Modeling Data
Scrubbers 101 & 102

Exhaust flow rate:	
acfm	48,600
scfm	
Stack diameter, in	58 in
Stack height, ft	50 ft
Temperature, F	75 F
Catalytic	

Rain cap?	Yes	No*
		x

*Or with a swing raincap fully open when operated.

Data for modeling:

Actual volume flow rate (acfm)	48,600 acfm
Stack diameter, m	1.47 m
Stack height, m	15.24 m
Temperature, K	297 K

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	87.23	398.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

2200.	16.83	6	1.0	1.1	10000.0	38.60	176.62	85.14	NO
2300.	15.92	6	1.0	1.1	10000.0	38.60	182.71	87.48	NO
2400.	15.10	6	1.0	1.1	10000.0	38.60	188.69	89.77	NO
2500.	14.35	6	1.0	1.1	10000.0	38.60	194.57	92.01	NO
2600.	13.67	6	1.0	1.1	10000.0	38.60	200.35	94.20	NO
2700.	13.04	6	1.0	1.1	10000.0	38.60	206.04	96.35	NO
2800.	12.47	6	1.0	1.1	10000.0	38.60	211.64	98.46	NO
2900.	11.94	6	1.0	1.1	10000.0	38.60	217.15	100.52	NO
3000.	11.45	6	1.0	1.1	10000.0	38.60	222.59	102.55	NO
3500.	9.479	6	1.0	1.1	10000.0	38.60	248.61	112.20	NO
4000.	8.064	6	1.0	1.1	10000.0	38.60	272.96	121.13	NO
4500.	7.003	6	1.0	1.1	10000.0	38.60	295.89	129.49	NO
5000.	6.181	6	1.0	1.1	10000.0	38.60	317.61	137.36	NO
5500.	5.526	6	1.0	1.1	10000.0	38.60	338.27	144.83	NO
6000.	4.993	6	1.0	1.1	10000.0	38.60	358.00	151.94	NO
6500.	4.552	6	1.0	1.1	10000.0	38.60	376.90	158.74	NO
7000.	4.181	6	1.0	1.1	10000.0	38.60	395.06	165.27	NO
7500.	3.864	6	1.0	1.1	10000.0	38.60	412.55	171.56	NO
8000.	3.591	6	1.0	1.1	10000.0	38.60	429.45	177.63	NO
8500.	3.354	6	1.0	1.1	10000.0	38.60	445.79	183.50	NO
9000.	3.146	6	1.0	1.1	10000.0	38.60	461.64	189.20	NO
9500.	2.961	6	1.0	1.1	10000.0	38.60	477.02	194.73	NO
10000.	2.797	6	1.0	1.1	10000.0	38.60	491.98	200.11	NO
15000.	1.794	6	1.0	1.1	10000.0	38.60	623.68	247.63	NO
20000.	1.319	6	1.0	1.1	10000.0	38.60	733.36	287.45	NO
25000.	1.042	6	1.0	1.1	10000.0	38.60	829.18	322.40	NO
30000.	.8608	6	1.0	1.1	10000.0	38.60	915.28	353.92	NO
40000.	.7228	4	1.0	1.1	320.0	68.88	1552.30	1553.24	NO
50000.	.6427	4	1.0	1.1	320.0	68.88	1745.81	1750.07	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 25. M:

398.	87.23	6	1.0	1.1	10000.0	38.60	41.30	26.11	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
50.	37.30	3	10.0	10.9	3200.0	19.96	10.97	10.08	NO
1000.	44.30	6	1.0	1.1	10000.0	38.60	93.21	51.03	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

10/28/08
13:02:27

```
 ***  SCREEN3 MODEL RUN  ***
 *** VERSION DATED 96043 ***

Scrubbers 101 & 102

SIMPLE TERRAIN INPUTS:
   SOURCE TYPE            =        POINT
   EMISSION RATE (G/S)    =      1.00000
   STACK HEIGHT (M)       =      15.2400
   STK INSIDE DIAM (M)    =       1.4700
   STK EXIT VELOCITY (M/S)=      13.5147
   STK GAS EXIT TEMP (K)  =     297.0000
   AMBIENT AIR TEMP (K)   =     293.0000
   RECEPTOR HEIGHT (M)    =        .0000
   URBAN/RURAL OPTION     =        URBAN
   BUILDING HEIGHT (M)    =        .0000
   MIN HORIZ BLDG DIM (M) =        .0000
   MAX HORIZ BLDG DIM (M) =        .0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

   STACK EXIT VELOCITY WAS CALCULATED FROM
   VOLUME FLOW RATE =   48600.000      (ACFM)

BUOY. FLUX =      .964 M**4/S**3;  MOM. FLUX =   97.341 M**4/S**2.

*** FULL METEOROLOGY ***

**********************************
*** SCREEN AUTOMATED DISTANCES ***
**********************************

*** TERRAIN HEIGHT OF    0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***
```

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
25.	.4943	3	10.0	10.9	3200.0	19.96	5.57	5.11	NO
100.	59.74	3	4.0	4.4	1280.0	28.94	21.92	20.38	NO
200.	55.05	4	2.5	2.8	800.0	36.70	31.40	27.88	NO
300.	77.50	6	1.0	1.1	10000.0	38.60	31.89	21.02	NO
400.	87.22	6	1.0	1.1	10000.0	38.60	41.39	26.16	NO
500.	82.23	6	1.0	1.1	10000.0	38.60	50.65	30.97	NO
600.	73.34	6	1.0	1.1	10000.0	38.60	59.64	35.46	NO
700.	64.40	6	1.0	1.1	10000.0	38.60	68.39	39.68	NO
800.	56.53	6	1.0	1.1	10000.0	38.60	76.88	43.66	NO
900.	49.87	6	1.0	1.1	10000.0	38.60	85.15	47.44	NO
1000.	44.30	6	1.0	1.1	10000.0	38.60	93.21	51.03	NO
1100.	39.65	6	1.0	1.1	10000.0	38.60	101.05	54.47	NO
1200.	35.73	6	1.0	1.1	10000.0	38.60	108.71	57.76	NO
1300.	32.43	6	1.0	1.1	10000.0	38.60	116.18	60.92	NO
1400.	29.60	6	1.0	1.1	10000.0	38.60	123.48	63.96	NO
1500.	27.18	6	1.0	1.1	10000.0	38.60	130.61	66.90	NO
1600.	25.08	6	1.0	1.1	10000.0	38.60	137.59	69.74	NO
1700.	23.25	6	1.0	1.1	10000.0	38.60	144.43	72.49	NO
1800.	21.65	6	1.0	1.1	10000.0	38.60	151.12	75.16	NO
1900.	20.23	6	1.0	1.1	10000.0	38.60	157.68	77.75	NO
2000.	18.97	6	1.0	1.1	10000.0	38.60	164.11	80.28	NO
2100.	17.84	6	1.0	1.1	10000.0	38.60	170.43	82.74	NO

Intrc

SCREENING INPUT

Table A

modeling emissions rate	7.94	lb/hr
modeling emissions rate	34.76	tons/yr
Max hr/dy	24	hr/day
day per week	7	dy/wk
wk/yr	52	wk/yr
MODELING RESULTS -MAX ONE HOUR		
Distance residence	1000.00	meter
Max. 1-hour Conc. Residence	43.14	ug/m3
Annualized Conc. Residence	3.45	ug/m3
Distance Commerical	418.00	meter
Max. 1-hour Conc. Commerical	79.65	ug/m3
Annualized Conc. Commercial	6.37	ug/m3

Annualized X/Q

X/Q Residential	0.09928	(ug/m^3)/(tons/yr)
X/Q Commercial	0.1833	(ug/m^3)/(tons/yr)

Max. X/Q

X/Q Residential	5.43564	(ug/m^3)/(lbs/hr)
X/Q Commercial	10.0359	(ug/m^3)/(lbs/hr)

Table B

	Interpolation								
	Stc Ht: 50			row: 3					
	Residential			Industrial			X/Q for one-in-a-million		
	near	actual	far	near	actual	far	near	actual	far
distance	900.00	1000.00	1100.00	400.00	418.00	500.00	900.00	1760.43	500.00
X/Q - 1 hr conc ug/m3	52.40	43.14	41.17	79.46	79.65	76.76	52.40		76.76
X/Q Annualized (ug/m^3)/(tons/yr)	0.12	0.10	0.09	0.18	0.18	0.18	0.12		0.18

CONVERSION CALCULATOR To Convert from British to Metric Units

SCREEN INPUT DATA

actual exhuast rate	60000.00	acfm
Temp.	75.00	degree F
Stack diameter	72.00	in
Stack height	50.00	ft
modeling emissions ra	7.94	lb/hr

SCREEN INPUT DATA

Temp	296.889	degrees k
Stack dia	1.829	meter
Stack area	2.626	square meter
Stack height	15.240	meter
Stack velocity	10.786	m/s
modeling emissions ra	1.00132	gr/s

A/N: 495576 Date: 02/11/09

	HIC - Commercial												
Compound	AL	BN	CV	DEV	END	EYE	HEM	IMM	KID	NS	REP	RESP	SKIN
Arsenic and arsenic compou			6.34E-03	6.34E-03						6.34E-03			
Phosphoric acid												1.35E-04	
Hydrogen chloride (hydroch												1.04E-03	
Hydrogen fluoride (hydrof													
Sulfuric acid and oleum												4.78E-03	
Total			6.34E-03	6.34E-03						6.34E-03		5.96E-03	

6b. Hazard Index Chronic

HIC = [Q(ton/yr) * (X/Q) * MET * MP] / Chronic REL

	HIC - Residential												
Compound	AL	BN	CV	DEV	END	EYE	HEM	IMM	KID	NS	REP	RESP	SKIN
Arsenic and arsenic compou			3.53E-03	3.53E-03						3.53E-03			
Phosphoric acid												7.29E-05	
Hydrogen chloride (hydroch												5.64E-04	
Hydrogen fluoride (hydrof													
Sulfuric acid and oleum												2.59E-03	
Total			3.53E-03	3.53E-03						3.53E-03		3.23E-03	

	HIA - Commercial									
Compound	AL	CV	DEV	EYE	HEM	IMM	NS	REP	RESP	SKIN
Arsenic and arsenic compou			5.95E-03					5.95E-03		
Phosphoric acid										
Hydrogen chloride (hydroch				5.60E-05					5.60E-05	
Hydrogen fluoride (hydrof				6.23E-04					6.23E-04	
Sulfuric acid and oleum									4.99E-04	
Total			5.95E-03	6.79E-04				5.95E-03	1.18E-03	

A/N: 495576 Date: 02/11/09

6a. Hazard Index Acute

HIA = [Q(lb/hr) * (X/Q)max] *AF/ Acute REL

	HIA - Residential									
Compound	AL	CV	DEV	EYE	HEM	IMM	NS	REP	RESP	SKIN
Arsenic and arsenic compou			3.22E-03					3.22E-03		
Phosphoric acid										
Hydrogen chloride (hydroch				3.03E-05					3.03E-05	
Hydrogen fluoride (hydrof				3.38E-04					3.38E-04	
Sulfuric acid and oleum									2.70E-04	
Total			3.22E-03	3.68E-04				3.22E-03	6.38E-04	

6. Hazard Index

HIA = [Q(lb/hr) * (X/Q)max] * AF / Acute REL

HIC = [Q(ton/yr) * (X/Q) * MET * MP] / Chronic REL

Target Organs	Acute	Chronic
Alimentary system (liver) - AL		
Bones and teeth - BN		
Cardiovascular system - CV		6.34E-03
Developmental - DEV	5.95E-03	6.34E-03
Endocrine system - END		
Eye	6.79E-04	
Hematopoietic system - HEM		
Immune system - IMM		
Kidney - KID		
Nervous system - NS		6.34E-03
Reproductive system - REP	5.95E-03	
Respiratory system - RES	1.18E-03	5.96E-03
Skin		

A/N: 495576 Date: 02/11/09

TIER 3 RESULTS

5. MICR

MICR = CP (mg/(kg-day))^-1 * Q (ton/yr) * (X/Q) * Afann * Met * DBR * EVF * 1.E-6 * MP

Compound	Residential	Commercial
Arsenic and arsenic compounds (inorganic)	9.24E-07	3.18E-07
Phosphoric acid		
Hydrogen chloride (hydrochloric acid)		
Hydrogen fluoride (hydrofluoric acid)		
Sulfuric acid and oleum		
Total	**9.24E-07**	**3.18E-07**
	Pass	**Pass**

No Cancer Burden, MICR<1.E=-6

5a. Cancer Burden		no
X/Q for one-in-a-million:		
Distance (meter		no data
Area (km2):		
Population:		
Cancer Burden:		

4. Emission Calculations

Compound	uncontrolled R1-lb/hr	controlled R2-lb/hr	R2-lb/yr	R2-ton/yr
Arsenic and arsenic compounds (inorganic)	1.28E-04	1.28E-04	1.1181218	0.0005591
Phosphoric acid	1.18E-03	1.18E-03	10.286528	0.0051433
Hydrogen chloride (hydrochloric acid)	1.17E-02	1.17E-02	102.33022	0.0511651
Hydrogen fluoride (hydrofluoric acid)	1.49E-02	1.49E-02	130.23461	0.0651173
Sulfuric acid and oleum	5.97E-03	5.97E-03	52.142844	0.0260714
Total	3.39E-02	3.39E-02	2.96E+02	1.48E-01

3. Rule 1401 Compound Data

Code	Compound	R1 - uncontrolled (lbs/hr)	R2 - controlled (lbs/hr)	CP	MP MICR Resident	MP MICR Worker	MP Chronic Resident	MP Chronic Worker	REL Chronic	REL Acute
a13	Arsenic and arsenic compounds (inorganic)	1.28E-04	1.28E-04	1.20E+01	4.783133	4.572289	1.90625	1.85625	0.03	0.19
p7	Phosphoric acid	1.18E-03	1.18E-03		1	1	1	1	7	
h11	Hydrogen chloride (hydrochloric acid)	1.17E-02	1.17E-02		1	1	1	1	9	2100
f2	Hydrogen fluoride (hydrofluoric acid)	1.49E-02	1.49E-02		1	1	1	1		240
s8	Sulfuric acid and oleum	5.97E-03	5.97E-03		1	1	1	1	1	120
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
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					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		

TIER 3 SCREENING RISK ASSESSMENT

A/N:	495576	Application deemed complete date	02/11/09
Fac:	International Rectifier		

2. Tier 2 Data

MET Factor	1.00
4 hr	0.85
6 or 7 hrs	0.71

Dispersion Factors

3	3A & 3B For Chronic X/Q
6	For Acute X/Q

Dilution Factors (ug/m3)/(tons/yr)

Receptor	X/Q	X/Qmax
Residential	0.099281096	5.43564
Commercial	0.18330411	10.0359

Adjustment and Intake Factors

	Afann	DBR	EVF
Residential	1	302	0.96
Worker	1	149	0.38

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South Coast Air Quality Management District
21865 E.Copley Drive
Diamond Bar, CA 91765

