apcd

County of San Diego

R. J. Sommerville
Air Pollution Control Officer

May 8, 1990

[redacted]

Mark Lough
U.S. Silica
3231 Oceanside Blvd.
Oceanside, CA 92056

SUBJECT: **RENEWAL TEST REPORT**

The enclosed test report is the result of testing done at your facility.

If you have any questions, please call me at (619) 694-3359.

C. W. Ridenour
Senior Air Pollution Chemist

Enclosures

AIR POLLUTION CONTROL DISTRICT
9150 Chesapeake Drive. San Diego, California 92123-1095
(619) 565-5901

SAN DIEGO AIR POLLUTION CONTROL DISTRICT
9150 CHESAPEAKE DRIVE
SAN DIEGO, CA. 92123

SUMMARY:
SOURCE TEST OF PARTICULATE EMISSIONS TO THE ATMOSPHERE

TEST SITE: U.S. Silica
3231 Oceanside Blvd.
Oceanside Ca. 92056

TEST #: 89234 P/O # : 000236 TEST DATE: 22 AUG. 89

EQUIPMENT: Fluid bed dryer on a glass sand process line: crushing, drying, & screening systems with dust laden air from bagging & lower bin areas vented to an antipol wet type air scrubber, 24000 dscfm, w/ 250 gpm of water. (appl. #10658)
(appl. #860749 gea)
UNIT TESTED: Venturi-type scrubber

SITE PERSONNEL: Mark Lough
APCD PERSONNEL: T. Wood, J. Jackson,and G. Mazis
REPORT BY: J.Jackson DATE 18 DEC. 89
APPROVED BY: C.W. Ridenour DATE: 5/8/90
C.W. RIDENOUR
SENIOR AIR POLLUTION CHEMIST

PARAMETERS:	MEASURED:
STACK GAS FLOW RATE (DSCFM):	19,617
STACK GAS TEMPERATURE °F (AVG):	137
PRODUCTION RATE (AVG):	70.8 tons/hr.

RESULTS:

TEST	PERMIT LIMIT	MEASURED	PERFORMANCE
RULE 54 DUST AND FUME	40.00 lb/hr	1.71 lbs/hr	PASSED
RULE 50: General	20 %	10 %	PASSED

TEST REFERENCE:
San Diego Air Pollution Control District Quality Assurance Manual Method 5 for Particulate Emissions from Stationary Sources.

TEST DESCRIPTION

Introduction: This report presents the results of particulate loading and gas volume tests at U.S. Silica The test was performed on a Venturi-type scrubber serving the fluidized bed dryer.

System Description:

Glass sand is dried in a fluid bed dryer which is fired by natural gas. The exhaust from this dryer is pulled through a venturi-type scrubber, the emissions to the atmosphere from this scrubber are the subject of this report.

Procedures:
The procedures and equipment utilized in performing these tests are based on EPA New Source Performance Standards Method 5. The sampling train was modified to exclude the front-end filter and include a back-end filter, per the San Diego Air Pollution Control District Method 5 testing guidelines. The calculations were designed to include the impinger catch so that the test results can be compared to Rule 54 of SDAPCD.

Velocity Traverse:
Prior information regarding the stack velocity profile eliminated the need for a separate exploratory traverse. Temperature and pitot tube data collected during actual sampling were used to calculate stack volume.

Particulate Sampling:
This sample consisted of 28 traverse points, 7 from each of 4 sample ports as shown in Figure 1&2. Two of the ports were inaccessible due to probe interference with railing. The sample was collected 114 inches below the top of the stack. Field data associated with samp collection has been transferred to computer printout and is shown in the report. Calculations were done by computer and are also shown within the report.

Gas Analysis:
An integrated bag sample was collected on site and measured. The oxygen and carbon dioxide content of the stack gas was measured using a Teledyne model # 320P-4 serial # 66676, and an Anarad gas analyzer model # AR-400, serial # 305, respectively, as per Method 3 in SDAPCD test guidelines.

Comments:
This report provides sufficient information to determine that the site is in compliance despite equipment problems which prevented sampling in the standard configuration.

