3.6.10

APPENDIX A
MASS OF TCE IN MEDIA CALCULATIONS

FEASIBILITY STUDY REPORT
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
AUGUST 1992
REVISED DECEMBER 1992

TABLE 1
TCE IN DRY TILL
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT

LOCATION	X (ft)	Y (ft)	Average Conc (ug/kg)	Porosity (Vv/Vs)	Density (lb/cf)	Phase Depth (ft)	Mass TCE/ Area (lb/sf)	POINT DATA: Conc1	Z1	Conc2	Z2	Avg2	Avg
DW-1t	15.74	16.53	105000	0.3	140	9	1.32E-01	0	1	210000	9	840000	105000
B-25	8.4	29	11.05	0.3	140	9	1.39E-05	5.1	1	17	9	88.4	11.05
B-26	-7	34	0	0.3	140	9	0.00E+00	0	9				0
B-28	-34	127	0	0.3	140	9	0.00E+00	0	9				0
B-37	112	110	27	0.3	140	4	1.51E-05	0	1	54	3	54	27
B-38	113	117	600	0.3	140	4	3.36E-04	1200	1	0	3	1200	600
B-30	118	128	0	0.3	140	4	0.00E+00	0	3				0
B-36	122	115	0	0.3	140	4	0.00E+00	0	3				0
B-31	123	124	0	0.3	140	4	0.00E+00	0	3				0
B-46	128	100	0	0.3	140	8	0.00E+00	0	8				0
B-29	129	130	26	0.3	140	9	3.28E-05	26	9				26
B-35	130	115	0	0.3	140	4	0.00E+00	0	3				0
B-32	131	122	0	0.3	140	4	0.00E+00	0	3				0
B-34	135	110	0	0.3	140	4	0.00E+00	0	3				0
B-33	135	120	0	0.3	140	4	0.00E+00	0	3			0	0
B-40	145	125	6.5	0.3	140	4	3.64E-06	13	1	0	3	13	6.5
B-41	150	125	19	0.3	140	4	1.06E-05	38	1	0	3	38	19
B-43	150	105	0	0.3	140	4	0.00E+00	0	3				0
B-42	155	115	47.5	0.3	140	4	2.66E-05	95	1	0	3	95	47.5
B-44	180	74	0	0.3	140	8	0.00E+00	0	8				0
B-45	190	74	0	0.3	140	8	0.00E+00	0	8				0
MW-25t	-110	97	0	0.3	140	7	0.00E+00	0	7				0
B-39	-140	126	860	0.3	140	9	1.08E-03	860	9				860
MW-24t	-210	133	0	0.3	140	8	0.00E+00	0	8				0
DW-2T	30	50	0	0.3	140	7	0.00E+00	0	1				0
OW-3T	30	65	0	0.3	140	9	0.00E+00	0	1				0

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TABLE 1 (CONTINUED)
TCE IN DRY TILL
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT

LOCATION	X (ft)	Y (ft)	Averag Conc (ug/kg)	Porosit (Vv/Vs)	Density (lb/cf)	Phase Depth (ft)	Mass TCE/ Area (lb/sf)	POINT DATA: Conc1	Z1	Conc2	Z2	Avg2	Avg
OW-4t	53	40	0	0.3	140	7	0.00E+00	0	2				0
OW-1t	25	32	7.3	0.3	140	7	7.15E-06	7.3	1				7.3
DW-4t	70	27	200	0.3	140	6	1.68E-04	200	1				200
OW-7t	90	30	0	0.3	140	6	0.00E+00	0	1				0
OW-5t	55	25	0	0.3	140	7	0.00E+00	0	1				0
DW-3t	40	23	155	0.3	140	6	1.30E-04	155	3				155
OW-6t	60	10	0	0.3	140	6	0.00E+00	0	5				0
OW-2t	30	6	36	0.3	140	6	3.02E-05	36	1				36
RO-1A	465	110	0	0.05	165	0	0.00E+00						0
RO-1B	465	150	0	0.05	165	0	0.00E+00						0
RO-1C	505	130	0	0.05	165	0	0.00E+00						0
RO-1D	565	45	0	0.05	165	0	0.00E+00						0
0	620	-130	0	0.05	165	0	0.00E+00						0
RO-1F	650	-335	0	0.05	165	0	0.00E+00						0
RO-1G	640	-390	0	0.05	165	0	0.00E+00						0
RO-1H	595	-340	0	0.05	165	0	0.00E+00						0
RO-1I	575	-240	0	0.05	165	0	0.00E+00						0
RO-1J	535	-10	0	0.05	165	0	0.00E+00						0
RO-2A	-35	-225	0	0.05	165	0	0.00E+00						0
RO-2B	5	-290	0	0.05	165	0	0.00E+00						0
RO-2C	10	-360	0	0.05	165	0	0.00E+00						0
RO-2D	-10	-425	0	0.05	165	0	0.00E+00						0
RO-2E	-35	-380	0	0.05	165	0	0.00E+00						0
RO-2F	-40	-265	0	0.05	165	0	0.00E+00						0
RO-3A	-100	-250	0	0.05	165	0	0.00E+00						0
RO-3B	-70	-310	0	0.05	165	0	0.00E+00						0
RO-3C	-75	-365	0	0.05	165	0	0.00E+00						0

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TABLE 1 (CONTINUED)
TCE IN DRY TILL
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT

LOCATION	X (ft)	Y (ft)	Averag Conc (ug/kg)	Porosit (Vv/Vs)	Density (lb/cf)	Phase Depth (ft)	Mass TCE/ Area (lb/sf)	POINT DATA: Conc1	Z1	Conc2	Z2	Avg2	Avg
RO-3D	-90	-315	0	0.05	165	0	0.00E+00						0
RO-4A	40	-665	0	0.05	165	0	0.00E+00						0
RO-4B	25	-710	0	0.05	165	0	0.00E+00						0
RO-4C	-30	-785	0	0.05	165	0	0.00E+00						0
RO-4D	-70	-790	0	0.05	165	0	0.00E+00						0
RO-4E	-65	-740	0	0.05	165	0	0.00E+00						0
RO-4F	-10	-675	0	0.05	165	0	0.00E+00						0
RO-5A	-400	-620	0	0.05	165	0	0.00E+00						0
RO-5B	-350	-685	0	0.05	165	0	0.00E+00						0
RO-5C	-435	-855	0	0.05	165	0	0.00E+00						0
RO-5D	-480	-890	0	0.05	165	0	0.00E+00						0
RO-5E	-540	-870	0	0.05	165	0	0.00E+00						0
RO-5F	-515	-725	0	0.05	165	0	0.00E+00						0

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TABLE 2
TCE IN SATURATED TILL
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT

LOCATION	X (ft)	Y (ft)	Average Conc (ug/l)	Porosity (Vv/Vs)	Density (lb/cf)	Phase Depth (ft)	Mass TCE/ Area (lb/sf)
DW-1t	9	12	160000	0.3	140	29	0.086304
MW-10t	22	5	400000	0.3	140	28	0.20832
MW-4t	140	58	27000	0.3	140	39	0.0195858
MW-1t	165	570	3.5	0.3	140	58	3.7758E-06
MW-6t	605	265	690	0.3	140	18	0.000231012
MW-11t	550	630	28	0.3	140	20	1.0416E-05
MW-18t	1080	485	0	0.3	140	25	0
MW-12t	1315	130	0	0.3	140	13	0
MW-17td	140	-120	16.0	0.3	140	28	8.3328E-06
MW-17ts	155	-125	4.7	0.3	140	37	3.23454E-06
MW-8t	930	-840	7.9	0.3	140	3	2.9388E-07
MW-3t	-435	-375	0	0.3	140	8	0
MW-16t	-95	115	49000	0.3	140	37	0.0337218
MW-23t	-140	130	43000	0.3	140	38	0.0303924
MW-24t	-205	130	4.2	0.3	140	31	2.42172E-06
MW-2t	-305	160	2.8	0.3	140	35	1.8228E-06
MW-EPA-A	-170	175	32000	0.3	140	52	0.0309504
MW-EPA-A	-145	175	750	0.3	140	38	0.0005301
MW-25t	-100	90	11	0.3	140	32	6.5472E-06
MW-15t	-170	480	74	0.3	140	80	0.000110112
MW-27t	-140	685	0	0.3	140	81	0
MW-26t	5	40	540000	0.3	140	21	0.210924
RO-1A	465	110	0	0.05	145	0	0
RO-1B	465	150	0	0.05	145	0	0
RO-1C	505	130	0	0.05	145	0	0
RO-1D	565	45	0	0.05	145	0	0
RO-1E	620	-130	0	0.05	145	0	0
RO-1F	650	-335	0	0.05	145	0	0
RO-1G	640	-390	0	0.05	145	0	0

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TABLE 2 (CONTINUED)
TCE IN SATURATED TILL
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT

LOCATION	X (ft)	Y (ft)	Average Conc (ug/l)	Porosity (Vv/Vs)	Density (lb/cf)	Phase Depth (ft)	Mass TCE/ Area (lb/sf)
RO-1H	595	-340	0	0.05	145	0	0
RO-1I	575	-240	0	0.05	145	0	0
RO-1J	535	-10	0	0.05	145	0	0
RO-2A	-35	-225	0	0.05	145	0	0
RO-2B	5	-290	0	0.05	145	0	0
RO-2C	10	-360	0	0.05	145	0	0
RO-2D	-10	-425	0	0.05	145	0	0
RO-2E	-35	-380	0	0.05	145	0	0
RO-2F	-40	-265	0	0.05	145	0	0
RO-3A	-100	-250	0	0.05	145	0	0
RO-3B	-70	-310	0	0.05	145	0	0
RO-3C	-75	-365	0	0.05	145	0	0
RO-3D	-90	-315	0	0.05	145	0	0
RO-4A	40	-665	0	0.05	145	0	0
RO-4AB	25	-710	0	0.05	145	0	0
RO-4C	-30	-785	0	0.05	145	0	0
RO-4D	-70	-790	0	0.05	145	0	0
RO-4E	-65	-740	0	0.05	145	0	0
RO-4F	-10	-675	0	0.05	145	0	0
RO-5A	-400	-620	0	0.05	145	0	0
RO-5B	-350	-685	0	0.05	145	0	0
RO-5C	-435	-855	0	0.05	145	0	0
RO-5D	-480	-890	0	0.05	145	0	0
RO-5E	-540	-870	0	0.05	145	0	0
RO-5F	-515	-725	0	0.05	145	0	0
MW-28T	-265	-95	0	0.30	140	28	0
MW-29T	-355	335	0	0.30	140	29	0
MW-30TS	-110	10	0	0.30	140	23	0
MW-30TD	-110	15	0	0.30	140	31	0
MW-10TS	20	10	220000	0.30	140	35	0.14322

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TABLE 3
TCE IN SHALLOW BEDROCK
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT

LOCATION	X (ft)	Y (ft)	Average Conc (ug/l)	Porosity (Vv/Vs)	Density (lb/cf)	Phase Dept (ft)	Mass TCE/ Area (lb/sf)
MW-10sb	20	25	51000	0.05	140	15	2.37E-03
MW-1sb	155	595	50	0.05	140	15	2.33E-06
MW-11sb	550	615	41	0.05	140	15	1.91E-06
MW-6sb	615	275	5400	0.05	140	15	2.51E-04
MW-9sb	980	265	160	0.05	140	15	7.44E-06
MW-18sb	1080	495	0	0.05	140	15	0.00E+00
MW-12sb	1320	110	0	0.05	140	15	0.00E+00
MW-17sb	140	135	0	0.05	140	15	0.00E+00
MW-5sb	65	-785	0	0.05	140	15	0.00E+00
MW-7sb	780	-365	2.7	0.05	140	15	1.26E-07
MW-8sb	940	-855	12	0.05	140	15	5.58E-07
MW-14sb	1030	-480	0.6	0.05	140	15	2.79E-08
MW-19sb	1030	-60	28	0.05	140	15	1.30E-06
MW-20sb	1260	-745	0.6	0.05	140	15	2.79E-08
MW-16sb	-80	135	9.9	0.05	140	15	4.60E-07
MW-EPA-Asb	-155	155	5.2	0.05	140	15	2.42E-07
MW-15sb	-155	485	0	0.05	140	15	0.00E+00
MW-27sb	-110	685	39	0.05	140	15	1.81E-06
MW-28sb	-255	-100	0	0.05	140	15	0.00E+00
MW-29sb	-370	320	0	0.05	140	15	0.00E+00