FOR COMBUSTION SOURCES, FILL IN THE DATA ON THE LEAN BURN, RICH BURN, BOILER, AND DIESEL SHEETS
THE CHEMICALS AND EMISSION RATES ARE AUTOMATICALLY COPIED TO THE TABLES BELOW - DO NOT CHANGE THESE TABLES

LEAN BURN ICE		R1 - uncontroll	R2 - controlled
Code	Compound	lbs/hr	lbs/hr
A1	Acetaldehyde	1.71E-01	3.93E-03
A3	Acrolein	1.05E-01	2.42E-03
B1	Benzene (includi	9.00E-03	2.07E-04
B9	Butadiene, 1,3-	5.46E-03	1.26E-04
C3	Carbon tetrachlo	7.51E-04	1.73E-05
D6	Dichloroethane,	4.83E-04	1.11E-05
E4	Ethyl benzene	8.12E-04	1.87E-05
E7	Ethylene dibromi	9.06E-04	2.08E-05
E8	Ethylene dichlori	4.83E-04	1.11E-05
F3	Formaldehyde	1.08E+00	2.48E-02
H8	Hexane (n-)	2.27E-02	5.22E-04
M6	Methanol (methy	5.11E-02	1.18E-03
M13	Methylene chlori	4.09E-04	9.41E-06
P3	Phenol	4.91E-04	1.13E-05
P9	PolyCyclic Arom	5.50E-04	1.27E-05
P12	Benzo[b]fluora	3.40E-06	7.81E-08
P15	Chrysene	1.42E-05	3.26E-07
P30	Napthalene	1.52E-03	3.50E-05
S6	Styrene (vinyl be	4.83E-04	1.11E-05
T1	Tetrachloroethan	8.18E-04	1.88E-05
T3	Toluene (methyl	8.35E-03	1.92E-04
T7	Trichloroethane,	6.51E-04	1.50E-05
V5	Vinyl chloride (cl	3.05E-04	7.01E-06
X1	Xylenes (isomers	3.76E-03	8.66E-05
c7	Chlorobenzene	6.22E-04	1.43E-05
c14	Chloroform(trich	5.83E-04	1.34E-05

RICH BURN ICE		R1 - uncontroll	R2 - controlled
Code	Compound	lbs/hr	lbs/hr
A1	Acetaldehyde	3.63E-03	8.35E-05
A3	Acrolein	3.42E-03	7.87E-05
B1	Benzene (includi	2.06E-03	4.73E-05
B9	Butadiene, 1,3-	8.63E-04	1.98E-05
C3	Carbon tetrachlo	2.30E-05	5.30E-07
C7	Chlorobenzene	1.68E-05	3.86E-07
C14	Chloroform(trich	1.78E-05	4.10E-07
D6	Dichloroethane,	1.47E-05	3.38E-07
E4	Ethyl benzene	3.23E-05	7.42E-07
E7	Ethylene dibromi	2.77E-05	6.37E-07
E8	Ethylene dichlori	1.47E-05	3.38E-07
F3	Formaldehyde	2.67E-02	6.13E-04
M6	Methanol (methy	3.98E-03	9.16E-05
M13	Methylene chlori	5.36E-05	1.23E-06
P9	PolyCyclic Arom	5.71E-05	1.31E-06
P30	Napthalene	1.26E-04	2.91E-06
S6	Styrene (vinyl be	1.55E-05	3.56E-07
T1	Tetrachloroethan	3.29E-05	7.57E-07
T3	Toluene (methyl	7.26E-04	1.67E-05
T7	Trichloroethane,	1.99E-05	4.58E-07
V5	Vinyl chloride (cl	9.34E-06	2.15E-07
X1	Xylenes (isomers	2.54E-04	5.83E-06

BOILERS		R1 - uncontrolled
Code	Compound	lbs/hr
A1	Acetaldehyde	2.33429E-05
A3	Acrolein	1.46571E-05
B1	Benzene (includi	4.34286E-05
E4	Ethyl benzene	5.15714E-05
F3	Formaldehyde	9.22857E-05
H8	Hexane (n-)	0.0000342
P30	Napthalene	1.62857E-06
P9	PolyCyclic Arom	5.42857E-07
P78	Propylene	0.003968286
T3	Toluene (methyl	0.000198686
X1	Xylenes (isomers	0.000147657

TIER 3 SCREENING RISK ASSESSMENT

Application deemed complete date:	02/11/09

A/N:	495579
Fac:	International Rectifier

1. Stack Data		Units
Hour/Day	24	hr/day
Day/Week	7	day/wk
Week/Year	52	wk/yr
Emission Units	lb/hr	
Control Efficiency		fraction range 0-1
Does source have TBACT?	NO	
Point or Volume Source ?	P	p or v
Stack Height or Building Height	50	feet
Area (For Volume Source Only)		ft²
Distance-Residential	1000	meters
Distance-Commercial	50	meters
Meteorological Station	Banning	

Source Type:	O - Other	
Screening Mode	YES	

Emission Units	lb/hr	
Source output capacity	n/a	n/a

FOR USER-DEFINED CHEMICALS AND EMISSIONS, FILL IN THE TABLE BELOW

USER DEFINED CHEMICALS AND EMISSIONS				R1 - uncont	Efficiency Facto	R2 - controlled
Code	Compound	lb/hr	Molecular Weight	lbs/hr	fraction range 0-	lbs/hr
a13	Arsenic and arsenic comp	1.28E-04	74.92	0.000128		0.00013
p7	Phosphonc acid	1.18E-03	98	0.0011775		0.00118
h11	Hydrogen chloride (hydro	1.17E-02	36.46	0.0117136		0.01171
f2	Hydrogen fluoride (hyd	0.01	20	0.0149078		0.01491
s8	Sulfunc acid and oleum	0.01	98.08	0.0059687		0.00597

			PM		PM10	
	Emission	From	Uncontr.	Contr.	Uncontr.	Contr.
lb/hr	H_3PO_4	PH_3	0.003	0.000161	0.003	0.000155
	SiO_2	$SiH_{4\,Poly}$	0.013	0.0013	0.013	0.0013
	SiO_2	$SiH_{4\,LTO}$	0.001	0.0001	0.001	0.0001
	SiO_2	SiH_2Cl_2	-	-	-	-
	HCl	SiH_2Cl_2	-	-	-	-
	H_3BO_3	BF_3	-	-	-	-
	HF	BF_3	-	-	-	-
	H_3BO_3	BCl_3	-	-	-	-
	HCl	BCl_3	-	-	-	-
	HF	C_2F_6	0.009	0.0004	0.01	0.0004
	HF	CHF3	-	-	-	-
	HF	CF4	-	-	-	-
	HCl	Cl_2	0.02	0.001	0.02	0.001
	HF	SF_6	0.029	0.0015	0.03	0.001
	H_2SO_4	SF_6	0.024	0.00120	0.02	0.00115
	HBr	HBr	-	-	-	-
	HF	NF3	-	-	-	-
	H_3PO_4	$POCl_3$	-	-	-	-
	HCl	$POCl_3$	-	-	-	-
	HCl	CH_3CCl_3	0.38	0.019	0.37	0.018
	HCl	CHCl3	-	-	-	-
	SiO2	C8H20SiO4	-	-	-	-
	Total		0.48	0.02	0.46	0.02
lb/day					11.10	0.57
lb/yr						207.80

Uncontrolled PM10

lb/hr (From the table above)		0.46	lb/hr
lb/day	0.46 lb/hr*24 hrs/day =	11.10	lb/day
lb/yr	11.1 lb/day*7 days/wk*52 wks/yr =	4,040.29	lb/yr

Controlled PM10 emissions:

lb/hr (From the table above)		0.02	lb/hr
lb/day	0.02 lb/hr*24 hrs/day =	0.57	lb/day
lb/yr	0.57 lb/day*7 days/wk*52 wks/yr =	207.80	lb/yr

NSR & AEIS Inputs:

	PM	PM10
lb/hr		
Uncontr.	0.48	0.46
Contr.	0.02	0.02
lb/day		
Uncontr.		11
Contr.		0.57
lb/yr (Contr.)		207.80

PM10

Uncontrolled	0.003 lb/hr*0.96 =	0.003 lb/hr
Controlled	0.000161 lb/hr*0.96 =	0.000155 lb/hr

SiO2 from SiH4 Poly (Poly process)

PM

Uncontrolled	With diffusion furnaces integrated filters control efficiency being counted	
	5.1 lb/month/30 days/month/24 hrs/day*(1/1)*60.08 lb/lbmole/32.12 lb/lbmole =	0.013 lb/hr
Controlled	0.013 lb/hr*(1-0.9) =	0.0013 lb/hr

PM10

Uncontrolled	0.013 lb/hr*0.96 =	0.013 lb/hr
Controlled	0.0013 lb/hr*0.96 =	0.0013 lb/hr

SiO2 from SiH4 (LTO process)

PM

Uncontrolled	With diffusion furnaces integrated filters control efficiency being counted	
	4.3 lb/month/30 days/month/24 hrs/day*(1/1)*60.08 lb/lbmole/32.12 lb/lbmole*(1-0.95) =	0.001 lb/hr
Controlled	0.001 lb/hr*(1-0.9) =	0.0001 lb/hr

PM10

Uncontrolled	0.001 lb/hr*0.96 =	0.001 lb/hr
Controlled	0.0001 lb/hr*0.96 =	0.0001 lb/hr

HF from C2F6

PM

Uncontrolled		
	36.37 lb/month/30 days/month/24 hrs/day*(6/1)*20.01 lb/lbmole/138.01 lb/lbmole*0.2 =	0.0088 lb/hr
Controlled	0.0088 lb/hr*(1-0.95) =	0.0004 lb/hr

PM10

Uncontrolled	0.0088 lb/hr*0.96 =	0.0084 lb/hr
Controlled	0.0004 lb/hr*0.96 =	0.0004 lb/hr

HCl from Cl2

PM

Uncontrolled	15.57 lb/month/30 days/month/24 hrs/day*(2/1)*36.46 lb/lbmole/70.91 lb/lbmole =	0.02 lb/hr
Controlled	0.02 lb/hr*(1-0.95) =	0.001 lb/hr

PM10

Uncontrolled	0.02 lb/hr*0.96 =	0.02 lb/hr
Controlled	0.001 lb/hr*0.96 =	0.00 lb/hr

HF from SF6

PM

Uncontrolled		
	32.07 lb/month/30 days/month/24 hrs/day*(6/1)*20.01 lb/lbmole/146.05 lb/lbmole*0.8 =	0.03 lb/hr
Controlled	0.03 lb/hr*(1-0.95) =	0.001 lb/hr

PM10

Uncontrolled	0.03 lb/hr*0.96 =	0.03 lb/hr
Controlled	0.001 lb/hr*0.96 =	0.001 lb/hr

H2SO4 from SF6

PM

Uncontrolled		
	32.07 lb/month/30 days/month/24 hrs/day*(1/1)*98.07 lb/lbmole/146.05 lb/lbmole*0.8 =	0.02 lb/hr
Controlled	0.02 lb/hr*(1-0.95) =	0.001196 lb/hr

PM10

Uncontrolled	0.02 lb/hr*0.96 =	0.02 lb/hr
Controlled	0.001196 lb/hr*0.96 =	0.001149 lb/hr

HCl from CH_3CCl_3

PM

Uncontrolled		
	334.11 lb/month/30 days/month/24 hrs/day*(3/1)*36.46 lb/lbmole/133.4 lb/lbmole =	0.380 lb/hr
Controlled	0.38 lb/hr*(1-0.95) =	0.019 lb/hr

PM10

Uncontrolled	0.38 lb/hr*0.96 =	0.37 lb/hr
Controlled	0.019 lb/hr*0.96 =	0.018 lb/hr

ATTACHMENT

Integrated Circuit

Subsequent: 460717/495576 A/N: 302034

Given:

		MW	Process	Through Vector	lb/month	Breakdown Information[Note 1]: Used Ui	Part of Ui Transformed To	Amount	Reacted to Form Acids
						(1)	(2)	(3)	(1)-(3)
AsH_3		77.95			-				
PH_3	Diffusion	34.00	Etch		0.81				
SiH_4	Diffusion	32.12	Poly	0%	5.10				
SiH_4	Diffusion	32.12	LTO	0%	4.30				
SiH_2Cl_2		101.01							
BF_3		67.81	Implant						
BCl_3		303.326							
C_2F_6		138.01	Etch	0%	36.37	0.6	CF4	0.4	0.2
CHF_3		70.01	Etch			0.6	CF4	0.07	0.53
CF_4		88.00	Etch			0.3			0.3
Cl_2		70.91			15.57				
SF_6		146.05	Etch		32.07	0.8			0.8
HBr		80.91							
$SiCl_4$		169.90							
NH_3		17.03							
N_2O		44.01							
NF_3		71.00	Etch			0.8			0.8
Metex L5B									
$POCl_3$	Diffusion	153.33							
Isopropanol									
Acetone									
CH_3CCl_3 (TCA)		133.40			334.1				
$CHCl_3$		119.38							
(Breakdown: Assumed same as CHF3)									
$C_8H_{20}SiO_4$		208.33	Diffusion						

Note 1: Information from 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Molecular weight (MW)

	AsH3	PH3	SiH4	BF3	CF4	N2O	H3PO4	SiO2	H3BO3
MW	77.95	34.00	32.12	67.81	88.00	44.0128	98	60.08	61.83

	HCl	H_2SO_4	BCl3	C2F6	SF6	HBr	NH3	HF	POCl3
MW	36.46	98.07	303.33	138.01	146.05	80.9119	17.03	20.01	153.3322

Operating schedule:

hrs/day	24 hrs/day
days/wk	7 days/wk
wks/yr	52 wks/yr

Main scrubber control efficiencies[a]

HCl		95%
HF		95%
H_2SO_4		95%
H_3PO_4		95%
HBr		95%
H_3BO_3		95%
SiO_2	(The acceptable 90% is used)	90%

[a] Information from HEE Environmental Engineering.

LTO diffusion furnaces integrated filters control efficiency:

SiO_2	95%
P_2O_5	0%
PM10 in PM	96%

Computations:

It is believed that N_2O is used to supply O_2 for the reaction to form SiO2. N_2 is liberated with the break-up of N_2O. The unreacted N_2O, a non-criteria pollutant, will go through the system.

Emissions, lb/hr: Except where indicated, all chemicals are used up in the process.