SITE: U.S. Silica

OPERATOR: J.Jackson

TEST DATE: 22 AUG. 89

TEST: 89234

DATA SUMMARY: #

TRAVERSE POINT NUMBER	GAS METER READING (Vm), ft3	PRESS. DIFF. ACROSS PITOT TUBES	PRESS. DIFF. ACROSS ORIF.	DRY GAS METER TEMPERATURE		STACK TEMP	IMP. TEMP	STACK FLOW (velocity)
				INLET	OUTLET			
	9.865		ACTUAL					
1		.10	0.10	94	102	174	67	19.88
2		.10	0.10	93	113	174	65	19.88
3		.20	0.12	92	116	174	63	28.12
4		.50	0.27	92	119	174	57	44.46
5		.80	0.48	92	122	161	53	55.66
6		.70	0.42	92	122	153	53	51.73
7		.40	0.24	92	122	147	55	38.91
8		.15	0.18	92	117	140	67	23.69
9		.35	0.21	92	122	160	61	36.79
10		.60	0.36	93	126	152	54	47.85
11		1.15	0.70	93	128	145	52	65.87
12		1.60	0.95	94	130	138	51	77.25
13		1.60	0.95	94	131	136	50	77.12
14		1.00	0.60	94	130	135	52	60.92
15		.50	0.30	99	109	119	64	42.49
16		1.00	0.60	98	126	118	53	60.04
17		1.60	0.95	97	129	121	53	76.14
18		2.10	1.25	96	130	119	51	87.08
19		2.70	1.61	96	129	122	52	99.00
20		2.70	1.61	95	125	118	52	98.66
21		1.50	0.90	94	121	122	53	73.79
22		1.40	0.84	96	114	118	57	71.04
23		2.25	1.34	98	127	119	51	90.14
24		2.95	1.76	95	128	119	51	103.21
25		3.75	2.25	95	133	120	52	116.47
26		4.50	2.69	95	136	121	52	127.69
27		4.10	2.45	95	135	121	53	121.89
28	50.959	2.80	1.70	95	135	113	46	100.03
29								
30								
31								
32								

Pressures are in inches of water, temperatures are in degrees Fahrenheit, velocities are in ft/sec. All measurements are actual - uncorrected - values.

Average:	Vm	ΔP	ΔH	t1	t2	ts	ti	vs
	41.094	1.54	0.93	94	124	137	55	68.42

DATA SUMMARY:

PRESSURES

P bar 29.9 in Hg

P static 3.50 in H2O

Ps 30.2 in Hg

AVERAGE TEMPERATURES

ts = 137 F

tm = 1/2(ave.t1+ave.t2) = 109 F

ti = 55 F

VOLUMES

Vm, meter 41.094 ft^3

Vlc, impingers 109.4 ml

VAPOR PRESSURES

Vpw @ imp = 0.436 inHg

METER BOX PARAMETERS

ΔH@ = 2.72 inH2O

ΔP = 1.54 inH2O

ΔH = .93 inH2O

METER BOX I.D.# D-337

NOZZLE AND PROBE

Dn = 0.146 in

An = Dn^2*π/4 = .0167 in^2

Cp = 0.840

Y = .9898

STACK MEASUREMENTS

%CO2 1.40

%CO .00

%O2 19.50

%N2 79.10

Ø = sampling time 98 minutes

mn=particulate collect'd .0249 grams

STACK PARAMETERS

Stack Diameter = 2.50 ft

Ao=Area stack = 6.25 ft^2

CALCULATIONS:

				EQUATION NUMBER
corr Vwm = ((Vm*Vpw@imp/Ps)*Pm*Tstd)/(Tm*Pstd) = water volume correction at meter w/o silica gel	=	0.5518	ft^3	1
Vm std = (Vm*Y*Tstd*Pm/(Pstd*Tm))-corr Vwm = meter volume corrected to STP	=	37.23	ft^3	2
Pm= Pbar+(ΔH/13.6)= corrected pressure of meter	=	29.97	in Hg	3
Tm= (t1+t2)/2 + 460 = meter temperature	=	569.3	°R	4
Ts = ts+460 = corrected stack temperature	=	596.9	°R	5
Ps= Pbar + (P static/13.6)= corrected stack pressure	=	30.16	in Hg	6
Vw std = Vlc*∂*R*Tstd/(Pstd*Md)+corr Vwm = water volume at STP	=	5.72	ft^3	7
Bws = (Vw std+corr Vwm)/(Vw std+corr Vwm+Vm std) = moisture	=	0.1441		8
mn= grams of particulate (from laboratory sheet)	=	0.0249	grams	9
Cs = 15.43*mn/Vm std = grain loading (dry)	=	0.0103	grains/dscf	10