TABLE 4
TCE IN DEEP BEDROCK
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT

LOCATION	X	Y	Average Conc	Porosity	Density	Phase Depth	Mass TCE/ Area	POINT DATA:													
	(ft)	(ft)	(ug/l)	(Vv/Vs)	(lb/cf)	(ft)	(lb/sf)	Conc1	Z1	Conc2	Z2	Avg2	Conc3	Z3	Avg3	Conc4	Z4	Avg4	Conc5	Z5	Avg5	Avg
MW-1db	155	580	344.4785	0.05	165	215	2.30E-04	50	438	250	410	4200	550	385	10000	270	305	32800	340	275	9150	344.4785
MW-6db	550	255	2618.846	0.05	165	265	2.15E-03	5400	469	2300	449	77000	2400	408	96350	3100	369	107250	890	339	59850	2618.846
MW-11db	580	640	159.403	0.05	165	205	1.01E-04	41	444	61	418	1326	310	310	20034			0			0	159.403
MW-18db	1060	510	7.143182	0.05	165	158	3.50E-06	0	423	8.4	381	176.4	8.4	321	504	9.1	291	262.5			0	7.143182
MW-12db	1305	115	0	0.05	165	169	0.00E+00	0				0			0			0	0		0	0
MW-17db	125	-125	2093.359	0.05	165	336	2.18E-03	0	496	350	457	6825	1600	360	94575	5100	290	234500	2900	240	200000	2093.359
MW-21db	125	-620	1700	0.05	165	361	1.90E-03					0			0			0			0	1700
MW-13db	360	-650	0	0.05	165	260	0.00E+00					0			0			0			0	0
MW-22db	260	-1070	0.78	0.05	165	310	7.30E-07	3.2	449	0.8	404	90	0	344	24	0	299	0			0	0.78
MW-8db	910	-860	9.163287	0.05	165	168	4.77E-06	12	401	13	388	162.5	6.4	331	552.9	9.9	258	594.95			0	9.163287
MW-14db	1015	-490	3.242308	0.05	165	174	1.75E-06	0.6	413	1	387	20.8	1.2	347	44	8.6	257	441			0	3.242308
GW-10db	-65	90	37779.28	0.05	165	268	3.14E-02	33000	491	34000	459	1072000	43000	269	7315000			0			0	37779.28
GW-12db	-50	435	5500	0.05	165	18	3.07E-04					0			0			0			0	5500
MW-15db	-160	505	222.0079	0.05	165	246	1.69E-04	0	398	320	346	8320	210	271	19875			0			0	222.0079
MW-27db	-135	710	17	0.05	165	199	1.05E-05					0			0			0			0	17
GW-08db	105	-930	1600	0.05	165	270	1.34E-03					0			0			0			0	1600
MW-28db	-250	-115	59.15625	0.05	165	457	8.38E-05	0	525	49	475	1225	47	425	2400	77	295	8060	84	205	7245	59.15625
MW-29db	-370	330	26.64607	0.05	165	329	2.92E-05	0	479	31	442	573.5	34	352	2925	27	252	3050	26	212	1100	26.64607

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
DDM	1/6/92	HE Kei	7/20/92	86-88/26

Linemaster

SHEET NO. of

TCE IN TILL (DRY)

$$\frac{\text{MASS TCE}}{\text{AREA}} = \frac{\text{mass TCE}}{\text{mass TILL}} \times \text{Density (M/V)} \times \text{Depth of phase}$$

$$= \frac{\mu g}{Kg} \times \frac{lb}{ft^3} \times ft$$

$$= \frac{1 \times 10^{-6}\ g}{1 \times 10^{3}\ g} \times \frac{lb}{ft^3} \times ft = \frac{lb}{ft^2} = \frac{\text{mass TCE}}{\text{AREA}}$$

TCE IN Till (Aqueous) / Bedrock

$$\frac{\text{mass TCE}}{\text{AREA}} = \frac{\text{mass TCE}}{\text{vol of } H_2O} \times \text{Porosity} \times \text{Depth of Phase}$$

$$= \frac{\mu g}{l} \times \frac{\text{Vol voids}}{\text{Vol total}} \times ft$$

Convert ug/l to lbs/ft3

$1\ lb = 454\ g \quad \therefore \quad 1 \times 10^{-6}\ g \times \frac{lb}{454\ g} = 2.2 \times 10^{-9}\ lbs$

$l \times 0.03531 = ft^3 \quad \therefore \quad 1L = 0.03531\ ft^3$

$$\therefore \frac{\mu g}{l^0} = \frac{2.2 \times 10^{-9}\ lbs}{0.03531\ ft^3} = 6.23 \times 10^{-8}\ \frac{lbs}{ft^3}$$

6.23

Lotus Equation: Avg conc (ug/l) x Porosity (dimensionless) x Phase Depth (ft)
x 0.000000062 $\frac{lbs}{ft^3}$ = $\frac{lbs}{ft^2}$ TCE

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
DAY	3/5/92	HeKlei	7/20/92	86-88/2

Linemaster Switch : Summarization of Data used for TCE Mass Balance — SHEET NO. of

(I.) TCE in Dry till

- Well # and location (x(ft), y(ft)) : reference Zone 1 & Zone 4 Borings Plate 3, NOV 1991.
- Porosity and Density : reference 1/15/92 memo from Herb Klei
- Average TCE Concentration (ug/Kg) :

The AVG concentration was calculated by averaging x # of sample results located ABOVE the groundwater table, for each specific boring or well for the specific phase depth

- Data from TABLE 3-14 of phase 1B WK Plan were used for the borings
- Most recent soil data, which was from Jan 1992, was used for observation & penetrating well points in the Zone 1 Area.
- See Lotus spread sheet, TABLE 1 - Feb 26, 1992, for a complete listing of wells & actual DATA USED.

