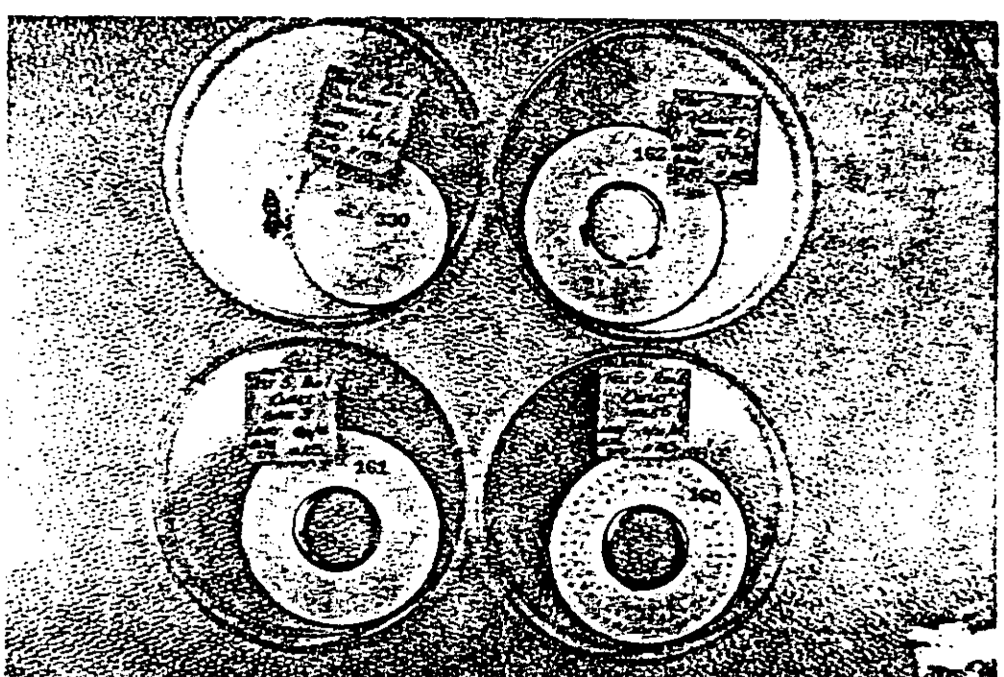
CHROME PLATING SCRUBBER # 103 BLDG. 210 LBNSY 24 MAY 84