GAS ANALYSIS

component	gas comp.	Bws	Mw g/g*mole	Mw wet
H2O	.14	0.1441	18	2.59
		1 - Bws		
Oxygen	.20	0.8559	32	5.34
Carbon monoxide	.00	0.8559	28	0.00
Carbon dioxide	.01	0.8559	44	0.53
N2 + inerts	.79	0.8559	28	19.09

Md = 0.32*%O2+0.44*%CO2+0.28*(100-%O2-%CO2) = average molecular weight, dry	(g/g*mol)=	27.55
vs= 85.49*Cp*((Ts*ΔP)/(Ps*Ms))^.5 = stack velocity	(ft/s)=	68.42
Qs = (vs)*Ao*60 = stack flow rate	(acfm)=	25,658
Qstd =17.68*Qs*(1-Bws)*Ps/Ts =flow rate at STP	(dscfm)=	19,617
I = 144*100*Ts*(.002669*Vlc+(Vm/Tm)*Pm)/(60*Ø*vs*Ps*An) =isokinetic	(%) =	95.33
E = (0.00847)*(Qstd)*Cs = particulate emission rate	(lbs/hr) =	1.71

SUMMARY OF CALCULATIONS:

I = % isokinetics = 95.3 %

Cs = grain loading (dry) = 0.010 grains/dscf

E = particulate emission rate = 1.71 lbs/hr

% CO2 = 1.40 %

NOMENCLATURE:

* = multiplication
/ = division
^ = exponentiation
Vm = sample gas volume, uncorrected = (ft^3)
ΔP = root mean pitot tube differential pressure
= (summation(press.diff. across pitot tubes^.5)/number entries)^2 = (in H2O)
ΔH = average differential pressure across the orifice = (in H2O)
t1 = dry gas meter inlet temperature = (°F)
t2 = dry gas meter outlet temperature = (°F)
ts = stack temperature = (°F)
ti = Impinger out temperature = (°F)
vs = stack gas velocity = 85.49*Cp*(Ts*ΔP/(Ps*Ms))^.5 = (ft/s)
Pbar = barometric pressure = (in Hg)
Pstatic = stack static pressure = (in Hg)
Ps = Absolute stack pressure = Pbar +(Pstatic/13.6) = (in Hg)
tm = dry gas meter temperature =(t1+t2)/2 = (°F)
Vlc = collected water,impingers = (ml)
Vpw = Vapor pressure of water = (in Hg)
ΔH @ = orifice pressure differential that equates to 0.75 cfm of air @ 68ºF and 29.92 in Hg
Dn = nozzle diameter = (in)
An = nozzle area = π*Dn^2/4 = (in^2)
π = the ratio of circumference of a circle to its diameter = 22/7 (dimensionless)
Cp = pitot tube coefficient = (dimensionless)
Y = meter box coefficient = (dimensionless)
CO2 = carbon dioxide = (%)
CO = carbon monoxide = (%)
O2 = oxygen = (%)
N2 = nitrogen = (%)
Ø = sampling time = (minutes)
mn = particulate found in sample train = (grams)
Ao = stack area = stack diameter^2*π/4 if round; length *width if rectanglar = (ft^2)
Corr Vwm = ((Vm*Vpw@imp/Ps)*Pm*Tstd)/(Tm*Pstd) = (ft^3)
Pm = absolute meter pressure = Pbar+(ΔH/13.6) = (in Hg)
Tstd = temperature at standard conditions = (528°R)
Tm = dry gas meter temperature =(t1+t2)/2+460 = (°R)
Pstd = pressure at standard condition = (29.92 in. Hg)
Vm std = corrected volume of meter = Vm*Y*T std*Pm/(Pstd*Tm)-corr Vwm = (ft^3)
Ts = stack temperature = (°R)
Vw std = water volume at STP = Vlc*∂*R*Tstd/(Pstd*Md) = (ft^3)

NOMENCLATURE: cont.