H3PO4 from PH3 The ratio 1/1 means 1 mole of H3PO4 is created per mole of PH3

PM

Uncontrolled With diffusion furnaces integrated filters control efficiency being counted

0.81 lb/month/30 days/month/24 hrs/day*(1/1)*98 lb/lbmole/34 lb/lbmole*(1-0) = 0.003 lb/hr

Controlled 0.003 lb/hr*(1-0.95) = 0.000161 lb/hr

(c) Total arsenic emissions:	0.222 lb/yr+0.00115 lb/yr =	0.224 lb/yr
	0.224 lb/yr/52 wks/yr/7 days/wk/24 hrs/day =	2.560E-05 lb/hr
Arsine usage	0.0102 L/min*60 min/hr*24 hrs/day*7 days/wk*52 wks/yr*1 =	5,362.85 L/yr
	5362.85 L/yr*0.035 cf/L/379.49 cf/lbmole*77.95 lb/lbmole =	38.90 lb/yr
Overall control efficiency:	1-0.224/22.25 =	98.995%

For a maximum of 5 cans:

Total arsenic emissions:	0.224 lb/yr-can *5 cans =	1.118 lb/yr
	1.118 lb/yr/52 wks/yr/7 days/wk/24 hrs/day =	1.28E-04 lb/hr

Results of risk analysis:

	Residential	Commercial
MICR	9.24E-07	3.18E-07

Arsine flow rate limit (per can)	0.0102 L/min*1 (cushion factor) =	0.01 L/min

NSR input: lb/hr * 10^6

Uncontrolled arsenic emission	0.00255 lb/hr/can*5 cans* 10^6 =	12,733 lb/hr * 10^6
Controlled arsenic emission	0.000128 lb/hr*10^6 =	128 lb/hr * 10^6

Arsine Emissions
5 Ion Implanters Using Arsine

Given:	A/N 495576
1 Arsine flow rate to implanter	0.01 L/min
2 Operating schedule:	
a Hours/day	24
b Days/week	7
c Weeks/year	52
3 Sensor analyzing time (collecting sample & analyzing) (6 times: 3 at breakthrough at main canister and 3 at breakthrough at standby canister, 60 sec each)	360 sec
4 Time period between the time sensor detects break through at outlet of main canister and the time that effluent from implanter is completely switched to standby canister (Interlocks for automatic switching are required) - 3 times at 30 seconds each.	90 sec
5 Time period between the time sensor detects break through at outlet of standby canister and the time that arsine flow to implanter is shut down (Interlocks for automatic shutdown are required) - 3 times at 30 seconds each.	90 sec
6 Scrubber replacements each year	3
7 Number of scrubbers (cans) in the permit unit	5
Molecular weights:	
Arsine	77.95 lb/lbmole
Arsenic	74.92 lb/lbmole
Ionization efficiency	90%
Arsenic in arsine	96%
Implant efficiency	45%
Control efficiency:	99%
Ideal gas molar volume @ 60 F & 1 atmosphere	379.49 ft^3/lbmole
Conversion from liters to ft^3:	0.035 ft^3/L
Arsine usage cushion factor	1

Note: Cushion factor is based on permit engineer's judgements and used to give the applicant a cushion to the permit limit(s) to insure compliance.

Computations:

For 1 resin can:

(a) During normal operation:

Arsine usage:

0.0102 L/min*0.035 cf/L*60 min/hr*24 hrs/day*7 days/wk*52 wks/yr/379.49 cf/lbmole*77.95 lb/lbmole*1 = 38.90 lb/yr

Arsenic emissions:

Uncontrolled	38.9 lb/yr*0.96 arsenic in 1 arsine *((1-0.9)+0.9*(1-0.45)) =	22.25 lb/yr
	22.25 lb/yr/52 wks/yr/7 days/wk/24 hrs/day =	0.00255 lb/hr
Controlled	22.25 lb/yr*(1-0.99) =	0.222 lb/yr
	0.00255 lb/hr*(1-0.99) =	2.55E-05 lb/hr

(b) During other periods:

(Switching from main canister to standby canister and shutdown)

Amount of time when arsine is not controlled: (360 sec+90 sec+90 sec)*3 times/yr = 1620 sec/yr

Arsine used:

0.0102 L/min/60 sec/min*1620 sec/yr*0.035 cf/L/379.49 cf/lbmole*77.95 lb/lbmole*1 = 0.00200 lb/yr

Arsenic emissions: 0.002 lb/yr*0.96 lb arsenic/lb arsine*((1-0.9)+0.9*(1-0.45)) = 0.00115 lb/yr

Controlled PM10 emissions:

lb/hr	(From the table above)		0.04	lb/hr
lb/day		0.04 lb/hr*24 hrs/day =	0.89	lb/day
lb/yr		0.89 lb/day*7 days/wk*52 wks/yr =	323.20	lb/yr

Rule 1401 chemicals

(lb/hr from the table above)

H_3PO_4	lb/hr	0.0006005+0.000577 =	0.001177	lb/hr
	lb/yr	0.0012 lb/hr*24 hrs/day*7 days/wk*52 wks/yr =	10.2865	lb/yr
HCl	lb/hr	0+0+0.0111+0.001 =	0.012	lb/hr
	lb/yr	0.012 lb/hr*24 hrs/day*7 days/wk*52 wks/yr =	102.33	lb/yr
HF	lb/hr	0.0001+0.003+0.0031+0+0.01+0.0012212349246992 =	0.01	lb/hr
	lb/yr	0.01 lb/hr*24 hrs/day*7 days/wk*52 wks/yr =	130.23	lb/yr
H_2SO_4	lb/hr		0.01	lb/hr
	lb/yr	0.01 lb/hr*24 hrs/day*7 days/wk*52 wks/yr =	52.14	lb/yr

NSR & AEIS Inputs:

	PM	PM10
lb/hr		
Uncontr.	0.78	0.75
Contr.	0.04	0.04
lb/day		
Uncontr.		18
Contr.		0.89
lb/yr (Contr.)		323.20

Permit limits:

PH_3			3	lb/month
SiH_4		35+85.5 =	120.5	lb/month
BF_3			2	lb/month
C_2F_6			340	lb/month
CHF_3			99	lb/month
Cl_2			155	lb/month
SF_6			160	lb/month
NF_3			26	lb/month
$POCl_3$			13	lb/month
CH_3CCl_3			70	lb/month
$C_8H_{20}SiO_4$	TEOS		40	lb/month

HF from NF3

PM

Uncontrolled

26 lb/month/30 days/month/24 hrs/day*(3/1)*20.01 lb/lbmole/71 lb/lbmole*0.8 = 0.024

Controlled 0.024 lb/hr*(1-0.95) = 0.0012 lb/hr

PM10

Uncontrolled 0.024 lb/hr*0.96 = 0.02 lb/hr

Controlled 0.0012 lb/hr*0.96 = 0.0012 lb/hr

H_3PO_4 from $POCl_3$

PM

Uncontrolled 1/1 means 1 mole of H_3PO_4 is produced per mole of $POCl_3$

13 lb/month/30 days/month/24 hrs/day*(1/1)*98 lb/lbmole/153.33 lb/lbmole = 0.012 lb/hr

Controlled 0.012 lb/hr*(1-0.95) = 0.000577 lb/hr

PM10

Uncontrolled 0.012 lb/hr*0.96 = 0.011 lb/hr

Controlled 0.000577 lb/hr*0.96 = 0.0006 lb/hr

HCl from $POCl_3$

PM

Uncontrolled

13 lb/month/30 days/month/24 hrs/day*(3/1)*36.46 lb/lbmole/153.33 lb/lbmole = 0.013 lb/hr

Controlled 0.013 lb/hr*(1-0.95) = 0.001 lb/hr

PM10

Uncontrolled 0.013 lb/hr*0.96 = 0.01 lb/hr

Controlled 0.0006 lb/hr*0.96 = 0.001 lb/hr

HCl from CH3CCl3

PM

Uncontrolled

13 lb/month/30 days/month/24 hrs/day*(3/1)*36.46 lb/lbmole/153.33 lb/lbmole = 0.080 lb/hr

Controlled 0.08 lb/hr*(1-0.95) = 0.004 lb/hr

PM10

Uncontrolled 0.08 lb/hr*0.96 = 0.08 lb/hr

Controlled 0.004 lb/hr*0.96 = 0.004 lb/hr

SiO2 from C8H20SiO4

PM

Uncontrolled

40 lb/month/30 days/month/24 hrs/day*(1/1)*60.08 lb/lbmole/208.33 lb/lbmole = 0.0003 lb/hr

Controlled 0.0003 lb/hr*(1-0.9) = 0.00003 lb/hr

PM10

Uncontrolled 0.0003 lb/hr*0.96 = 0.0003 lb/hr

Controlled 0.00003 lb/hr*0.96 = 0.00003 lb/hr

			PM		PM10	
	Emission	From	Uncontr.	Contr.	Uncontr.	Contr.
lb/hr	H_3PO_4	PH_3	0.012	0.000600	0.012	0.000576
	SiO_2	$SiH_{4\ Poly}$	0.002	0.0002	0.002	0.00017
	SiO_2	$SiH_{4\ LTO}$	0.004	0.0004	0.004	0.00043
	SiO_2	SiH_2Cl_2	-	-	-	-
	HCl	SiH_2Cl_2	-	-	-	-
	H_3BO_3	BF_3	0.003	0.0001	0.002	0.00012
	HF	BF_3	0.002	0.0001	0.002	0.00012
	H_3BO_3	BCl_3	-	-	-	-
	HCl	BCl_3	-	-	-	-
	HF	C_2F_6	0.082	0.003	0.08	0.003
	HF	CHF3	0.062	0.0031	0.060	0.0030
	HF	CF4	-	-	-	-
	HCl	Cl_2	0.22	0.011	0.21	0.0106
	HF	SF_6	0.146	0.0073	0.14	0.00701
	H_2SO_4	SF_6	0.119	0.00597	0.11	0.00573
	HBr	HBr	-	-	-	-
	HF	NF3	0.02	0.0012	0.02	0.00117
	H_3PO_4	$POCl_3$	0.01	0.001	0.01	0.00055
	HCl	$POCl_3$	0.01	0.001	0.01	0.00062
	HCl	CH3CCl3	0.08	0.004	0.08	0.00383
	HCl	CHCl3	-	-	-	-
	SiO2	C8H20SiO4	0.000	0.000	0.00	0.00003
	Total		0.78	0.04	0.75	0.037
lb/day					18.06	0.89
lb/yr						323.20

Uncontrolled PM10 emissions:

lb/hr (From the table above) 0.75 lb/hr

lb/day 0.75 lb/hr*24 hrs/day = 18.06 lb/day

PM10

Uncontrolled	0.012 lb/hr*0.96 =	0.012 lb/hr
Controlled	0.0006 lb/hr*0.96 =	0.000576 lb/hr

SiO2 from SiH4 Poly (Poly process)

PM

Uncontrolled		
35 lb/month/30 days/month/24 hrs/day*(1/1)*60.08 lb/lbmole/32.12 lb/lbmole*(1-0.98) =		0.0018 lb/hr
Controlled	0.002 lb/hr*(1-0.9) =	0.0002 lb/hr

PM10

Uncontrolled	0.002 lb/hr*0.96 =	0.002 lb/hr
Controlled	0.0002 lb/hr*0.96 =	0.0002 lb/hr

SiO2 from SiH4 (LTO process)

PM

Uncontrolled		
85.5 lb/month/30 days/month/24 hrs/day*(1/1)*60.08 lb/lbmole/32.12 lb/lbmole*(1-0.98) =		0.004 lb/hr
Controlled	0.004 lb/hr*(1-0.9) =	0.00044 lb/hr

PM10

Uncontrolled	0.004 lb/hr*0.96 =	0.004 lb/hr
Controlled	0.0004 lb/hr*0.96 =	0.0004 lb/hr

H3BO3 from BF3

PM

Uncontrolled	2 lb/month/30 days/month/24 hrs/day*(1/1)*61.83 lb/lbmole/67.81 lb/lbmole =	0.0025 lb/hr
Controlled	0.0025 lb/hr*(1-0.95) =	0.00013 lb/hr

PM10

Uncontrolled	0.0025 lb/hr*0.96 =	0.0024 lb/hr
Controlled	0.00013 lb/hr*0.96 =	0.0001 lb/hr

HF from BF3

PM

Uncontrolled	2 lb/month/30 days/month/24 hrs/day*(3/1)*20.01 lb/lbmole/67.81 lb/lbmole =	0.0025 lb/hr
Controlled	0.0025 lb/hr*(1-0.95) =	0.0001 lb/hr

PM10

Uncontrolled	0.0025 lb/hr*0.96 =	0.0024 lb/hr
Controlled	0.0001 lb/hr*0.96 =	0.0001 lb/hr

HF from C2F6

PM

Uncontrolled		
340 lb/month/30 days/month/24 hrs/day*(6/1)*20.01 lb/lbmole/138.01 lb/lbmole*0.2 =		0.082 lb/hr
Overall control efficiency for Vector scrubber: 1-(0.25*(1-0.95)+1-0.25) =0.25*0.95 =		24%
(25% goes thru Vector scrubber, 75 % bypasses it)		
Controlled	0.0822 lb/hr*(1-0.24)*(1-0.95) =	0.0031 lb/hr

PM10

Uncontrolled	0.0822 lb/hr*0.96 =	0.079 lb/hr
Controlled	0.0031 lb/hr*0.96 =	0.0030 lb/hr

HF from CHF3

PM

Uncontrolled		
99 lb/month/30 days/month/24 hrs/day*(3/1)*20.01 lb/lbmole/70.01 lb/lbmole*0.53 =		0.0625 lb/hr
Controlled	0.062483 lb/hr*(1-0.95) =	0.0031 lb/hr

PM10

Uncontrolled	0.0625 lb/hr*0.96 =	0.0600 lb/hr
Controlled	0.0031 lb/hr*0.96 =	0.0030 lb/hr

HCl from Cl2

PM

Uncontrolled	155 lb/month/30 days/month/24 hrs/day*(2/1)*36.46 lb/lbmole/70.91 lb/lbmole =	0.22 lb/hr
Controlled	0.22 lb/hr*(1-0.95) =	0.011 lb/hr

PM10

Uncontrolled	0.22 lb/hr*0.96 =	0.21 lb/hr
Controlled	0.011 lb/hr*0.96 =	0.01 lb/hr

HF from SF6

PM

Uncontrolled		
160 lb/month/30 days/month/24 hrs/day*(6/1)*20.01 lb/lbmole/146.05 lb/lbmole*0.8 =		0.15 lb/hr
Controlled	0.15 lb/hr*(1-0.95) =	0.007 lb/hr

PM10

Uncontrolled	0.15 lb/hr*0.96 =	0.14 lb/hr
Controlled	0.007 lb/hr*0.96 =	0.007 lb/hr

H2SO4 from SF6

PM

Uncontrolled		
160 lb/month/30 days/month/24 hrs/day*(1/1)*98.07 lb/lbmole/146.05 lb/lbmole*0.8 =		0.12 lb/hr
Controlled	0.12 lb/hr*(1-0.95) =	0.00597 lb/hr

PM10

Uncontrolled	0.12 lb/hr*0.96 =	0.11 lb/hr
Controlled	0.00597 lb/hr*0.96 =	0.00573 lb/hr

ATTACHMENT

Integrated Circuit

Previous: F5750 A/N: 495576

Control 492808 Scrubbers 101 & 102 (Fab2)

Given:

		MW	Process	Through Vector	lb/month	Breakdown Information[Note 1] Used Ui (1)	Part of Ui Transformed To (2)	Amount (3)	Reacted to Form Acids (1)-(3)
AsH_3		77.95			-				
PH_3	Diffusion	34.00	Etch	100%	3				
SiH_4	Diffusion	32.12	Poly	16%	35				
SiH_4	Diffusion	32.12	LTO & Nitrile		85.5				
SiH_2Cl_2		101.01							
BF_3	Boron trifluoride	67.81	Implant		2				
BCl_3	Boron tricholoride	303.326							
C_2F_6	Hexafluoroethane	138.01	Etch	25%	340	0.6	CF4	0.4	0.2
CHF_3	Fluoroform	70.01	Etch		99	0.6	CF4	0.07	0.53
CF_4	Tetrafluoromethane	88.00	Etch			0.3			0.3
Cl_2		70.91			155				
SF_6	Sulfur hexachloride	146.05	Etch		160	0.8			0.8
HBr		80.9119							
$SiCl_4$		169.90							
NH_3		17.03							
N_2O		44.01							
NF_3	Nitrogen trifluoride	71.00	Etch		26	0.8			0.8
Metex L5B									
$POCl_3$	Diffusion	153.33			13				
Isopropanol									
Acetone									
CH_3CCl_3	(TCA)	133.40			70				
$CHCl_3$	Chloroform	119.38	Etch						
$C_8H_{20}SiO_4$ (TEOS)		208.33	Diffusion		40				

Note 1: Information from 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Molecular weight (MW)

	AsH3	PH3	SiH4	BF3	CF4	N2O	H3PO4	SiO2	H3BO3
MW	77.95	34.00	32.12	67.81	88.00	44.0128	98	60.08	61.83

	HCl	H_2SO_4	BCl3	C2F6	SF6	HBr	NH3	HF	POCl3
MW	36.46	98.07	303.33	138.01	146.05	80.9119	17.03	20.01	153.3322

Operating schedule:

hrs/day	24 hrs/day
days/wk	7 days/wk
wks/yr	52 wks/yr

Main scrubber control efficiencies[a]

HCl	95%
HF	95%
H_2SO_4	95%
H_3PO_4	95%
HBr	95%
H_3BO_3	95%
SiO_2	90%

[a] Information from HEE Environmental Engineering.