- phase depth : was determined by using the distance from ground elevation to the groundwater elevation (see Attached Figure 1)

- MASS TCE/Area = (AVG CONC) x (Density) x (phase depth) x 10^{-9}

= $\frac{\text{lb}}{\text{ft}^2}$ TCE

* NOTE : - Ground Surface elevations and groundwater elevations were referenced from TABLE 1 Summary of well Completion Details for January 1992.

- Rock outcrops (RO-) were assumed to have 0 concentration and 0 phase depth. (see plate 11 for RO locations)

FO - # 110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
DDAY	3/5/92	Herb Klei	7/20/92	86-88/27

Livemaster

SHEET NO
of

(II.) TCE IN TILL GROUND WATER

- Well # & location (x, y): reference "Interim Removal Action Collection System" Plate 1, NOV 1991.
- porosity & density: reference 1/15/92 memo from Herb Klei
- Avg. TCE Concentration (ug/l): Reference TCE in till isopleth, Plate 15, NOV. 1991.
  (see ALPHA LAB Sample 9200128.2 for MW-27E)
- phase depth: calculated by subtracting the bedrock surface elevation from the water contour elevation for each till monitoring well.
  - water contour elev: reference plate 12, NOV 1991
  - bedrock contour elev: reference plate 11, NOV 1991

- Mass TCE/Area = (AVG conc) x (Porosity) x (phase depth) x 6.2×10^{-8} lbs/ug/l water

  = lbs/ft² TCE

NOTE: - AVG TCE conc. was taken to be representative of the entire phase depth.

- Rock outcrops (RO-1) were assumed to have 0 concentration and 0 phase depth. (see plate 11 for RO locations)

NOTE: (HEK) If more than one well sample at different depths were available, an integrated average was used.

FO - # 110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT I
DDaly	3/5/92	HeKlei	7/20/92	86-88/2-

SHEET NO of

(III.) TCE IN SB GROUND WATER

- Well # and location (x,y) : reference "Interim Removal Action Collection System" Plate 1, NOV. 1991
- porosity & Density : ref. 1/15/92 memo from Herb Klei
- AVG TCE Conc (ug/l) : ref "Shallow Bedrock TCE Isopleth", plate 16, NOV 1991
  for MW-27sb ref alpha lab Sample 9200128.1
- phase depth : per conversation w/ Jim Olsen & Herb K we agreed to use 15ft for the average phase depth of all SB wells.
- MASS TCE/Area = (AVG conc) x (Porosity) x (phase depth) x

$$6.2 \times 10^{-8} \frac{lbs}{ft^3} = \frac{lbs}{ft^2} \text{ TCE}$$

NOTE : AVG TCE concentration was taken to be representative of the entire phase depth.

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
DDAy	3/5/92	HEKlei	7/20/92	86-88/27

SHEET NO. of

(IV.) TCE IN db GROUND WATER

- Well # and location (x,y) : reference "Interim Removal Action Collection System" Plate 1, NOV 1991.
- porosity & Density : ref 1/15/92 memo from Herb Klei
- AVG TCE CONCENTRATION (ug/l) : ref TCE in deep bedrock, Plate 17, NOV 1991

MW-27d's see ALPH LAB Sample 9200087.4

where a db well has more than 1 sample depth, the sample results from varying depths were averaged together for the entire phase depth to arrive at an AVG TCE conc.
(HEK) The average was an integrated average over the depth.

- phase depth : ref Summary of Well Completion Details, NOV 199

phase depth = BEDROCK Surf Elev - depth of Sb - db well pt elev
= # - 15' - #

- MASS TCE/Area = (AVG CONC) x (Porosity) x (phase depth)

$\times 6.2 \times 10^{-8} \frac{lbs}{ft^3} = \frac{lbs\ TCE}{ft^2}$.

NOTE : AVG TCE conc. was taken to be representative of the entire phase depth.

FO-#110

APPENDIX B
PILOT VAPOR EXTRACTION TEST RESULTS

FEASIBILITY STUDY REPORT
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
AUGUST 1992

1.0 VAPOR EXTRACTION PILOT TESTS

In August 1989, a field pilot vapor extraction study was conducted in the Zone 1 area at Linemaster by Vapex Environmental Technologies, Inc., Canton, Massachusetts. The objective of the project was to assess the feasibility of utilizing soil vapor extraction technology to remediate vadose zone volatile organic contamination in the Zone 1 area.

The pilot test included: field pilot and air permeability tests; air flow modeling and data interpretation; and, conclusions regarding the feasibility and practicality of the application of soil vapor extraction to remediate subsurface volatile organic compound contamination in the Zone 1 area.

1.1 Test Design

The initial air permeability test design called for the utilization of one vapor extraction well surrounded by a cluster of nested vapor probes to evaluate soil vapor extraction-related characteristics of the vadose zone soil in the Zone 1 area. After an unexpected rise in ground-water levels, it was necessary to install a shallow replacement vapor extraction well. The vapor extraction well and vapor probe locations were chosen in an effort to evaluate the most contaminated soil zones in the Zone 1 area.