∂ = density of water at STP = 0.002201 = (lb/ml)
R = ideal gas constant = 21.85 in. Hg*ft^3/°R*lb*mole
Md = dry stack gas molecular weight = 0.32*%O2+0.44*%CO2+0.28(100-%O2-%CO2)
= (g/g*mole)
Bws = fractional stack gas moisture content = (Vw std+Corr Vwm)/(Vwstd+Corr Vwm+Vm std
= (%/100)
Cs = grain loading = 15.430*mn/Vm std = (grains/dscf)
Mw = molecular weight = (g/g*mole)
Ms = wet stack gas molecular weight = Md*(1-Bws)+Bws*18 = (g/g*mole)
Qs = flow rate = vs*Ao*60 = (acfm)
Qstd = flow rate at standard conditions = 17.68*Qs*(1-Bws)*Ps/Ts = (dscfm)
I = isokinetics = 144*100*Ts*(.002669*Vlc+Vm/Tm)*Pm/(60*Ø*vs*Ps*An) = (%)
E = particulate emissions rate = 0.00847*Cs*Qstd = (lbs/hr)

CONSTANTS:

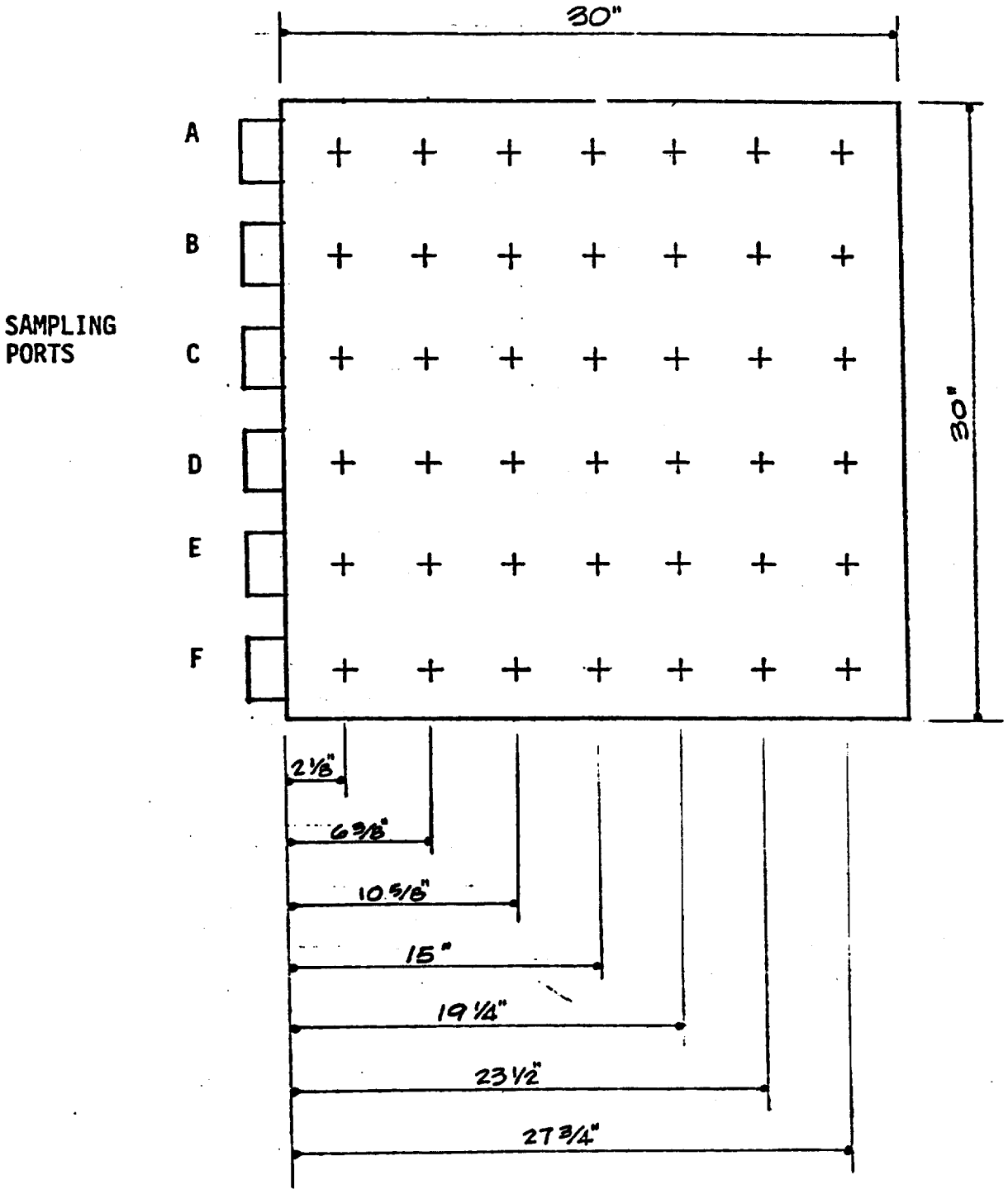
0.00847 lb/(gr*min/hr) = 1 lb/7000grains*60 min/hr
13.6 in H2O/in Hg
17.68 °R/in Hg
60 sec/min
32 g/g*mole = O2 molecular weight
44 g/g*mole = CO2 molecular weight
28 g/g*mole = N2 molecular weight
18 g/g*mole = H2O molecular weight
85.49 (ft/sec)*(lb*in Hg/(lb*mole*°R*in H2O))^.5
0.04707 = ft^3/ml
460 (demensionless) = conversion °F to °R
144 in^2/ft^2
15.43 gr/g
0.002669 in Hg*ft^3/(°R*ml)