Vector scrubber control efficiencies:

HF	(A conservative 95% is used)	95%
Solid		50%

Diffusion furnaces integrated filters control efficiency:

SiO_2	98%
P_2O_5	0%
PM10 in PM	96%

Computations:

Emissions, lb/hr: Except where indicated, all chemicals are used up in the process.

H3PO4 from PH3 The ratio 1/1 means 1 mole of H3PO4 is created per mole of PH3

PM

Uncontrolled

3 lb/month/30 days/month/24 hrs/day*(1/1)*98 lb/lbmole/34 lb/lbmole*(1-0) = 0.012 lb/hr

Controlled 0.012 lb/hr*(1-0.95) = 0.0006 lb/hr

Burn Box Rating

Fuel:		Hydrogen
Maximum fuel rate:		
scfm		0.9 scfm
scfh	0.9 scfm*60 min/hr =	54 scfh
HHV of hydogen, BTU/cf		324 BTU/cf
Maximum Heat Input Rating, MM BTU/hr:	54 scfh*324 BTU/cf*10^-6 =	0.017496 MM BTU/hr

Resin Adsorber
By-Pass Canister

Resin volume	(Manufacturer's data)	(0.3 gallon)	1.13	L
Resin capacity	(Manufacturer's data)		1.12	gmoles/L
Molecular weights:				
Arsine			77.95	g/gmole
Arsenic			74.92	g/gmole
Arsenic in arsine			96%	
Uncontrolled arsenic			0.006367	lb/hr
Conversion from g to lb			0.0022046	
Operating schedule				
hrs/day			24	
Days/month			30	
Uncontrolled arsine per Novapure can		0.006367 lb/hr/0.96 =	0.006624	lb/hr
		0.006624 lb/hr/0.0022046 lb/g/77.95 g/gmole =	0.03855	gmoles/hr
Resin capacity		1.13 L*1.12 gmoles/L =	1.27	gmoles
Resin lasts		1.27gmoles/0.038546 gmole/hr =	33	hrs
			1.4	days

Resin Adsorber
Main Canister

Resin volume	(Manufacturer's data)	(	32 gallons)	121 L
Resin capacity	(Manufacturer's data)			1.12 gmoles/L
Molecular weights:				
Arsine				77.95 g/gmole
Arsenic				74.92 g/gmole
Arsenic in arsine			74.92/77.95 =	96%
Uncontrolled arsenic				0.006367 lb/hr
Conversion from g to lb				0.0022046
Operating schedule				
hrs/day				24
Days/month				30
Uncontrolled arsine per Novapure can			0.006367 lb/hr/0.96 =	0.006624 lb/hr
			0.006624 lb/hr/0.0022046 lb/g/77.95 g/gmole =	0.03855 gmoles/hr
Resin capacity			121 L*1.12 gmoles/L =	135.52 gmoles
Resin lasts			135.52gmoles/0.038546 gmole/hr =	3,516 hrs
				146 days
				4.9 months
Replacement times per year:				3 times

Calculations
Photolithographic System

Previous: F62101 381809 A/N: 492805
Control: 492807/492810 McGill Oxidizer/Zink Oxidizer

Given:

Total resist used, lbs/day**	158
Volatile percent*	85%
VOC control efficiency+	95%
Operating schedule:	
hrs/day	24 hrs/day
days/wk	7 days/wk
wks/yr	52 wks/yr

*Information from A/N 381809 (Previous to 492805).

+Minimum of all control equipment control efficiencies.

Computations:

VOC:

lb/day		
Uncontrolled	158 lb/day*0.85 =	134.65 lb/day
Controlled	134.65 lb/day*(1-0.95) =	6.73 lb/day
lb/hr		
Uncontrolled	134.65 lb/day/24 hrs/day =	5.61 lb/hr
Controlled	6.73 lb/day/24 hrs/day =	0.28 lb/hr
lb/yr	6.73 lb/day*7 days/wk*52 wks/yr =	2450.608 lb/yr

	VOC	
	Uncontr.	Controlled
lb/hr	5.61	0.28
lb/day	135	6.7
lb/yr	-	2,450.61

**Note: This facility has a VOC cap of 1,800 lbs in any one calendar month. VOC emissions are calculated using the amount of solvent used (excluding solvage solvent) and VOC control efficiencies. For emission calculaltion purpose, controlled VOC emissions from the previous applications are used to calculate the emission rates.

Rule 1401:

To simplify our rist analysis, we use cresol emissions = total VOC emissions (conservative).

HIs:

	Emissions		Screening Levels		HIs Contributions		Compliance
	lb/hr	lb/yr	lb/hr	lb/yr	Acute	Chronic	
Cresol	0.28	2,450.61	-	1.98E+04	-	1.24E-01	Yes
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
Total					-	1.24E-01	

M-Pyrol

lb/day:

Uncontrolled	21.6 gals/month*8.3372 lb/gal*1.026/30 days/month =	6.16	lb/day
Controlled	6.16 lb/day*(1-0.987) =	0.080	lb/day

lb/hr

Uncontrolled	6.16 lb/day/24 hrs/day =	0.257	lb/hr
Controlled	0.257 lb/day*(1-0.987) =	0.003	lb/hr

lb/yr: 0.08 lb/day*7 days/wk*52 wks/yr = 29.14371 lb/yr

IPA (Through wet scrubber)

lb/day:

Uncontrolled	0.26 gals/month*8.3372 lb/gal*0.7851/30 days/month =	0.06	lb/day
Controlled	0.06 lb/day*(1-0) =	0.06	lb/day

lb/hr

Uncontrolled	0.06 lb/day/24 hrs/day =	0.002	lb/hr
Controlled	0.002 lb/day*(1-0) =	0.002	lb/hr

lb/yr: 0.06 lb/day*7 days/wk*52 wks/yr = 20.97962 lb/yr

Total VOC:

lb/day:

Uncontrolled	17.8+6.16+0.06 =	24.02	lb/day
Controlled	0.23+0.08+0.06 =	0.37	lb/day

lb/hr

Uncontrolled	0.74+0.26+0.002 =	1.00	lb/hr
Controlled	0.01+0+0.002 =	0.02	lb/hr

lb/yr: 84.24+29.14+20.98 = 134.37 lb/yr

PM/PM10 emissions:

lb/hr

Uncontrolled		0.69	lb/hr
Controlled		0.07	lb/hr

lb/day:

Uncontrolled	0.69 lb/hr*24 hrs/day =	16.56	lb/day
Controlled	0.069 lb/hr*24 hrs/day =	1.66	lb/day

lb/yr: 1.66 lb/day*7 days/wk*52 wks/yr = 602.8 lb/yr

Emissions:

	VOC	Acetone	TOG	PM/PM10
lb/hr				
Uncontr.	1.00	1.84	2.84	0.69
Contr.	0.02	0.02	0.04	0.07
lb/day				
Uncontr.	24	44	68	17
Contr.	0	1	1	1.66
lb/yr	134.37	209.44	343.81	602.78

*Note: This facility has a VOC cap of 1,800 lbs in any one calendar month. VOC emissions are calculated using the amount of solvent used (excluding solvage solvent) and VOC control efficiencies. For IPA venting to the wet scrubber , the VOC control efficiency is 0.

Rule 1401:

It is assumed that the chemical usage is the same as for previous application. Therefore, there is emission increases for toxic air contaminants.

ATTACHMENT
Wet Chemical/Solvent

Previous:	F5748 302033 (460727)	A/N:	492804
Control	492808/F52984/492810	Scrubber/Adsorber/Zink Oxidizer	

Chemicals used:

At bench venting to VOC control equipment		
Acetone	201.6	gals/month
IPA	81.6	gals/month
M-Pyrol	21.6	gals/month
At bench venting to wet scrubber (no VOC control)		
IPA	1.2	L/month
	0.26	gal/month
Water density	8.3372	lb/gal
Sp. Gr.		
Acetone	0.79	
IPA	0.7851	
M-Pyrol	1.026	
Operating schedule:		
hrs/day	24	hrs/day
days/wk	7	days/wk
wks/yr	52	wks/yr
VOC control efficiencies::		
VOC control equipment+:	98.7%	
Wet scrubber:	0%	

+Minimum of all control equipment control efficiencies.

PM emissions: (From previous A/N 302033)

lb/hr		
Uncontrolled	0.69	
Controlled	0.069	

Computations:

<u>Acetone:</u> (Non-VOC)

lb/day:			
Uncontrolled	201.6 gals/month*8.3372 lb/gal*0.79/30 days/month =	44.26	lb/day
Controlled	44.26 lb/day*(1-0.987) =	0.575	lb/day
lb/hr			
Uncontrolled	44.26 lb/day/24 hrs/day =	1.844	lb/hr
Controlled	1.844 lb/day*(1-0.987) =	0.024	lb/hr
lb/yr:	0.575 lb/day*7 days/wk*52 wks/yr =	209.4408	lb/yr

<u>IPA (Through VOC control equipment)</u>

lb/day:			
Uncontrolled	81.6 gals/month*8.3372 lb/gal*0.7851/30 days/month =	17.80	lb/day
Controlled	17.8 lb/day*(1-0.987) =	0.231	lb/day
lb/hr			
Uncontrolled	17.8 lb/day/24 hrs/day =	0.742	lb/hr
Controlled	0.742 lb/day*(1-0.987) =	0.010	lb/hr
lb/yr:	0.231 lb/day*7 days/wk*52 wks/yr =	84.24249	lb/yr

ATTACHMENT
Wet Chemical/Solvent

Previous: D89120 270414 (460726) A/N: 492803

Emissions:

	IPA	Xylene	VOC	PM/PM10
lb/hr				
Uncontr.	0.05	0.19	0.23	6.41
Contr.	0.0005	0.002	0.002	0.08
lb/day				
Uncontr.	1	4	6	154
Contr.	0	0	0	1.9
lb/yr	4.13	16.18	20.30	698.88

Consumptions:

IPA	5.20	gals/month
Xylene	15.59	gals/month

*Note: This facility has a VOC cap of 1,800 lbs in any one calendar month. VOC emissions are calculated using the amount of solvent used (excluding solvage solvent) and VOC control efficiencies.

Rule 1401:

There is no change in the the chemical usage. Therefore, there is no emission increase of toxic air contaminants.

ATTACHMENT
Wet Chemical/Solvent

Previous: D89120 270414 (460726) A/N: 492803
Control 492806/D89083 (Subsequent 468700 Cancelled) Scrubber/Carbon Adsorber

Chemicals used:		
IPA	5.20	gals/month
Xylene	15.59	gals/month
Water density	8.3372	lb/gal
Sp. Gr.		
IPA	0.78505	
Xylene	1.026	
Operating schedule:		
hrs/day	24	hrs/day
days/wk	7	days/wk
wks/yr	52	wks/yr
VOC control efficiency:	99%	

PM emissions: (From previous A/N 270414)

lb/hr		
Uncontrolled	6.41	lb/hr
Controlled	0.08	lb/hr

Computations:

IPA:

lb/day:			
Uncontrolled	5.2 gals/month*0.78505*8.3372 lb/gal/30 days/month =	1.13	lb/day
Controlled	1.13 lb/day*(1-0.99) =	0.011	lb/day
lb/hr			
Uncontrolled	1.13 lb/day/24 hrs/day =	0.047	lb/hr
Controlled	0.047 lb/day*(1-0.99) =	0.0005	lb/hr
lb/yr:	0.011 lb/day*7 days/wk*52 wks/yr =	4.126357	lb/yr

Xylene

lb/day:			
Uncontrolled	15.59 gals/month*1.026*0 lb/gal/30 days/month =	4.44	lb/hr
Controlled	4.44 lb/day*(1-0.99) =	0.044	lb/hr
lb/hr			
Uncontrolled	4.44 lb/day/24 hrs/day =	0.185	lb/hr
Controlled	0.185 lb/day*(1-0.99) =	0.002	lb/hr
lb/yr:	0.044 lb/day*7 days/wk*52 wks/yr =	16.18	lb/yr

PM/PM10 Emissions:

lb/hr			
Uncontrolled		6.41	lb/hr
Controlled		0.08	lb/hr
lb/day:			
Uncontrolled	6.41 lb/hr*24 hrs/day =	153.8	lb/day
Controlled	0.08 lb/hr*24 hrs/day =	1.92	lb/day
lb/yr:	1.92 lb/day*7 days/wk*52 wks/yr =	698.9	lb/yr

Modeling Data
Scrubbers 1 & 2

Exhaust flow rate:	
acfm	60,000
scfm	
Stack diameter, in	72
Stack height, ft	50
Temperature, F	75
Catalytic	

	Yes	No*
Rain cap?		x

*Or with a swing raincap fully open when operated.

Data for modeling:

Actual volume flow rate (ACFM)	60,000
Stack diameter, m	1.83
Stack height, m	15.24
Temperature, K	297

CALCULATION PROCEDURE	MAX CONC (UG/M**3)	DIST TO MAX (M)	TERRAIN HT (M)
SIMPLE TERRAIN	79.65	418.	0.