RUN 1

INLET IMPACTOR STAGES -



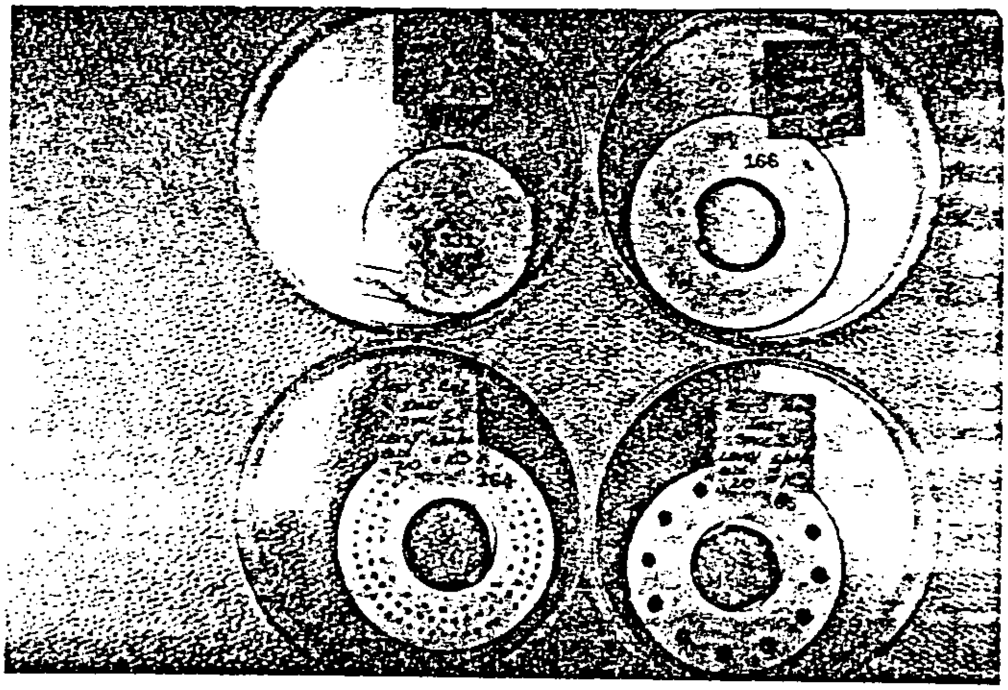
OUTLET IMPACTOR STAGES -



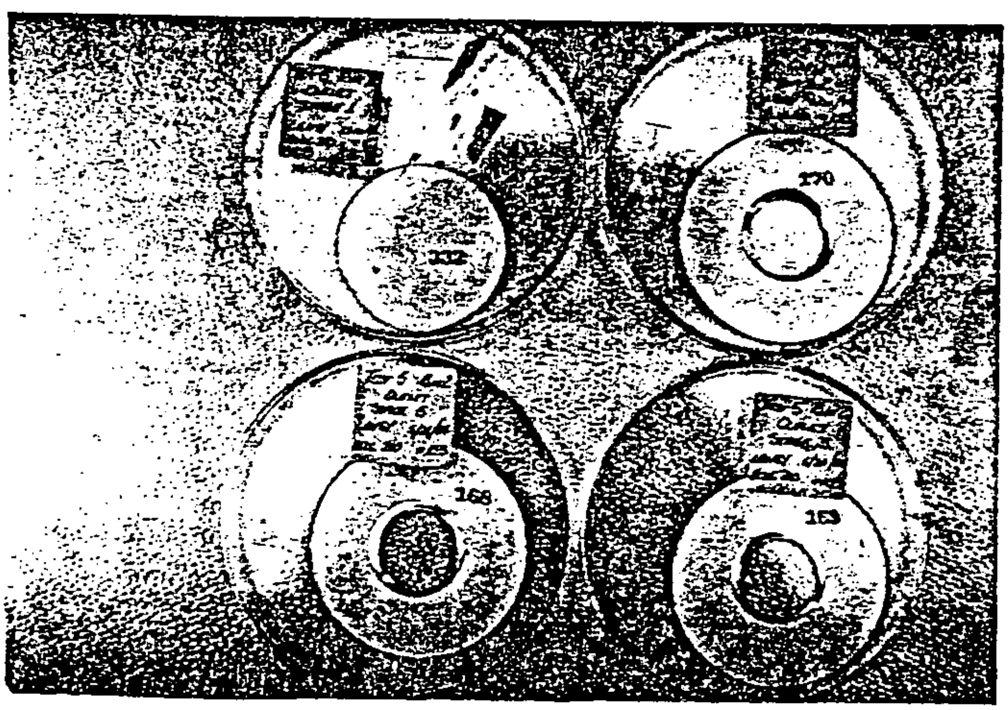
CHROME PLATING SCRUBBER # 103 BLDG. 210 LBNSY 24 MAY 84