SAN DIEGO AIR POLLUTION CONTROL DISTRICT

TRAVERSE POINTS

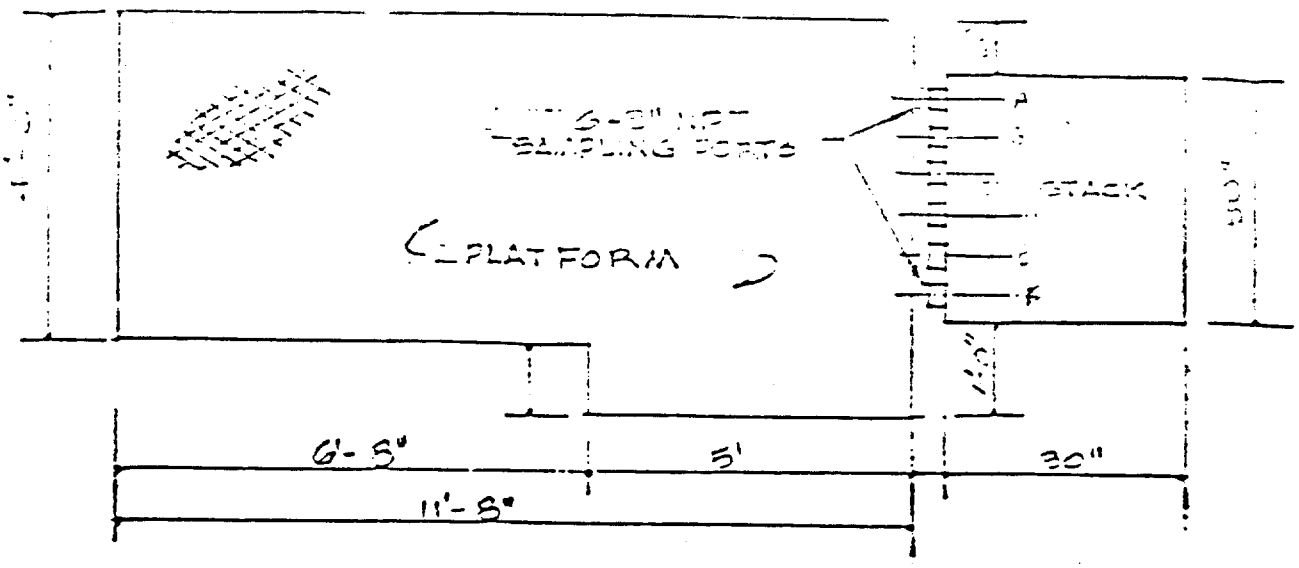
CRYSTAL SILICA

EXHAUST FROM FLUID BED DRYER