1.2 Well and Probe Configuration

One vapor extraction well (VW1) and six soil vapor probes were installed on May 22, 1989. The locations of the wells and probes are shown on Figure 1-1. Two vapor probes (VP1-S and VP1-D) were placed in a borehole (VP-1) at depths of 4 and 8.5 feet. Three vapor probes (VP2-S, VP2-M and VP2-D) were placed in a borehole (VP-2) at depths of 4, 8 and 12 feet. One probe (VP3-S) was

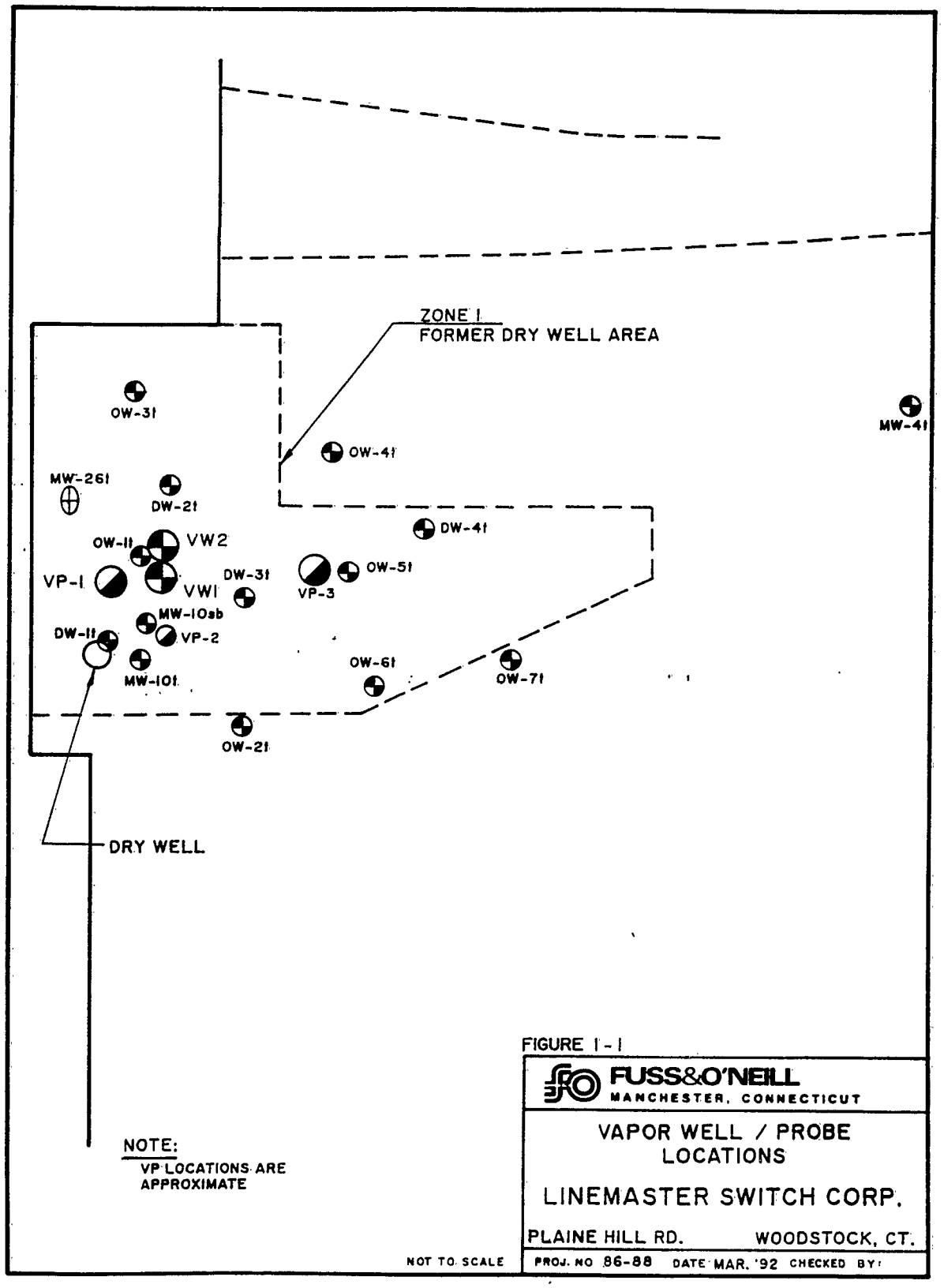

FIGURE 1 - 1

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VAPOR WELL / PROBE LOCATIONS

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061977

placed in a borehole (VP3) at a depth of 8 feet. On July 14 an additional extraction well (VW2) was installed approximately 5 feet north of VW1.

1.3 Probe Placement

Three soil borings were drilled to install vapor probes for the monitoring of the pilot test. Figure 1-2 shows a typical probe installation detail. Borings were advanced using hollow-stem auger techniques. Generally, borings were advanced to a depth of at least one foot beyond the desired vertical probe location, or until ground water was encountered. Each boring was backfilled with approximately one foot of silica sand to create a porous media in which to place the probe. The annular space between the borehole sidewalls and the vapor probe was also backfilled with silica sand to a height of approximately one foot above the probe. A six to twelve inch bentonite seal was placed above the sand filter to minimize the potential for short circuiting of soil gas through the borehole annular space. The remainder of the borehole was backfilled with native material. For boreholes containing a set of nested vapor probes, the installation was repeated for each vapor probe at the desired depth.