****
** REMEMBER TO INCLUDE BACKGROUND CONCENTRATIONS **
****

2200.	16.67	6	1.0	1.1	10000.0	40.30	176.64	85.18	NO
2300.	15.78	6	1.0	1.1	10000.0	40.30	182.73	87.52	NO
2400.	14.97	6	1.0	1.1	10000.0	40.30	188.71	89.81	NO
2500.	14.23	6	1.0	1.1	10000.0	40.30	194.59	92.05	NO
2600.	13.56	6	1.0	1.1	10000.0	40.30	200.37	94.24	NO
2700.	12.94	6	1.0	1.1	10000.0	40.30	206.06	96.39	NO
2800.	12.38	6	1.0	1.1	10000.0	40.30	211.66	98.49	NO
2900.	11.85	6	1.0	1.1	10000.0	40.30	217.17	100.56	NO
3000.	11.37	6	1.0	1.1	10000.0	40.30	222.60	102.59	NO
3500.	9.426	6	1.0	1.1	10000.0	40.30	248.62	112.23	NO
4000.	8.025	6	1.0	1.1	10000.0	40.30	272.97	121.16	NO
4500.	6.974	6	1.0	1.1	10000.0	40.30	295.91	129.51	NO
5000.	6.158	6	1.0	1.1	10000.0	40.30	317.62	137.39	NO
5500.	5.507	6	1.0	1.1	10000.0	40.30	338.28	144.85	NO
6000.	4.978	6	1.0	1.1	10000.0	40.30	358.01	151.96	NO
6500.	4.539	6	1.0	1.1	10000.0	40.30	376.91	158.76	NO
7000.	4.170	6	1.0	1.1	10000.0	40.30	395.07	165.29	NO
7500.	3.855	6	1.0	1.1	10000.0	40.30	412.56	171.58	NO
8000.	3.583	6	1.0	1.1	10000.0	40.30	429.46	177.65	NO
8500.	3.347	6	1.0	1.1	10000.0	40.30	445.80	183.52	NO
9000.	3.139	6	1.0	1.1	10000.0	40.30	461.65	189.22	NO
9500.	2.956	6	1.0	1.1	10000.0	40.30	477.03	194.75	NO
10000.	2.792	6	1.0	1.1	10000.0	40.30	491.99	200.13	NO
15000.	1.792	6	1.0	1.1	10000.0	40.30	623.68	247.64	NO
20000.	1.318	6	1.0	1.1	10000.0	40.30	733.37	287.46	NO
25000.	1.041	6	1.0	1.1	10000.0	40.30	829.19	322.41	NO
30000.	.8603	6	1.0	1.1	10000.0	40.30	915.28	353.93	NO
40000.	.7228	4	1.0	1.1	320.0	68.44	1552.30	1553.23	NO
50000.	.6427	4	1.0	1.1	320.0	68.44	1745.81	1750.07	NO

MAXIMUM 1-HR CONCENTRATION AT OR BEYOND 25. M:

418.	79.65	6	1.0	1.1	10000.0	40.30	43.25	27.23	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SCREEN DISCRETE DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
50.	46.36	3	10.0	10.9	3200.0	18.80	10.95	10.07	NO
1000.	43.14	6	1.0	1.1	10000.0	40.30	93.24	51.10	NO

DWASH= MEANS NO CALC MADE (CONC = 0.0)
DWASH=NO MEANS NO BUILDING DOWNWASH USED
DWASH=HS MEANS HUBER-SNYDER DOWNWASH USED
DWASH=SS MEANS SCHULMAN-SCIRE DOWNWASH USED
DWASH=NA MEANS DOWNWASH NOT APPLICABLE, X<3*LB

****
*** SUMMARY OF SCREEN MODEL RESULTS ***
****

10/28/08
12:53:25

*** SCREEN3 MODEL RUN ***
*** VERSION DATED 96043 ***

Scrubbers 1 & 2

SIMPLE TERRAIN INPUTS:

SOURCE TYPE	=	POINT
EMISSION RATE (G/S)	=	1.00000
STACK HEIGHT (M)	=	15.2400
STK INSIDE DIAM (M)	=	1.8300
STK EXIT VELOCITY (M/S)	=	10.7660
STK GAS EXIT TEMP (K)	=	297.0000
AMBIENT AIR TEMP (K)	=	293.0000
RECEPTOR HEIGHT (M)	=	.0000
URBAN/RURAL OPTION	=	URBAN
BUILDING HEIGHT (M)	=	.0000
MIN HORIZ BLDG DIM (M)	=	.0000
MAX HORIZ BLDG DIM (M)	=	.0000

THE REGULATORY (DEFAULT) MIXING HEIGHT OPTION WAS SELECTED.
THE REGULATORY (DEFAULT) ANEMOMETER HEIGHT OF 10.0 METERS WAS ENTERED.

STACK EXIT VELOCITY WAS CALCULATED FROM
VOLUME FLOW RATE = 60000.000 (ACFM)

BUOY. FLUX = 1.190 M**4/S**3; MOM. FLUX = 95.732 M**4/S**2.

*** FULL METEOROLOGY ***

****
*** SCREEN AUTOMATED DISTANCES ***
****

*** TERRAIN HEIGHT OF 0. M ABOVE STACK BASE USED FOR FOLLOWING DISTANCES ***

DIST (M)	CONC (UG/M**3)	STAB	U10M (M/S)	USTK (M/S)	MIX HT (M)	PLUME HT (M)	SIGMA Y (M)	SIGMA Z (M)	DWASH
25.	1.110	3	10.0	10.9	3200.0	18.80	5.55	5.08	NO
100.	60.22	3	4.0	4.4	1280.0	28.82	21.92	20.37	NO
200.	55.52	4	2.5	2.8	800.0	36.52	31.39	27.87	NO
300.	67.71	6	1.0	1.1	10000.0	40.30	31.99	21.18	NO
400.	79.46	6	1.0	1.1	10000.0	40.30	41.48	26.29	NO
500.	76.76	6	1.0	1.1	10000.0	40.30	50.72	31.07	NO
600.	69.51	6	1.0	1.1	10000.0	40.30	59.70	35.55	NO
700.	61.68	6	1.0	1.1	10000.0	40.30	68.43	39.76	NO
800.	54.53	6	1.0	1.1	10000.0	40.30	76.93	43.74	NO
900.	48.36	6	1.0	1.1	10000.0	40.30	85.19	47.51	NO
1000.	43.14	6	1.0	1.1	10000.0	40.30	93.24	51.10	NO
1100.	38.73	6	1.0	1.1	10000.0	40.30	101.09	54.53	NO
1200.	35.00	6	1.0	1.1	10000.0	40.30	108.74	57.82	NO
1300.	31.82	6	1.0	1.1	10000.0	40.30	116.21	60.97	NO
1400.	29.10	6	1.0	1.1	10000.0	40.30	123.51	64.01	NO
1500.	26.76	6	1.0	1.1	10000.0	40.30	130.64	66.95	NO
1600.	24.72	6	1.0	1.1	10000.0	40.30	137.62	69.79	NO
1700.	22.94	6	1.0	1.1	10000.0	40.30	144.45	72.54	NO
1800.	21.38	6	1.0	1.1	10000.0	40.30	151.14	75.20	NO
1900.	19.99	6	1.0	1.1	10000.0	40.30	157.70	77.80	NO
2000.	18.76	6	1.0	1.1	10000.0	40.30	164.13	80.32	NO
2100.	17.66	6	1.0	1.1	10000.0	40.30	170.45	82.78	NO

Intrc

SCREENING INPUT

Table A

modeling emissions rate	7.94	lb/hr
modeling emissions rate	34.76	tons/yr
Max hr/dy	24	hr/day
day per week	7	dy/wk
wk/yr	52	wk/yr
MODELING RESULTS -MAX ONE HOUR		
Distance residence	1000.00	meter
Max. 1-hour Conc. Residence	44.30	ug/m3
Annualized Conc. Residence	3.54	ug/m3
Distance Commerical	398.00	meter
Max. 1-hour Conc. Commerical	87.23	ug/m3
Annualized Conc. Commercial	6.98	ug/m3

Annualized X/Q

X/Q Residential	0.10195	(ug/m^3)/(tons/yr)
X/Q Commercial	0.20075	(ug/m^3)/(tons/yr)

Max. X/Q

X/Q Residential	5.5818	(ug/m^3)/(lbs/hr)
X/Q Commercial	10.991	(ug/m^3)/(lbs/hr)

Table B

	Interpolation								
	Stc Ht: 50			row: 3					
	Residential			Industrial			X/Q for one-in-a-million		
	near	actual	far	near	actual	far	near	actual	far
distance	900.00	1000.00	1100.00	300.00	398.00	400.00	900.00	1567.60	400.00
X/Q - 1 hr conc ug/m3	49.87	44.30	39.65	77.50	87.23	87.22	49.87		87.22
X/Q Annualized (ug/m^3)/(tons/yr)	0.11	0.10	0.09	0.18	0.20	0.20	0.11		0.20

CONVERSION CALCULATOR To Convert from British to Metric Units

SCREEN INPUT DATA

actual exhuast rate	48600.00	acfm
Temp.	75.00	degree F
Stack diameter	58.00	in
Stack height	50.00	ft
modeling emissions ra	7.94	lb/hr

SCREEN INPUT DATA

Temp	296.889	degrees k
Stack dia	1.473	meter
Stack area	1.704	square meter
Stack height	15.240	meter
Stack velocity	13.463	m/s
modeling emissions ra	1.00132	gr/s

A/N: 492802 Date: 12/12/08

	HIC - Commercial												
Compound	AL	BN	CV	DEV	END	EYE	HEM	IMM	KID	NS	REP	RESP	SKIN
Arsenic and arsenic compou			6.94E-03	6.94E-03						6.94E-03			
Phosphoric acid												1.20E-04	
Hydrogen chloride (hydroch												3.66E-04	
Hydrogen fluoride (hydrof													
Sulfuric acid and oleum												6.54E-04	
Total			6.94E-03	6.94E-03						6.94E-03		1.14E-03	

6b. Hazard Index Chronic

HIC = [Q(ton/yr) * (X/Q) * MET * MP] / Chronic REL

	HIC - Residential												
Compound	AL	BN	CV	DEV	END	EYE	HEM	IMM	KID	NS	REP	RESP	SKIN
Arsenic and arsenic compou			3.62E-03	3.62E-03						3.62E-03			
Phosphoric acid												6.08E-05	
Hydrogen chloride (hydroch												1.86E-04	
Hydrogen fluoride (hydrof													
Sulfuric acid and oleum												3.32E-04	
Total			3.62E-03	3.62E-03						3.62E-03		5.79E-04	

	HIA - Commercial									
Compound	AL	CV	DEV	EYE	HEM	IMM	NS	REP	RESP	SKIN
Arsenic and arsenic compou			6.52E-03					6.52E-03		
Phosphoric acid										
Hydrogen chloride (hydroch				1.96E-05					1.96E-05	
Hydrogen fluoride (hydrof				6.77E-05					6.77E-05	
Sulfuric acid and oleum									6.83E-05	
Total			6.52E-03	8.73E-05				6.52E-03	1.56E-04	

A/N: 492802 Date: 12/12/08

6a. Hazard Index Acute HIA = [Q(lb/hr) * (X/Q)max] *AF/ Acute REL

	HIA - Residential									
Compound	AL	CV	DEV	EYE	HEM	IMM	NS	REP	RESP	SKIN
Arsenic and arsenic compou			3.31E-03					3.31E-03		
Phosphoric acid										
Hydrogen chloride (hydroch				9.98E-06					9.98E-06	
Hydrogen fluoride (hydrof				3.44E-05					3.44E-05	
Sulfuric acid and oleum									3.47E-05	
Total			3.31E-03	4.44E-05				3.31E-03	7.91E-05	

6. Hazard Index

HIA = [Q(lb/hr) * (X/Q)max] * AF / Acute REL

HIC = [Q(ton/yr) * (X/Q) * MET * MP] / Chronic REL

Target Organs	Acute	Chronic
Alimentary system (liver) - AL		
Bones and teeth - BN		
Cardiovascular system - CV		6.94E-03
Developmental - DEV	6.52E-03	6.94E-03
Endocrine system - END		
Eye	8.73E-05	
Hematopoietic system - HEM		
Immune system - IMM		
Kidney - KID		
Nervous system - NS		6.94E-03
Reproductive system - REP	6.52E-03	
Respiratory system - RES	1.56E-04	1.14E-03
Skin		

A/N: 492802 Date: 12/12/08

TIER 3 RESULTS

5. MICR

MICR = CP (mg/(kg-day))^-1 * Q (ton/yr) * (X/Q) * Afann * Met * DBR * EVF * 1.E-6 * MP

Compound	Residential	Commercial
Arsenic and arsenic compounds (inorganic)	9.48E-07	3.49E-07
Phosphoric acid		
Hydrogen chloride (hydrochloric acid)		
Hydrogen fluoride (hydrofluoric acid)		
Sulfuric acid and oleum		
Total	**9.48E-07**	**3.49E-07**
	Pass	**Pass**

No Cancer Burden, MICR<1.E=-6

5a. Cancer Burden		no
X/Q for one-in-a-million:		
Distance (meter		no data
Area (km2):		
Population:		
Cancer Burden:		

4. Emission Calculations

Compound	uncontrolled R1-lb/hr	controlled R2-lb/hr	R2-lb/yr	R2-ton/yr
Arsenic and arsenic compounds (inorganic)	1.28E-04	1.28E-04	1.1181218	0.0005591
Phosphoric acid	9.56E-04	9.56E-04	8.3478183	0.0041739
Hydrogen chloride (hydrochloric acid)	3.75E-03	3.75E-03	32.797769	0.0163989
Hydrogen fluoride (hydrofluoric acid)	1.48E-03	1.48E-03	12.91437	0.0064572
Sulfuric acid and oleum	7.46E-04	7.46E-04	6.5178555	0.0032589
Total	7.06E-03	7.06E-03	6.17E+01	3.08E-02

3. Rule 1401 Compound Data

Code	Compound	R1 - uncontrolled (lbs/hr)	R2 - controlled (lbs/hr)	CP	MP MICR Resident	MP MICR Worker	MP Chronic Resident	MP Chronic Worker	REL Chronic	REL Acute
a13	Arsenic and arsenic compounds (inorganic)	1.28E-04	1.28E-04	1.20E+01	4.783133	4.572289	1.90625	1.85625	0.03	0.19
p7	Phosphoric acid	9.56E-04	9.56E-04		1	1	1	1	7	
h11	Hydrogen chloride (hydrochloric acid)	3.75E-03	3.75E-03		1	1	1	1	9	2100
f2	Hydrogen fluoride (hydrofluoric acid)	1.48E-03	1.48E-03		1	1	1	1		240
s8	Sulfuric acid and oleum	7.46E-04	7.46E-04		1	1	1	1	1	120
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
					1	1	1	1		
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					1	1	1	1		
					1	1	1	1		

TIER 3 SCREENING RISK ASSESSMENT

A/N:	492802	Application deemed complete date	12/12/08
Fac:	International Rectifier		

2. Tier 2 Data

MET Factor	1.00
4 hr	0.85
6 or 7 hrs	0.71

Dispersion Factors

3	3A & 3B For Chronic X/Q
6	For Acute X/Q

Dilution Factors (ug/m3)/(tons/yr)