RUN 2

INLET IMPACTOR STAGES -

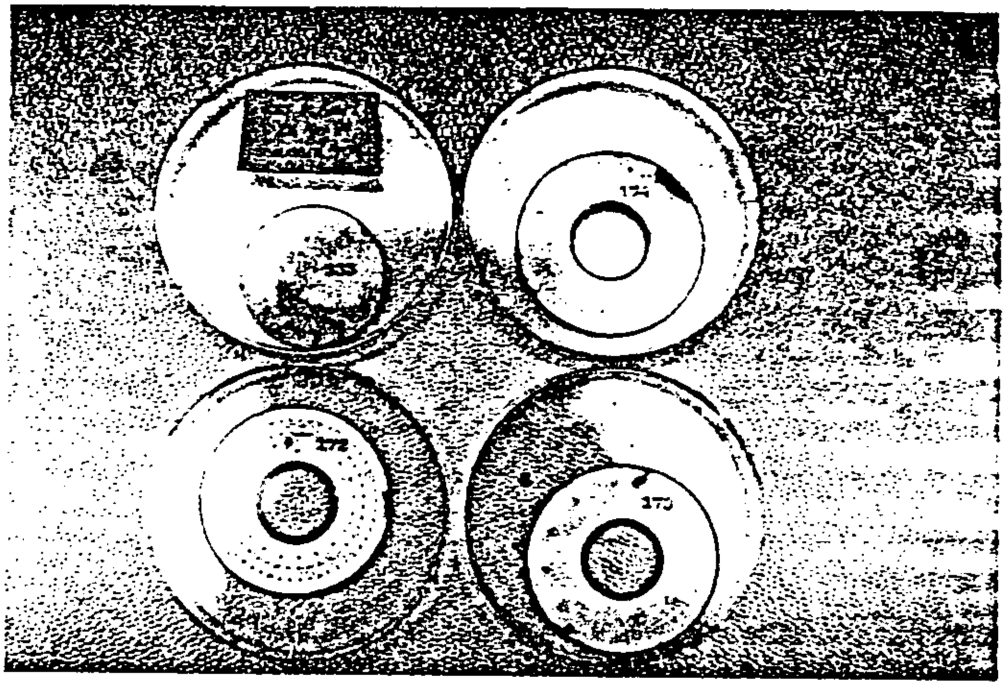


OUTLET IMPACTOR STAGES -

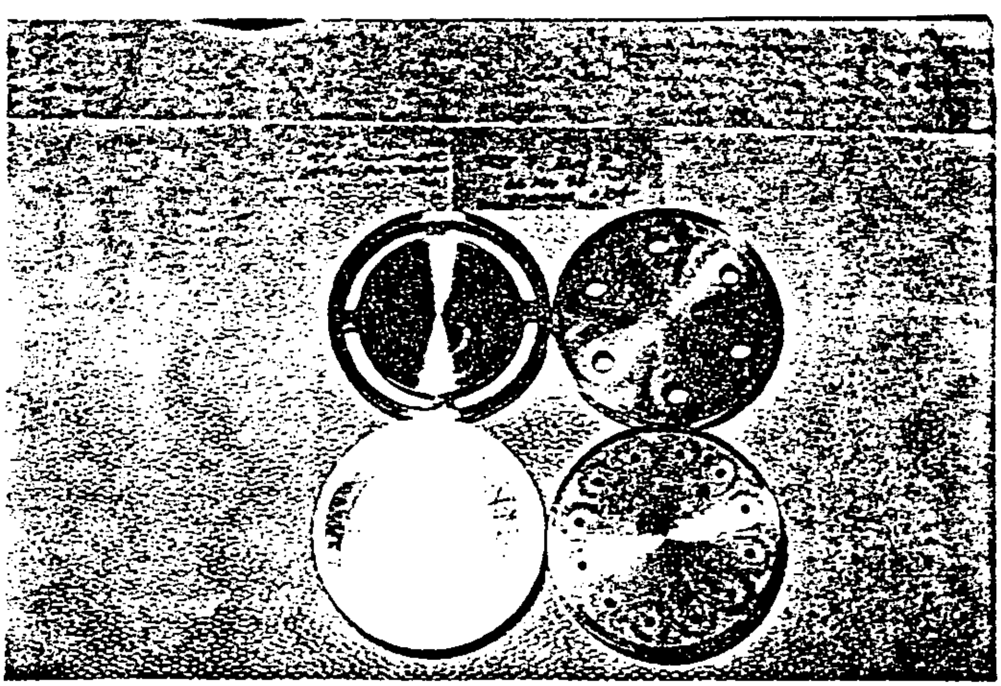


HCl SCRUBBER # 104 BLDG. 210 LBNSY 26 MAY 84

INLET IMPACTOR STAGES -

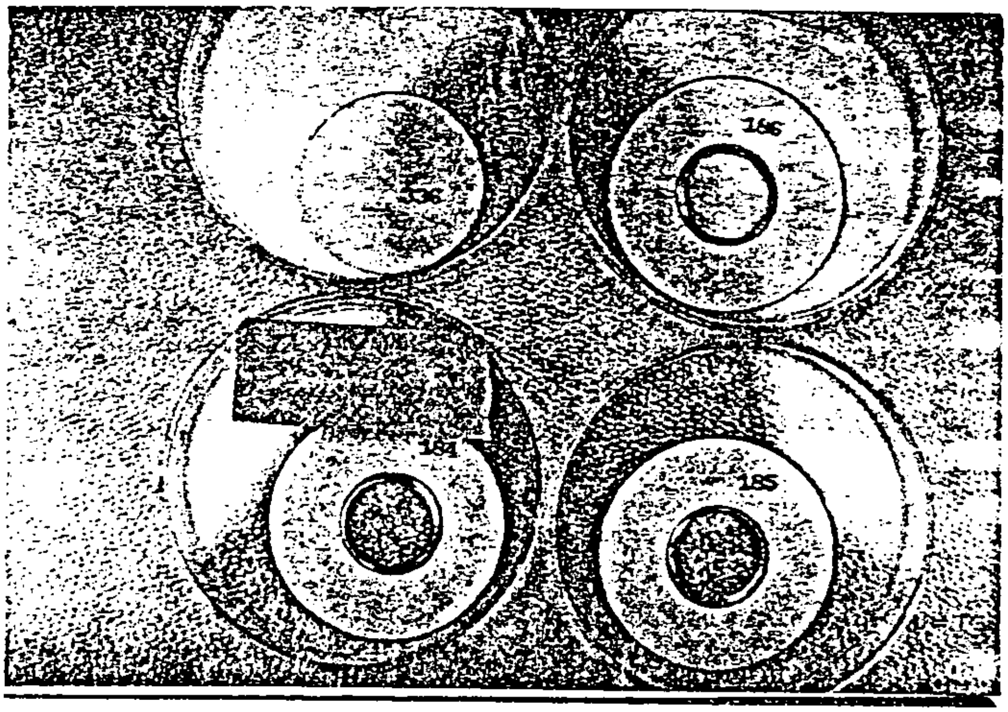


UNDERSIDE OF IMPACTOR FILTER SUPPORT PLATES (NOTE PATTERNS OF COLLECTED AEROSOL)

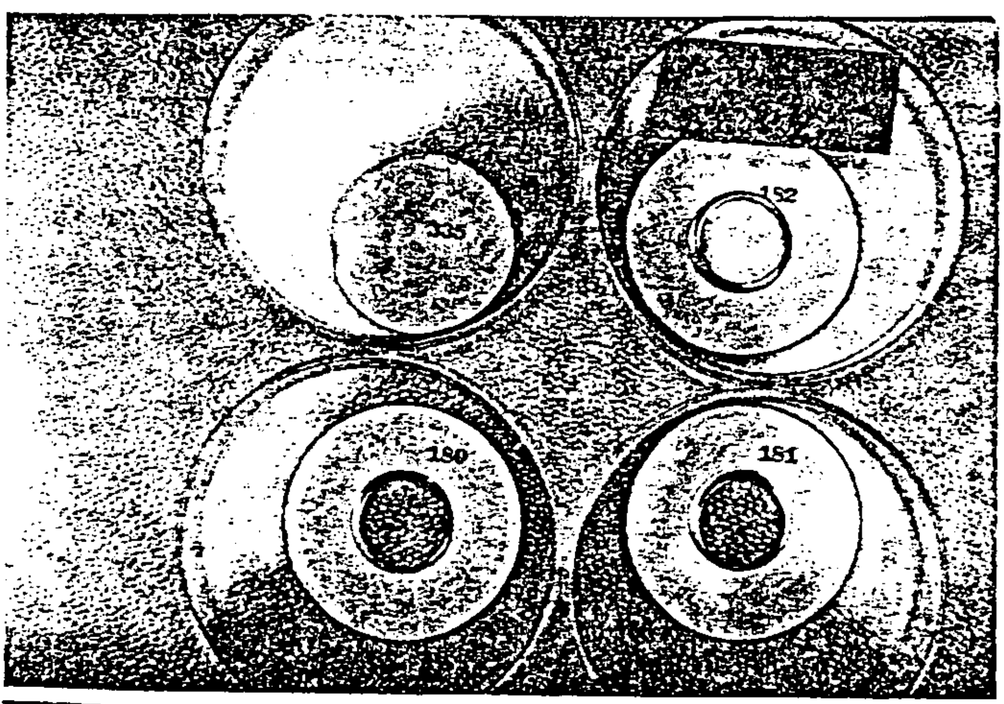


CHROMATE SCRUBBER #106 BLDG. 210 LBNSY 30 MAY 84

INLET IMPACTOR STAGES -



OUTLET IMPACTOR STAGES -



RESUME

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1984, January to June	Engineering Trainee Coal/Air Department Naval Energy & Environmental Support Activity Port Hueneme, California

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1977	Source Test Engineer Air Pollution Technology, Inc. San Diego, California
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1979-1981	M.S. Chemical Engineering Washington State Pullman, Washington
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1982-1984	Mechanical Engineer NAVOSH Department Naval Energy and Environmental Support Activity