1.4 Vapor Extraction Well Installation

The boring for VW1 was drilled to a depth of 18 feet using standard hollow stem auguring techniques, and after a period of one hour, ground water was observed at 13 feet below grade. A bentonite seal was set from the base of the boring up to depth of eleven feet below the surface. Figure 1-3 shows a typical extraction well detail. The remainder of the boring was backfilled to the well set point with silica sand. The extraction well was constructed of 2 inch Schedule 40 PVC well screen (20 slot), 5 feet in length, and extended to grade using a five foot section of 2 inch Schedule 40 PVC casing. The annular space between the well screen and the boring was backfilled with silica

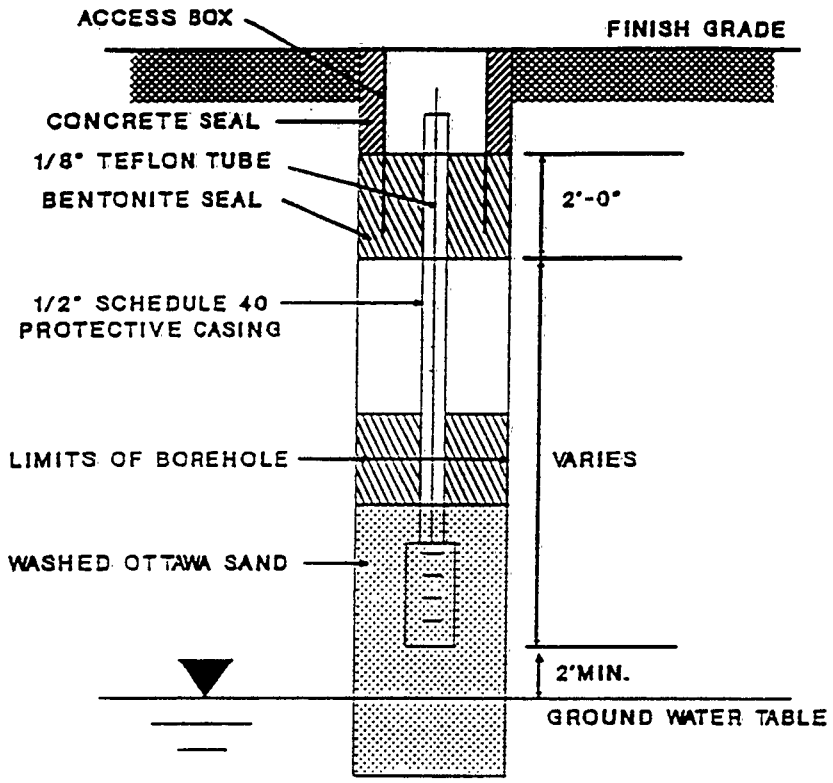

FIGURE 1 - 2

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TYPICAL VAPOR PROBE INSTALLATION DETAIL

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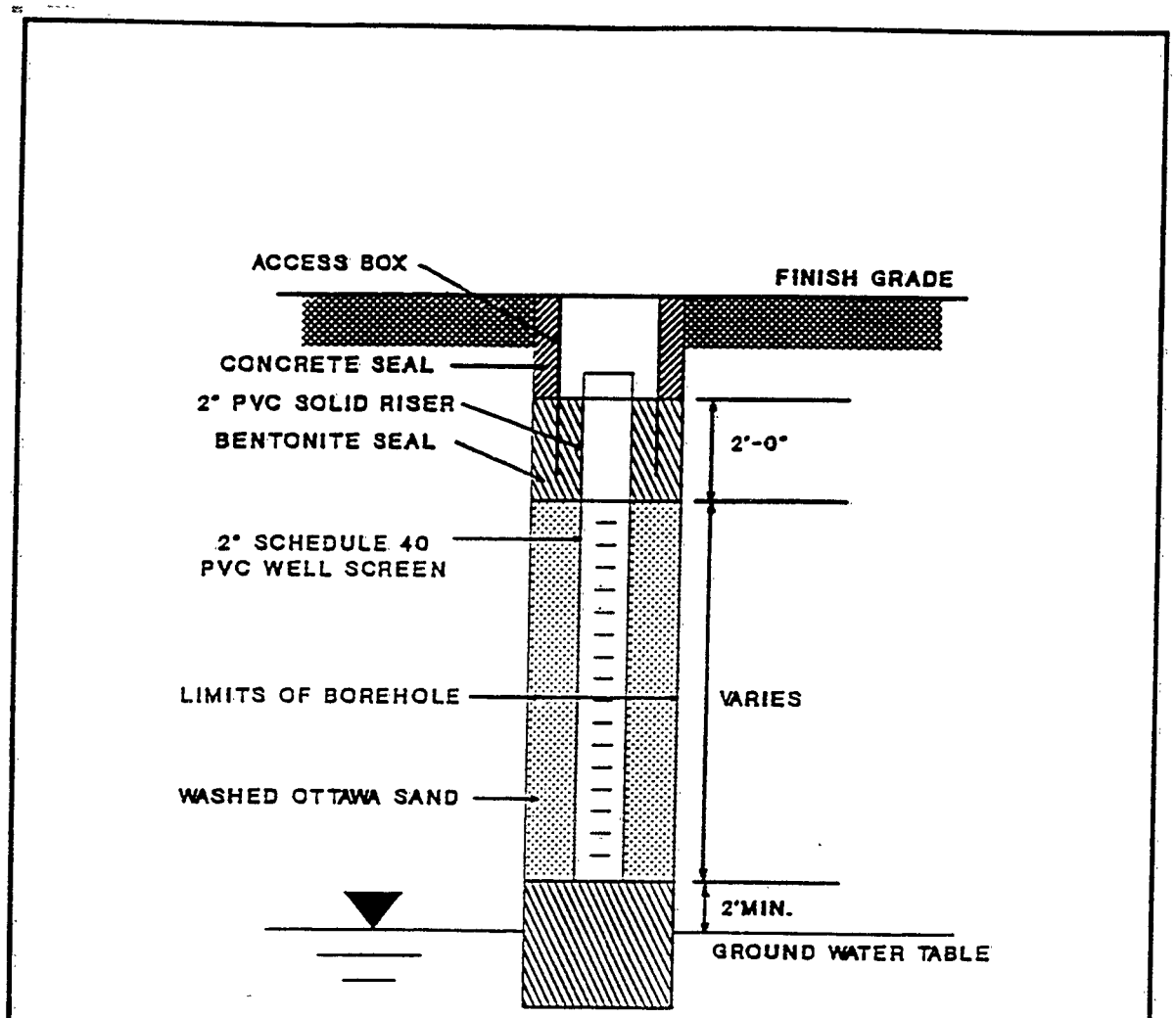

FIGURE 1 - 3

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TYPICAL VAPOR EXTRACTION WELL INSTALLATION DETAIL

LINEMASTER SWITCH CORP.