Receptor	X/Q	X/Qmax
Residential	0.101950685	5.5818
Commercial	0.200748493	10.99098

Adjustment and Intake Factors

	Afann	DBR	EVF
Residential	1	302	0.96
Worker	1	149	0.38

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FOR COMBUSTION SOURCES, FILL IN THE DATA ON THE LEAN BURN, RICH BURN, BOILER, AND DIESEL SHEETS
THE CHEMICALS AND EMISSION RATES ARE AUTOMATICALLY COPIED TO THE TABLES BELOW - DO NOT CHANGE THESE TABLES

LEAN BURN ICE		R1 - uncontroll	R2 - controlled
Code	Compound	lbs/hr	lbs/hr
A1	Acetaldehyde	1.71E-01	3.93E-03
A3	Acrolein	1.05E-01	2.42E-03
B1	Benzene (includi	9.00E-03	2.07E-04
B9	Butadiene, 1,3-	5.46E-03	1.26E-04
C3	Carbon tetrachlo	7.51E-04	1.73E-05
D6	Dichloroethane,	4.83E-04	1.11E-05
E4	Ethyl benzene	8.12E-04	1.87E-05
E7	Ethylene dibrom	9.06E-04	2.08E-05
E8	Ethylene dichlori	4.83E-04	1.11E-05
F3	Formaldehyde	1.08E+00	2.48E-02
H8	Hexane (n-)	2.27E-02	5.22E-04
M6	Methanol (methy	5.11E-02	1.18E-03
M13	Methylene chlori	4.09E-04	9.41E-06
P3	Phenol	4.91E-04	1.13E-05
P9	PolyCyclic Arom	5.50E-04	1.27E-05
P12	Benzo[b]fluora	3.40E-06	7.81E-08
P15	Chrysene	1.42E-05	3.26E-07
P30	Napthalene	1.52E-03	3.50E-05
S6	Styrene (vinyl be	4.83E-04	1.11E-05
T1	Tetrachloroethan	8.18E-04	1.88E-05
T3	Toluene (methyl	8.35E-03	1.92E-04
T7	Trichloroethane,	6.51E-04	1.50E-05
V5	Vinyl chloride (cl	3.05E-04	7.01E-06
X1	Xylenes (isomers	3.76E-03	8.66E-05
c7	Chlorobenzene	6.22E-04	1.43E-05
c14	Chloroform(trich	5.83E-04	1.34E-05

RICH BURN ICE		R1 - uncontroll	R2 - controlled
Code	Compound	lbs/hr	lbs/hr
A1	Acetaldehyde	3.63E-03	8.35E-05
A3	Acrolein	3.42E-03	7.87E-05
B1	Benzene (includi	2.06E-03	4.73E-05
B9	Butadiene, 1,3-	8.63E-04	1.98E-05
C3	Carbon tetrachlo	2.30E-05	5.30E-07
C7	Chlorobenzene	1.68E-05	3.86E-07
C14	Chloroform(trich	1.78E-05	4.10E-07
D6	Dichloroethane,	1.47E-05	3.38E-07
E4	Ethyl benzene	3.23E-05	7.42E-07
E7	Ethylene dibrom	2.77E-05	6.37E-07
E8	Ethylene dichlori	1.47E-05	3.38E-07
F3	Formaldehyde	2.67E-02	6.13E-04
M6	Methanol (methy	3.98E-03	9.16E-05
M13	Methylene chlori	5.36E-05	1.23E-06
P9	PolyCyclic Arom	5.71E-05	1.31E-06
P30	Napthalene	1.26E-04	2.91E-06
S6	Styrene (vinyl be	1.55E-05	3.56E-07
T1	Tetrachloroethan	3.29E-05	7.57E-07
T3	Toluene (methyl	7.26E-04	1.67E-05
T7	Trichloroethane,	1.99E-05	4.58E-07
V5	Vinyl chloride (cl	9.34E-06	2.15E-07
X1	Xylenes (isomers	2.54E-04	5.83E-06

BOILERS		R1 - uncontrolled
Code	Compound	lbs/hr
A1	Acetaldehyde	2.33429E-05
A3	Acrolein	1.46571E-05
B1	Benzene (includi	4.34286E-05
E4	Ethyl benzene	5.15714E-05
F3	Formaldehyde	9.22857E-05
H8	Hexane (n-)	0.0000342
P30	Napthalene	1.62857E-06
P9	PolyCyclic Arom	5.42857E-07
P78	Propylene	0.003968286
T3	Toluene (methyl	0.000198686
X1	Xylenes (isomers	0.000147657

TIER 3 SCREENING RISK ASSESSMENT

Application deemed complete date:	12/12/06

A/N:	492802
Fac:	International Rectifier

1. Stack Data		Units
Hour/Day	24	hr/day
Day/Week	7	day/wk
Week/Year	52	wk/yr
Emission Units	lb/hr	
Control Efficiency		fraction range 0-1
Does source have TBACT?	NO	
Point or Volume Source ?	P	p or v
Stack Height or Building Height	50	feet
Area (For Volume Source Only)		ft²
Distance-Residential	1000	meters
Distance-Commercial	50	meters
Meteorological Station	Banning	

Source Type:	O - Other	
Screening Mode	YES	

Emission Units	lb/hr	
Source output capacity	n/a	n/a

FOR USER-DEFINED CHEMICALS AND EMISSIONS, FILL IN THE TABLE BELOW

USER DEFINED CHEMICALS AND EMISSIONS				R1 - uncon	Efficiency Facto	R2 - controlled
Code	Compound	lb/hr	Molecular Weight	lbs/hr	fraction range 0-	lbs/hr
a15	Arsenic and arsenic comp	1.28E-04	74.92	0.000128		0.00013
p7	Phosphoric acid	9.56E-04	98	0.0009556		0.00096
hl1	Hydrogen chloride (hydro	3.75E-03	36.46	0.0037543		0.00375
f2	Hydrogen fluoride (hyd	0.00	20	0.0014783		0.00148
s8	Sulfuric acid and oleum	7.46E-04	98.08	0.0007461		0.00075

(c) Total arsenic emissions:	0.556 lb/yr+0.00287 lb/yr =	0.559 lb/yr
	0.559 lb/yr/52 wks/yr/7 days/wk/24 hrs/day =	6.400E-05 lb/hr
Arsine usage	0.0256 L/min*60 min/hr*24 hrs/day*7 days/wk*52 wks/yr*1 =	13,407.14 L/yr
	13407.14 L/yr*0.035 cf/L/379.49 cf/lbmole*77.95 lb/lbmole =	97.25 lb/yr
Overall control efficiency:	1-0.559/55.62 =	98.995%

For a maximum of 2 cans:

Total arsenic emissions:	0.559 lb/yr-can *2 cans =	1.118 lb/yr
	1.118 lb/yr/52 wks/yr/7 days/wk/24 hrs/day =	1.28E-04 lb/hr

Results of risk analysis:

	Residential	Commercial
MICR	9.48E-07	3.49E-07

Arsine flow rate limit (per can)	0.0256 L/min*1 (cushion factor) =	0.0256 L/min

NSR input: lb/hr * 10^6

Uncontrolled arsenic emission	0.00637 lb/hr/can*2 cans* 10^6 =	12,733
Controlled arsenic emission	0.000128 lb/hr*10^6 =	128

Arsine Emissions
2 Ion Implanters Using Arsine

Given:	A/N 492802
1 Arsine flow rate to implanter	0.0256 L/min
2 Operating schedule:	
a Hours/day	24
b Days/week	7
c Weeks/year	52
3 Sensor analyzing time (collecting sample & analyzing) (6 times: 3 at breakthrough at main canister and 3 at breakthrough at standby canister, 60 sec each)	360 sec
4 Time period between the time sensor detects break through at outlet of main canister and the time that effluent from implanter is completely switched to standby canister (Interlocks for automatic switching are required) - 3 times at 30 seconds each.	90 sec
5 Time period between the time sensor detects break through at outlet of standby canister and the time that arsine flow to implanter is shut down (Interlocks for automatic shutdown are required) - 3 times at 30 seconds each.	90 sec
6 Scrubber replacements each year	3
7 Number of scrubbers in the permit unit	2
Molecular weights:	
Arsine	77.95 lb/lbmole
Arsenic	74.92 lb/lbmole
Ionization efficiency	90%
Arsenic in arsine	96%
Implant efficiency	45%
Control efficiency:	99%
Ideal gas molar volume @ 60 F & 1 atmosphere	379.49 ft^3/lbmole
Conversion from liters to ft^3:	0.035 ft^3/L
Arsine usage cushion factor	1

Note: Cushion factor is based on permit engineer's judgements and used to give the applicant a cushion to the permit limit(s) to insure compliance.

Computations:

For 1 resin can:

(a) During normal operation:

Arsine usage:

0.0256 L/min*0.035 cf/L*60 min/hr*24 hrs/day*7 days/wk*52 wks/yr/379.49 cf/lbmole*77.95 lb/lbmole*1 = 97.3 lb/yr

Arsenic emissions:

Uncontrolled	97.25 lb/yr*0.96 arsenic in 1 arsine *((1-0.9)+0.9*(1-0.45)) =	55.62 lb/yr
	55.62 lb/yr/52 wks/yr/7 days/wk/24 hrs/day =	0.00637 lb/hr
Controlled	55.62 lb/yr*(1-0.99) =	0.556 lb/yr
	0.00637 lb/hr*(1-0.99) =	6.37E-05 lb/hr

(b) During other periods:

(Switching from main canister to standby canister and shutdown)

Amount of time when arsine is not controlled: (360 sec+90 sec+90 sec)*3 times/yr = 1620 sec/yr

Arsine used:

0.0256 L/min/60 sec/min*1620 sec/yr*0.035 cf/L/379.49 cf/lbmole*77.95 lb/lbmole*1 = 0.00501 lb/yr

Arsenic emissions: 0.00501 lb/yr*0.96 lb arsenic/lb arsine*((1-0.9)+0.9*(1-0.45)) = 0.00287 lb/yr

NSR & AEIS Inputs:

	PM	PM10
lb/hr		
Uncontr.	0.11	0.05
Contr.	0.01	0.01
lb/day		
Uncontr.		1
Contr.		0.23
lb/yr (Contr.)		84.59

HF from BF3

PM

Uncontrolled

0.82 lb/month/30 days/month/24 hrs/day*(3/1)*20.01 lb/lbmole/67.81 lb/lbmole = 0.001 lb/hr

Controlled 0.001 lb/hr*(1-0.95) = 0.00005 lb/hr

PM10

Uncontrolled 0.001 lb/hr*0.96 = 0.001 lb/hr

Controlled 0.00005 lb/hr*0.96 = 0.00005 lb/hr

HF from CF4

PM

Uncontrolled

44.52 lb/month/30 days/month/24 hrs/day*(4/1)*20.01 lb/lbmole/88 lb/lbmole*0.3 = 0.017 lb/hr

Controlled 0.017 lb/hr*(1-0.95) = 0.00084 lb/hr

PM10

Uncontrolled 0.017 lb/hr*0.96 = 0.016 lb/hr

Controlled 0.00084 lb/hr*0.96 = 0.0008 lb/hr

			PM		PM10	
	Emission	From	Uncontr.	Contr.	Uncontr.	Contr.
lb/hr	H_3PO_4	PH_3	0.02	0.0024	0.023	0.0023
	SiO_2	$SiH_{4\ Poly}$	0.063	0.0063	0.003	0.0061
	SiO_2	$SiH_{4\ LTO}$	0.004	0.0004	0.004	0.0004
	SiO_2	SiH_2Cl_2	-	-	-	-
	HCl	SiH_2Cl_2	-	-	-	-
	H_3BO_3	BF_3	0.001	0.0001	0.001	0.00005
	HF	BF_3	0.001	0.0001	0.001	0.00005
	H_3BO_3	BCl_3	-	-	-	-
	HCl	BCl_3	-	-	-	-
	HF	C_2F_6	-	-	-	-
	HF	CHF3	-	-	-	-
	HF	CF4	0.017	0.0008	0.016	0.0008
	HCl	Cl_2	-	-	-	-
	HF	SF_6	-	-	-	-
	H_2SO_4	SF_6	-	-	-	-
	HBr	HBr	-	-	-	-
	H_3PO_4	$POCl_3$	-	-	-	-
	HCl	$POCl_3$	-	-	-	-
	HCl	CHCl3	-	-	-	-
	Total		0.11	0.01	0.05	0.01
lb/day					1.15	0.23
lb/yr						84.59

Uncontrolled PM10 emissions:

lb/hr (From the table above) 0.05 lb/hr

lb/day 0.05 lb/hr*24 hrs/day = 1.15 lb/day

Controlled PM10 emissions:

lb/hr (From the table above) 0.01 lb/hr

lb/day 0.01 lb/hr*24 hrs/day = 0.23 lb/day

lb/yr 0.23 lb/day*7 days/wk*52 wks/yr = 84.59 lb/yr

Main scrubber control efficiencies[a]

HCl	95%
HF	95%
H_2SO_4	95%
H_3PO_4	95%
HBr	95%
H_3BO_3	95%
SiO_2	90%

[a] Information from HEE Environmental Engineering.

Main scrubber solid PM control efficiency

LTO diffusion furnaces integrated filters control efficiency:

SiO_2	95%
P_2O_5	0%

PM10 in PM 96%

Note 2: Arsine emissions will be calculated separately.

Computations: Except where indicated, all chemicals are used up in the process.