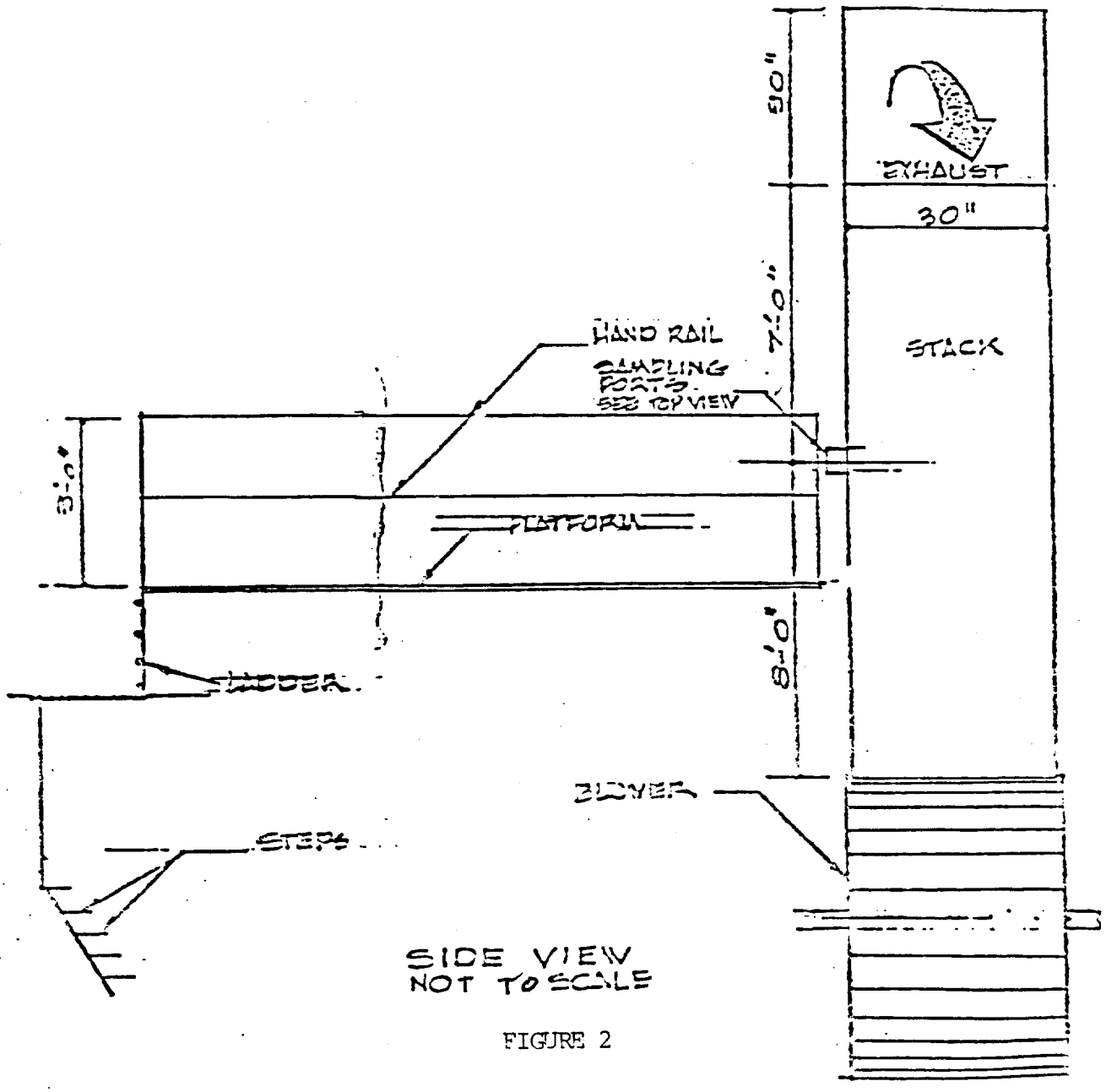


* Ports E&F were not unaccessible, thus not traversed.

Figure 1



TOP VIEW
NOT TO SCALE



SIDE VIEW
NOT TO SCALE

FIGURE 2