PLAINE HILL RD. WOODSTOCK, CT.

NOT TO SCALE

PROJ. NO. 86-88 DATE: MAR. '92 CHECKED BY:

061977

sand to six inches above the well screen and a minimum one foot thick bentonite seal was installed above the sand backfill. The remaining annular space was backfilled with native material auger cuttings to grade. The casing was capped with a 2-inch Schedule 40 PVC cap. The casing was then enclosed in a cast iron street box which was set in concrete.

During the installation of VP1 and VW1, two soil samples were collected for EPA Method 8010 analysis. The samples were selected in an attempt to establish a correlation between soil vapor volatile organic compound (VOC) concentrations, specifically trichloroethene (TCE), and soil VOC concentrations. The selection was aided by the use of an HNu Model P101 portable organic vapor analyzer, equipped with a photoionization detector (PID). The PID was used to screen soils during drilling.

The original pilot test was scheduled for May 25, 1989. However, it was discovered that after the installation of VW1 and the vapor probes, ground water rose to within five feet of the surface, thereby submerging the well screen of VW1 and four of the six vapor probes.

It was decided that the pilot test would be postponed until the ground water receded. By July, the ground water had receded only six inches. It was decided that a shallow extraction well would be installed to expedite the pilot test at the expense of the original, more detailed, test. On July 14, a shallow extraction well (VW2) was installed adjacent to VW1 at a depth of five feet with a three foot screened section.

As has been discussed in Section 4.3 of the Initial Site Characterization Report, the Zone 1 area is near the topographic high at the site in an area with little, if any, recharge other than precipitation. In addition, the till in the area is very dense and not very permeable. Water that percolates into the dense till remains in the till only leaching slowly along and

into the bedrock traveling toward more permeable material.

The late spring and summer 1989 were unusually wet. The May-August 1989 rainfall at Storrs, CT, the closest gauging station to the Site, was 7.3, 6.6, 4.9 and 10.0 inches respectively, totaling 28.8 inches. Rainfall for the first 4 months totaled only 12.2 inches. Ground-water levels declined unseasonably during January and were in the below-normal range statewide. During February, March and April, ground-water levels rose seasonally but remained in the low-normal to below-normal range throughout the state. Record precipitation in May caused all ground-water levels to rise into the high-normal to above-normal range. Ground-water levels declined during June and July; however, levels remained in the above normal range (U.S.G.S. 12/89).

Thus, once the vapor wells were installed, the water retained in the soil from the wet weather migrated to the open boreholes and filled the wells. Because the summer was unusually wet also (14.5 inches above normal May-August), no decrease in the water level was observed in the Zone 1 area.

Precipitation in December 1991 was 1.4 inches below normal while that for January 1992 was 0.2 inches above normal. The water level measured in the Zone 1 area in mid-February 1992 ranged from 8.3 to 11.3 feet below grade. Thus, the "normal" depth to ground water would be expected to be approximately 8-10 feet.

1.5 Soil Analysis

Two soil samples were collected from VP1 and VW1 for analysis by Toxicon Corporation of Woburn, MA, using EPA Method 8010. The sample taken from the VP1 boring at a depth of approximately 5 feet was found to contain 2,659 ug/kg methylene chloride, 200 ug/kg of 1,1,1-trichloroethane, 350 ug/kg trichloroethene, and 260 ug/kg tetrachloroethene. The sample taken from the VW1

boring at a depth of 10 feet was found to contain 2,510 ug/kg trichloroethene.

1.6 Pilot Test

On August 1, 1989 the field pilot test was performed on VW2. A portable 20 cfm rotary vane vacuum pump was used to conduct the field air permeability test. The pump was located adjacent to the vacuum well and was plumbed to the well using 1-1/2 inch diameter Schedule 40 PVC pipe. A schematic diagram of the system is shown in Figure 1-4. The pilot system discharged through one vapor phase carbon canister. Sampling ports were installed at the well head, the pump intake, the pump discharge, and the carbon canister discharge to allow periodic monitoring of the system during the test.

The air permeability and pilot testing was conducted at two different flow rates. A dilution ball valve was installed in-line between the well head and the pump intake. By opening the ball valve to the ambient air, the well head vacuum pressure could be reduced, which would result in a lower air flow rate from the well. During the initial test, a Dwyer Model-100 flow sensor was installed between the ball valve and the pump intake to measure the flow of dilution air through the ball valve. During the second test the flow sensor was placed between the well head and the pump intake to directly measure the flow rate being drawn from the vapor extraction well.

During each test, system performance was monitored by collecting the following data: vacuum pressures at the vapor probes; vacuum pressures at the well head and/or pump intake; flow rates from the well and/or dilution ball valve; volatile organic compound discharge concentrations at the pre-carbon and post-carbon sample ports; and VOCs at the vapor probes.