Emissions, lb/hr:

H3PO4 from PH3 The ratio 1/1 means 1 mole of H3PO4 is created per mole of PH3

PM

Uncontrolled With diffusion furnaces integrated filters control efficiency being counted

5.99 lb/month/30 days/month/24 hrs/day*(1/1)*98 lb/lbmole/34 lb/lbmole*(1-0) = 0.02 lb/hr

Controlled 0.02 lb/hr*(1-0.9) = 0.0024 lb/hr

PM10

Uncontrolled 0.02 lb/hr*0.96 = 0.0230 lb/hr

Controlled 0.0024 lb/hr*0.96 = 0.0023 lb/hr

SiO2 from SiH4 Poly

PM

Uncontrolled With diffusion furnaces integrated filters control efficiency being counted

24.4 lb/month/30 days/month/24 hrs/day*(1/1)*60.08 lb/lbmole/32.12 lb/lbmole = 0.063 lb/hr

Controlled 0.063 lb/hr*(1-0.9) = 0.0063 lb/hr

PM10

Uncontrolled 0.063 lb/hr*0.96 = 0.0030 lb/hr

Controlled 0.0063 lb/hr*0.96 = 0.0061 lb/hr

SiO2 from SiH4 LTO

Uncontrolled With diffusion furnaces integrated filters control efficiency being counted

31.06 lb/month/30 days/month/24 hrs/day*(1/1)*60.08 lb/lbmole/32.12 lb/lbmole*(1-0.95) = 0.004 lb/hr

Controlled 0.004 lb/hr*(1-0.9) = 0.0004 lb/hr

PM10

Uncontrolled 0.004 lb/hr*0.96 = 0.004 lb/hr

Controlled 0.0004 lb/hr*0.96 = 0.0004 lb/hr

H3BO3 from BF3

PM

Uncontrolled

0.82 lb/month/30 days/month/24 hrs/day*(1/1)*61.83 lb/lbmole/67.81 lb/lbmole = 0.001 lb/hr

Controlled 0.001 lb/hr*(1-0.95) = 0.0001 lb/hr

PM10

Uncontrolled 0.001 lb/hr*0.96 = 0.001 lb/hr

Controlled 0 lb/hr*0.96 = 0.00005 lb/hr

ATTACHMENT A

Integrated Circuit

Subsequent: 460716/492802

A/N: 337634

Previous to 337634: 293286

Given:

Breakdown Information[Note 1]

		MW	Process	Through Vector	lb/month	Used U_i	Transformed To	Transformed Amount	U_i Reacted to Form Acids
AsH_3		77.95							
PH_3	Diffusion	34.00			5.99				
SiH_4	Diffusion	32.12	Poly		24.40				
SiH_4	Diffusion	32.12	LTO		31.06				
SiH_2Cl_2		101.01							
BF_3		67.81			0.82				
BCl_3		117.169							
C_2F_6		138.01	Etch			0.6	CF4	0.4	0.2
CHF_3		70.0141	Etch			0.6	CF4	0.07	0.53
CF4		88.00	Etch		44.52	0.3			0.3
Cl_2		70.906							
SF_6		146.05	Etch			0.8			0.8
HBr		80.9119							
$SiCl_4$		169.90							
NH_3		17.03							
N_2O									
NF_3									
Metex L5B			-						
$POCl_3$	Diffusion	153.33							
Isopropanol			-						
Acetone			-						
CH_3CCl_3	(TCA)		-						
$CHCl_3$		119.38							

Note 1: Information from 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Molecular weight (MW)

	AsH3	PH3	SiH4	BF3	CF4	POCl3	H3PO4	SiO2	H3BO3
MW	77.95	34.00	32.12	67.81	88.00	153.3322	98	60.08	61.83

	HCl	H_2SO_4	BCl3	C2F6	SF6	HBr	NH3	HF	CHCl3
MW	36.46	98.07	303.33	138.01	146.05	80.9119	17.03	20.01	119.3779

Operating schedule:

hrs/day	24 hrs/day
days/wk	7 days/wk
wks/yr	52 wks/yr

Permit limits:

PH_3		3 lb/month
SiH_4	20+12 =	32 lb/month
SiH_2Cl_2		10 lb/month
BF_3		2 lb/month
CHF_3		8 lb/month
CF4		10 lb/month
Cl_2		40 lb/month
SF_6		20 lb/month
HBr		22 lb/month
$POCl_3$		8 lb/month
CH_3CCl_3		45 lb/month

lb/hr	HCl	BCl_3	-	-	-	-
	HF	C_2F_6	-	-	-	-
	HF	CHF3	0.005	0.0003	0.005	2.42E-04
	HF	CF4	0.004	0.0002	0.004	1.82E-04
	HCl	Cl_2	0.057	0.003	0.055	0.0027
	HF	SF_6	0.01827	0.0009	1.75E-02	0.0009
	H_2SO_4	SF_6	0.01492	0.0007	1.43E-02	0.0007
	HBr	HBr	0.03	0.002	0.03	0.0015
	H_3PO_4	$POCl_3$	0.007	3.55E-04	0.007	3.41E-04
	HCl	$POCl_3$	0.008	0.0004	0.008	0.00038
	HCl	CHCl3	-	-	-	-
	HCl	CH3CCl3	0.05	0.0026	0.05	0.0025
	Total		0.22	0.01	0.22	0.01
lb/day					5.180	0.261
lb/yr						95.05

Uncontrolled PM10 emissions:

lb/hr	(From the table above)		0.22	lb/hr
lb/day		0.22 lb/hr*24 hrs/day =	5.18	lb/day

Controlled PM10 emissions:

lb/hr	(From the table above)		0.01	lb/hr
lb/day		0.01 lb/hr*24 hrs/day =	0.26	lb/day
lb/yr		0.26 lb/day*7 days/wk*52 wks/yr =	95.05	lb/yr

Rule 1401 chemicals

(lb/hr from the table above)

H_3PO_4	lb/hr	0.0006+0 =	0.001	lb/hr
	lb/yr	0.001 lb/hr*24 hrs/day*7 days/wk*52 wks/yr =	8.35	lb/yr
HCl	lb/hr	0.000501338902127756+0+0.00286+0.0004+0 =	0.004	lb/hr
	lb/yr	0.004 lb/hr*24 hrs/day*7 days/wk*52 wks/yr =	32.80	lb/yr
HF	lb/hr	0.00012+0+0.00025+0.00019+0.0009 =	0.0015	lb/hr
	lb/yr	0 lb/hr*24 hrs/day*7 days/wk*52 wks/yr =	12.91	lb/yr
H_2SO_4	lb/hr		0.00075	lb/hr
	lb/yr	0.0007 lb/hr*24 hrs/day*7 days/wk*52 wks/yr =	6.52	lb/yr

NSR & AEIS Inputs:

	PM	PM10
lb/hr		
Uncontr.	0.22	0.22
Contr.	0.01	0.01
lb/day		
Uncontr.		5
Contr.		0.261
lb/yr (Contr.)		95.05

H2SO4 from SF6

PM

Uncontrolled 20 lb/month/30 days/month/24 hrs/day*(1/1)*98.07 lb/lbmole/146.05 lb/lbmole*0.8 = 0.015 lb/hr

Controlled 0.0149 lb/hr*(1-0.95) = 0.00075 lb/hr

PM10

Uncontrolled 0.0149 lb/hr*0.96 = 0.014 lb/hr

Controlled 0.000746 lb/hr*0.96 = 0.0007 lb/hr

HBr from HBr

PM

Uncontrolled 22 lb/month/30 days/month/24 hrs/day*(1/1)*80.91 lb/lbmole/80.91 lb/lbmole = 0.031 lb/hr

Controlled 0.031 lb/hr*(1-0.95) = 0.0015 lb/hr

PM10

Uncontrolled 0.031 lb/hr*0.96 = 0.029 lb/hr

Controlled 0.0015 lb/hr*0.96 = 0.0015 lb/hr

H_3PO_4 from $POCl_3$

PM

Uncontrolled 1/1 means 1 mole of H_3PO_4 is produced per mole of $POCl_3$

8 lb/month/30 days/month/24 hrs/day*(1/1)*98 lb/lbmole/153.33 lb/lbmole = 0.007 lb/hr

Controlled 0.007 lb/hr*(1-0.95) = 0.00036 lb/hr

PM10

Uncontrolled 0.007 lb/hr*0.96 = 0.007 lb/hr

Controlled 0.00036 lb/hr*0.96 = 0.0003409 lb/hr

HCl from $POCl_3$

PM

Uncontrolled

8 lb/month/30 days/month/24 hrs/day*(3/1)*36.46 lb/lbmole/153.33 lb/lbmole = 0.008 lb/hr

Controlled 0.008 lb/hr*(1-0.95) = 0.00040 lb/hr

PM10

Uncontrolled 0.008 lb/hr*0.96 = 0.008 lb/hr

Controlled 0.0004 lb/hr*0.96 = 0.00038 lb/hr

HCl from CH_3CCl_3

PM

Uncontrolled 45 lb/month/30 days/month/24 hrs/day*(3/1)*36.46 lb/lbmole/133.4 lb/lbmole = 0.051 lb/hr

Controlled 0.051 lb/hr*(1-0.95) = 0.00256 lb/hr

PM10

Uncontrolled 0.051 lb/hr*0.96 = 0.049 lb/hr

Controlled 0.00256 lb/hr*0.96 = 0.00246 lb/hr

		PM		PM10	
Emission	From	Uncontr.	Contr.	Uncontr.	Contr.
H_3PO_4	PH_3	0.012	0.0006	0.012	0.00058
SiO_2	$SiH_{4\ Poly}$	0.001	0.0001	0.001	0.00010
SiO_2	$SiH_{4\ LTO}$	0.001	0.0001	0.001	0.00006
SiO_2	SiH_2Cl_2	0.00	0.00002	0.0002	0.000016
HCl	SiH_2Cl_2	0.01	0.00050	0.0096	0.00048
H_3BO_3	BF_3	0.003	0.0001	0.002	1.22E-04
HF	BF_3	0.002	0.0001	0.002	1.18E-04
H_3BO_3	BCl_3	-	-	-	-

HCl from SiH2Cl2		
PM		
Uncontrolled	10 lb/month/30 days/month/24 hrs/day*(2/1)*36.46 lb/lbmole/101.01 lb/lbmole =	0.0100
Controlled	0.01 lb/hr*(1-0.95) =	0.0005
PM10		
Uncontrolled	0.01 lb/hr*0.96 =	0.010
Controlled	0.001 lb/hr*0.96 =	0.0005
H3BO3 from BF3		
PM		
Uncontrolled	2 lb/month/30 days/month/24 hrs/day*(1/1)*61.83 lb/lbmole/67.81 lb/lbmole =	0.003 lb/hr
Controlled	0.0025 lb/hr*(1-0.95) =	0.0001 lb/hr
PM10		
Uncontrolled	0.0025 lb/hr*0.96 =	0.002 lb/hr
Controlled	0 lb/hr*0.96 =	0.0001 lb/hr
HF from BF3		
PM		
Uncontrolled	2 lb/month/30 days/month/24 hrs/day*(3/1)*20.01 lb/lbmole/67.81 lb/lbmole =	0.002 lb/hr
Controlled	0.0025 lb/hr*(1-0.95) =	0.00012 lb/hr
PM10		
Uncontrolled	0.0025 lb/hr*0.96 =	0.002 lb/hr
Controlled	0.00012 lb/hr*0.96 =	0.00012 lb/hr
HF from CHF3		
PM		
Uncontrolled	8 lb/month/30 days/month/24 hrs/day*(3/1)*20.01 lb/lbmole/70.01 lb/lbmole*0.53 =	0.0050 lb/hr
Controlled	0.005 lb/hr*(1-0.95) =	0.00025 lb/hr
PM10		
Uncontrolled	0.005 lb/hr*0.96 =	0.005 lb/hr
Controlled	0.00025 lb/hr*0.96 =	0.00024 lb/hr
HF from CF4		
PM		
Uncontrolled	10 lb/month/30 days/month/24 hrs/day*(4/1)*20.01 lb/lbmole/88 lb/lbmole*0.3 =	0.004 lb/hr
Controlled	0.004 lb/hr*(1-0.95) =	0.00019 lb/hr
PM10		
Uncontrolled	0.004 lb/hr*0.96 =	0.004 lb/hr
Controlled	0.00019 lb/hr*0.96 =	0.00018 lb/hr
HCl from Cl2		
PM		
Uncontrolled	40 lb/month/30 days/month/24 hrs/day*(2/1)*36.46 lb/lbmole/70.91 lb/lbmole =	0.0571 lb/hr
Controlled	0.0571 lb/hr*(1-0.95) =	0.0029 lb/hr
PM10		
Uncontrolled	0.0571 lb/hr*0.96 =	0.055 lb/hr
Controlled	0.0029 lb/hr*0.96 =	0.0027 lb/hr
HF from SF6		
PM		
Uncontrolled	20 lb/month/30 days/month/24 hrs/day*(6/1)*20.01 lb/lbmole/146.05 lb/lbmole*0.8 =	0.0183 lb/hr
Controlled	0.0183 lb/hr*(1-0.95) =	0.0009 lb/hr
PM10		
Uncontrolled	0.0183 lb/hr*0.96 =	0.018 lb/hr
Controlled	0.0009 lb/hr*0.96 =	0.0009 lb/hr

Main scrubber control efficiencies[a]

HCl	95%
HF	95%
H_2SO_4	95%
H_3PO_4	95%
HBr	95%
H_3BO_3	95%
SiO_2	90%

[a] Information from HEE Environmental Engineering.

Diffusion furnaces integrated filters control efficiency:

SiO_2	98%
P_2O_5	0%
PM10 in PM	96%

Note 2: Arsine emissions will be calculated separately.

Computations: Except where indicated, all chemicals are used up in the process.

Emissions, lb/hr:

H3PO4 from PH3 — The ratio 1/1 means 1 mole of H3PO4 is created per mole of PH3

PM

Uncontrolled — With diffusion furnaces integrated filters control efficiency being counted

3 lb/month/30 days/month/24 hrs/day*(1/1)*98 lb/lbmole/34 lb/lbmole*(1-0) = 0.01 lb/hr

Controlled — 0.01 lb/hr*(1-0.95) = 0.0006 lb/hr

PM10

Uncontrolled — 0.01 lb/hr*0.96 = 0.0115 lb/hr

Controlled — 0.0006 lb/hr*0.96 = 0.00058 lb/hr

SiO2 from SiH4 Poly

PM

Uncontrolled — With diffusion furnaces integrated filters control efficiency being counted

20 lb/month/30 days/month/24 hrs/day*(1/1)*60.08 lb/lbmole/32.12 lb/lbmole*(1-0.98) = 0.001 lb/hr

Controlled — 0 lb/hr*(1-0.9) = 0.0001 lb/hr

PM10

Uncontrolled — 0 lb/hr*0.96 = 0.001 lb/hr

Controlled — 0.0001 lb/hr*0.96 = 0.0001 lb/hr

SiO2 from SiH4 LTO

Uncontrolled — With diffusion furnaces integrated filters control efficiency being counted

12 lb/month/30 days/month/24 hrs/day*(1/1)*60.08 lb/lbmole/32.12 lb/lbmole*(1-0.98) = 0.001 lb/hr

Controlled — 0.001 lb/hr*(1-0.9) = 0.0001 lb/hr

PM10

Uncontrolled — 0.001 lb/hr*0.96 = 0.001 lb/hr

Controlled — 0.0001 lb/hr*0.96 = 0.0001 lb/hr

SiO2 from SiH2Cl2

PM

Uncontrolled — With diffusion furnaces integrated filters control efficiency being counted

10 lb/month/30 days/month/24 hrs/day*(1/1)*60.08 lb/lbmole/101.01 lb/lbmole*(1-0.98) = 0.00017

Controlled — 0.00017 lb/hr*(1-0.9) = 0.00002

PM10

Uncontrolled — 0.00017 lb/hr*0.96 = 0.0002

Controlled — 0.00002 lb/hr*0.96 = 0.00002

ATTACHMENT A

Integrated Circuit

Previous: F52983 337634 A/N: 492802

Control: 460718 Scrubbers 1 & 2 (Fab1)

Given:

		MW	Process	Through Vector	lb/month	Used Ui	Breakdown Information[Note 1] Transformed To	Transformed Amount	Reacted to Form Acids
AsH_3		77.95							
PH_3	Diffusion	34.00		100%	3				
SiH_4	Diffusion	32.12	Poly		20				
SiH_4	Diffusion	32.12	LTO	100%	12				
SiH_2Cl_2		101.01			10				
BF_3		67.81			2				
BCl_3		117.169							
C_2F_6		138.01	Etch			0.6	CF4	0.4	0.2
CHF_3		70.0141	Etch		8	0.6	CF4	0.07	0.53
CF4		88.00	Etch		10	0.3			0.3
Cl_2		70.906			40				
SF_6		146.05	Etch		20	0.8			0.8
HBr		80.9119			22				
$SiCl_4$		169.90							
NH_3		17.03							
N_2O									
NF_3									
Metex L5B			-						
$POCl_3$	Diffusion	153.33			8				
Isopropanol			-						
Acetone			-						
CH_3CCl_3	(TCA)	133.40	-		45				
$CHCl_3$		119.38							

Note 1: Information from 2006 IPCC Guidelines for National Greenhouse Gas Inventories

Molecular weight (MW)

	AsH3	PH3	SiH4	BF3	CF4	POCl3	H3PO4	SiO2	H3BO3
MW	77.95	34.00	32.12	67.81	88.00	153.3322	98	60.08	61.83

	HCl	H_2SO_4	BCl3	C2F6	SF6	HBr	NH3	HF	CHCl3
MW	36.46	98.07	303.33	138.01	146.05	80.9119	17.03	20.01	119.3779

Operating schedule:

hrs/day	24 hrs/day
days/wk	7 days/wk
wks/yr	52 wks/yr

Total Vapor Pressure
95% H_2SO_4 Water Solution

LogP = A-B/(T+C)
P [=] mmHg
T [=] °C

Data:

Temperature			P*
C	F	C	mm Hg
20	68	20.00	0.000497
25	77	25.00	0.000765
30	86	30.00	0.00117

Reference: Perry, R. H. & Chilton, C. H., "Chemical Engineers' Handbood", Fifth Edition, McGraw-Hill Book Company, Table 3-13, Page 3-64.
*Estimated from data for 90% acid.

Pressure Equation and Calculated Constants A, B, and C:

LogP = A-B/(T+C)	A =	21.74
P = 10^(A-B/(T+C))	B =	16,621.26
	C =	643.61

Computations:

T 70 F (21 C)
P = 10^(21.74-16621.26/(21+643.61))
= 0.00055 mm Hg
1.06E-05 psia
7.20E-07 atm

Burn Box Rating

Fuel:			Hydrogen
Maximum fuel rate:			
scfm		0.9	scfm
scfh	0.9 scfm*60 min/hr =	54	scfh
HHV of hydogen, BTU/cf		324	BTU/cf
Maximum Heat Input Rating, MM BTU/hr:	54 scfh*324 BTU/cf*10^-6 =	0.017496	MM BTU/hr

Calculations

Photoresist

Previous: None A/N: 460747

Control:)81 (Sub: 473021,492810) / F52984 (Sub: 459172) Afterburner/Carbon Adsorber

Given:

Total resist used, lbs/day	633	
Volatile percent	85%	
VOC control efficiency*	98.7%	
		Zink

Operating schedule:

hrs/day	24 hrs/day
days/wk	7 days/wk
wks/yr	52 wks/yr

*Permit conditions (Permit F52981, Zink Oxidizer)

Computations:

VOC:

lb/hr

Uncontrolled:	633 lb/day*0.85/24 hrs/day =	22.42 lb/hr
Controlled	22.4 lb/hr*(1-0.987) =	0.29 lb/hr

lb/day

Uncontrolled:	22.4 lb/hr*24 hrs/day =	538.05 lb/day
Controlled	538.05 lb/day*(1-0.987) =	6.99 lb/day

lb/yr 6.99 lb/day*7 days/wk*52 wks/yr = 2546.05 lb/yr

	VOC	
	Uncontr.	Controlled
lb/hr	22.42	0.29
lb/day	538.05	6.99
lb/yr	-	2,546.05

*Note: This facility has a VOC cap of 1,800 lbs in any one calendar month. VOC emissions are calculated using the amount of solvent used (excluding solvage solvent) and VOC control efficiencies. For emission calculaltion purpose, controlled VOC emissions from the previous applications are used to calculate the emission rates.

Rule 1401:

To simplify our rist analysis, we use cresol emissions as total emissions.

HIs:

	Emissions		Screening Levels		HIs Contributions		Compliance
	lb/hr	lb/yr	lb/hr	lb/yr	Acute	Chronic	
Cresol	0.29	2,546.05	-	1.98E+04	-	1.29E-01	Yes
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
Total					-	1.29E-01	

TANKS 4.0.9d
Emissions Report - Detail Format
Individual Tank Emission Totals

Emissions Report for: July

T-406 - Vertical Fixed Roof Tank

	Losses(lbs)		
Components	Working Loss	Breathing Loss	Total Emissions
Waste Sulfuric Acid	2.42	0.01	2.43

TANKS 4.0.9d
Emissions Report - Detail Format
Detail Calculations (AP-42)

T-406 - Vertical Fixed Roof Tank

Month:	January	February	March	April	May	June	July	August	September	Oct
Standing Losses (lb):							0.0117			
Vapor Space Volume (cu ft):							8.0874			
Vapor Density (lb/cu ft):							0.0011			
Vapor Space Expansion Factor:							0.0426			
Vented Vapor Saturation Factor:							0.9716			
Tank Vapor Space Volume:										
Vapor Space Volume (cu ft):							8.0874			
Tank Diameter (ft):							2.5800			
Vapor Space Outage (ft):							1.5470			
Tank Shell Height (ft):							2.7500			
Average Liquid Height (ft):							1.3800			
Roof Outage (ft):							0.1770			
Roof Outage (Dome Roof)										
Roof Outage (ft):							0.1770			
Dome Radius (ft):							2.5800			
Shell Radius (ft):							1.2900			
Vapor Density										
Vapor Density (lb/cu ft):							0.0011			
Vapor Molecular Weight (lb/lb-mole):							18.0200			
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):							0.3567			
Daily Avg. Liquid Surface Temp. (deg. R):							530.9285			
Daily Average Ambient Temp. (deg. F):							73.0500			
Ideal Gas Constant R (psia cuft / (lb-mol-deg R)):							10.731			
Liquid Bulk Temperature (deg. R):							523.9983			
Tank Paint Solar Absorptance (Shell):							0.1700			
Tank Paint Solar Absorptance (Roof):							0.1700			
Daily Total Solar Insulation Factor (Btu/sqft day):							2,302.7457			
Vapor Space Expansion Factor										
Vapor Space Expansion Factor:							0.0426			
Daily Vapor Temperature Range (deg. R):							24.8571			
Daily Vapor Pressure Range (psia):							0.0000			
Breather Vent Press. Setting Range(psia):							0.0600			
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):							0.3567			
Vapor Pressure at Daily Minimum Liquid Surface Temperature (psia):							0.3567			
Vapor Pressure at Daily Maximum Liquid Surface Temperature (psia):							0.3567			
Daily Avg. Liquid Surface Temp. (deg R):							530.9285			
Daily Min. Liquid Surface Temp. (deg R):							524.7142			
Daily Max. Liquid Surface Temp. (deg R):							537.1427			
Daily Ambient Temp. Range (deg. R):							19.3000			
Vented Vapor Saturation Factor										
Vented Vapor Saturation Factor:							0.9716			
Vapor Pressure at Daily Average Liquid: Surface Temperature (psia):							0.3567			
Vapor Space Outage (ft):							1.5470			
Working Losses (lb):							2.4164			
Vapor Molecular Weight (lb/lb-mole):							18.0200			
Vapor Pressure at Daily Average Liquid Surface Temperature (psia):							0.3567			
Net Throughput (gal/mo.):							93,132.0000			
Annual Turnovers:							10,444.7103			
Turnover Factor:							0.1695			
Maximum Liquid Volume (gal):							107.0000			
Maximum Liquid Height (ft):							2.7500			
Tank Diameter (ft):							2.5800			
Working Loss Product Factor:							1.0000			
Total Losses (lb):							2.4282			

TANKS 4.0.9d
Emissions Report - Detail Format
Liquid Contents of Storage Tank

T-406 - Vertical Fixed Roof Tank

Mixture/Component	Month	Daily Liquid Surf. Temperature (deg F) Avg.	Min.	Max.	Liquid Bulk Temp (deg F)	Vapor Pressure (psia) Avg.	Min.	Max.	Vapor Mol. Weight.	Liquid Mass Fract.	Vapor Mass Fract.	Mol. Weight	Basis for Vapor Press Calculations
Waste Sulfuric Acid	Jul	71.26	65.04	77.47	64.33	0.3567	0.3567	0.3567	18.0200			0.00	

TANKS 4.0.9d
Emissions Report - Detail Format
Tank Indentification and Physical Characteristics

Identification

User Identification:	T-406
City:	
State:	
Company:	
Type of Tank:	Vertical Fixed Roof Tank
Description:	

Tank Dimensions

Shell Height (ft):	2.75
Diameter (ft):	2.58
Liquid Height (ft) :	2.75
Avg. Liquid Height (ft):	1.38
Volume (gallons):	107.00
Turnovers:	10,444.71
Net Throughput(gal/yr):	1,117,584.00
Is Tank Heated (y/n):	N

Paint Characteristics

Shell Color/Shade:	White/White
Shell Condition	Good
Roof Color/Shade:	White/White
Roof Condition:	Good

Roof Characteristics

Type:	Dome
Height (ft)	0.00
Radius (ft) (Dome Roof)	0.00

Breather Vent Settings

Vacuum Settings (psig):	-0.03
Pressure Settings (psig)	0.03

Meterological Data used in Emissions Calculations: Long Beach, California (Avg Atmospheric Pressure = 14.7 psia)

Previous: F62895 414236 A/N: 460744

Mixture Vapor Pressure
WASTE SULFURIC ACID
T-406

Operating temperature 70 F

Compounds	Amount, lb	Solution wt%*	Molecular Weight	VP mmHg	# moles (L)	mole fraction (L)	Partial VP mmHg	Mole Fraction (V)	Wt Contribution	wt% w/ water	wt% w/o water
Columns	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
H_2SO_4	10	10.00%	98.07	0.00055	0.0010196	2.00E-02	1.09E-05	5.94E-07	0.0001	0.0003%	100.00%
Water	90	90%	18.02	18.8	0.049958	0.9800	18.4420	1.00000	18.0152	99.9997%	-
	100	100%			0.050977	1.0000	18.4420	1.0000	18.02	100.00%	100.00%
						psia	0.35671		W/o water	0.0003%	

Desired throughput 93,132 gals/month
1,117,584 gals/yr

L = Liquid

(2)=(1)/100
(5)=(2)/(3)
(6)=(5)/0.050977
(7)=(4)*(6)
(8)=(7)/18.442
(9)=(3)*(8)

(10)=(9)/18.02
(11)=(10)/0.0003%

	PM/PM10/H_2SO_4
lb/hr	
Uncontr.	1.06E-08
Contr.	5.28E-10
lb/day	
Uncontr.	2.53E-07
Contr.	1.27E-08
lb/yr (Contr.)	4.61E-06

Rule 1401:

HIs:

	Emissions		Screening Levels		HIs Contributions		Compliance
	lb/hr	lb/yr	lb/hr	lb/yr	Acute	Chronic	
H_2SO_4	5.28E-10	4.61E-06	0.12	86.70	4.40E-09	5.32E-08	Yes
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
Total					4.40E-09	5.32E-08	

Monthly throughput limit: 108 gals*10348 times/yr/12 months/yr*1 = 93,132 gals/month

ATTACMENT
WASTE SULFURIC ACID
T-406
Vertical
Control: Scrubbers

Subsequent:	460744			A/N:	414236
Dimensions:	ft	inches	gals		
DIA.	2	7	108		
H	2	9			
Working volume				108	gals
Desired thoughput:				1,117,584	gals/yr
Turnovers per year				10,348	
Month selected for emission calculations:				July	
Number of days in July:				31	
Total pressure:				0.3567	psia
Maximum emissions**					
Working				2.42	lb/month
Breathing				0.01	lb/month
Note: **From TANK 4.0.9d Emissions Report				2.43	
Weight% of acid in vapor:				0.0003%	
Control efficiency:				95%	
Operating Schedule:					
hrs/day				24	hrs/day
days/wk				7	days/wk
weeks/yr				52	wks/yr
PM10 in PM				100%	
Cushion factor:				1.0	

(Cushion factor is used to give a cushion on the limit to insure compliance)

Calculations:

Emissions:

Total emission (working + breathing), lb/month	(2.42 + 0.01) lb/month =	2.43 lb/month
PM/PM10/HCl		
lb/day		
Uncontrolled	2.43 lb/month/31 days/month*0*1 =	0.000000253 lb/day
Controlled	0.000000253 lb/day*(1-0.95) =	0.000000013 lb/day
lb/hr		
Uncontrolled	0.000000253 lb/day/24 hrs/day =	0.0000000106 lb/hr
Controlled	0.000000013 lb/day/24 hrs/day =	0.0000000005 lb/hr
lb/yr	0.000000013 lb/day*7 days/wk*52 wks/yr =	0.000005 lb/yr

	PM/PM10/H_2SO_4
lb/hr	
Uncontr.	1.06E-08
Contr.	1.06E-08
lb/day	
Uncontr.	2.53E-07
Contr.	2.53E-07
lb/yr (Contr.)	9.22E-05

Rule 1401:

HIs:

	Emissions		Screening Levels		HIs Contributions		Compliance
	lb/hr	lb/yr	lb/hr	lb/yr	Acute	Chronic	
H_2SO_4	1.06E-08	9.22E-05	0.12	86.70	8.80E-08	1.06E-06	Yes
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
-	-	-	-	-	-	-	
Total					8.80E-08	1.06E-06	

Monthly throughput limit: 108 gals*10348 times/yr/12 months/yr*1 = 93,132 gals/month

ATTACMENT
WASTE SULFURIC ACID
T-406
Vertical
Control: None

Previous:	F62895	414236		A/N:	460744
Dimensions:	ft	inches	gals		
DIA.	2	7	108		
H	2	9			

Working volume	108	gals
Desired thoughput:	1,117,584	gals/yr
Turnovers per year	10,348	
Month selected for emission calculations:	July	
Number of days in July:	31	
Total pressure:	0.3567	psia
Maximum emissions**		
Working	2.42	lb/month
Breathing	0.01	lb/month
Note: **From TANK 4.0.9d Emissions Report	2.43	
Weight% of acid in vapor:	0.0003%	
Control efficiency:	0%	
Operating Schedule:		
hrs/day	24	hrs/day
days/wk	7	days/wk
weeks/yr	52	wks/yr
PM10 in PM	100%	
Cushion factor:	1.0	

(Cushion factor is used to give a cushion on the limit to insure compliance)

Calculations:

Emissions:

Total emission (working + breathing), lb/month	(2.42 + 0.01) lb/month =	2.43 lb/month
PM/PM10/HCl		
lb/day		
Uncontrolled	2.43 lb/month/31 days/month*0*1 =	0.000000253 lb/day
Controlled	0.000000253 lb/day*(1-0) =	0.000000253 lb/day
lb/hr		
Uncontrolled	0.000000253 lb/day/24 hrs/day =	0.0000000106 lb/hr
Controlled	0.000000253 lb/day/24 hrs/day =	0.0000000106 lb/hr
lb/yr	0.000000253 lb/day*7 days/wk*52 wks/yr =	0.000092 lb/yr