Prior to the initiation of the pilot test, soil gas from selected

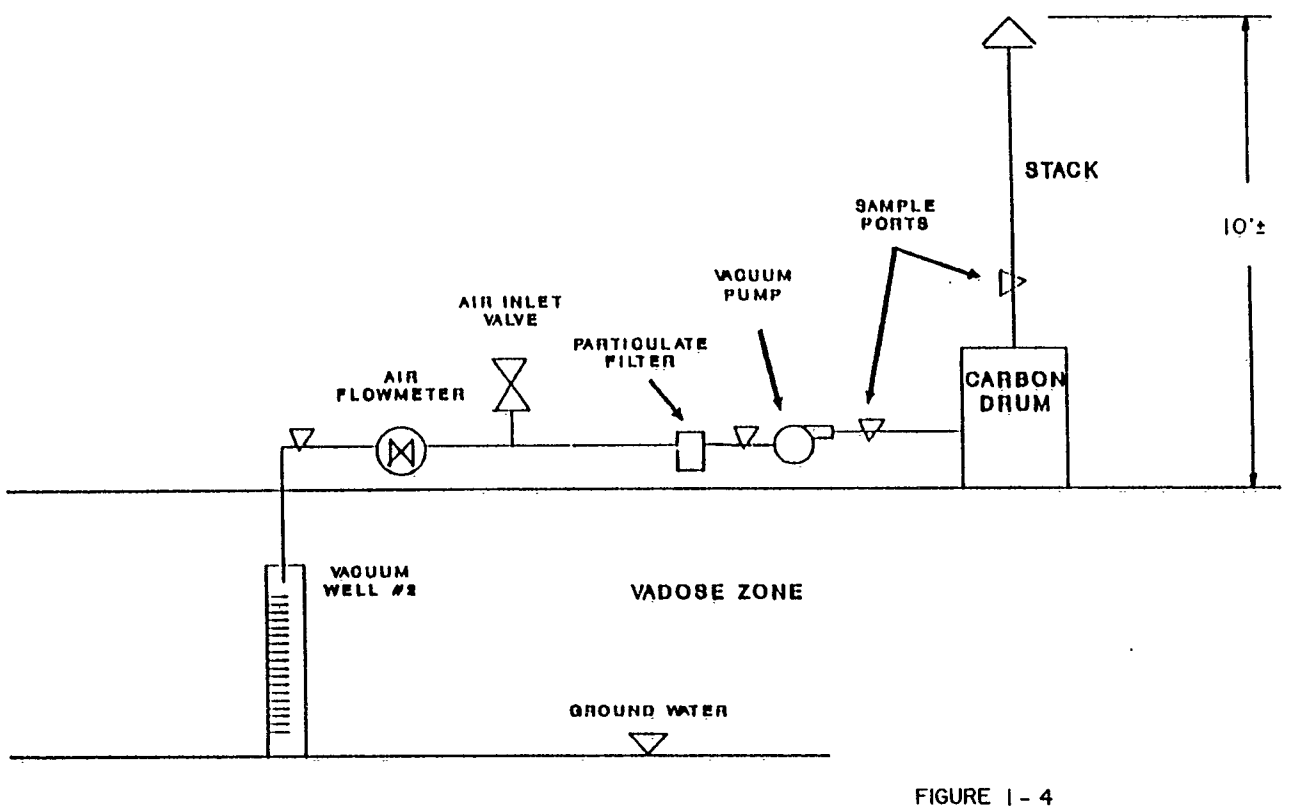

FIGURE I - 4

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PILOT TEST SCHEMATIC

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vapor probes was sampled. The data, shown in Table 1-1, obtained from this sampling event were used primarily to provide a screening base prior to gas chromatographic analyses. No readings were recorded because soil gas concentrations at each vapor probe were greater than 1000 ppm. While performing the flow tests at the vapor extraction well, soil gas from vapor probes VP1-S and VP2-S was sampled and analyzed for hydrocarbon composition and concentration using an HNu Model 321 gas chromatograph, equipped with a 10.2 eV photoionization detector (GC/PID). The GC/PID analyses were performed to determine the quantity of TCE in soil vapor samples taken from each area. The results of the OVA screening and GC/PID analyses of soil gas in vapor probe samples are presented in Table 1-1. OVA results are presented in terms of ppm of hydrocarbons on a volume per volume basis as benzene.

The initial test at VW2 (Test A) was conducted at a well flow rate of approximately 4.7 cfm (pump intake pressure of 122 inches of water), for a duration of one hour. The air flow rate was recorded at the flow sensor which was located between the air dilution valve and the pump. A dilution ball valve was used to control the vacuum level at the well to avoid inducing ground-water flow. The second test (Test B) at VW2 was conducted at a flow rate of approximately 3.5 cfm for a duration of 3.5 hours (pump intake pressure of 68 inches of water). Observation of the discharge for both tests indicated that excessive quantities of water vapor were being withdrawn at pump intake vacuum pressures in excess of 68 inches of water.

1.7 Pilot Test Results

During the initial test of VW2 at a well flow of 4.7 cfm, vacuum pressures for the two vapor probes remained below detectable limits (0.002 inches of water). The vacuum pressure at the well and pump intake during the initial test was 122 inches of water. For Test B, at a well flow rate of approximately 3.5 cfm, vacuum

TABLE 1-1

VAPOR PROBE SOIL GAS SAMPLING RESULTS
AUGUST 1989

FEASIBILITY STUDY REPORT

LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
AUGUST 1992

Sample Source	FID* (ppm)	GC/PID @** (ppm-TCE)	GC/PID (ppm Toluene)	GC/PID*** (ppm Xylenes)	
VP1-S		>1,000	458	10,387	5,344
VP2-S		>1,000	3,322	7,126	2,081

* Samples analyzed using a Thermo Electron Instruments Model 712 Total Hydrocarbon Analyzer, equipped with a flame-ionization detector (FID).

** Samples analyzed using an HNU Model 321 Gas Chromatograph, equipped with a photoionization detector (GC/PID).

*** Reported as total xylenes (includes o-, m- and p-xylene isomers, and ethylbenzene).

pressures at probes around VW2 ranged from less than 0.005 inches of water at VP1-S to 0.02 inches of water at VP2-S. The vacuum pressure at the pump intake was 68 inches of water.

As can be seen by the data, the ability to affect an area of soil (radius of influence) depends heavily on the air flow rate, the amount of vacuum and the depth of ground water. During the first test it is apparent that the induced flow of water vapor prevented the flow of air through the soil due to the high vacuum applied (122 inches of water). At the lower vacuum, 68 inches of water, the effect of the vacuum is evident, though not pronounced.

The vacuum pressure measurement results indicate a relatively limited zone of influence resulting from: a) the high silt and clay composition of the soil, and b) the high water table and capillary rise in the tight soils limiting the area of unsaturated soil being exposed to the well screen.

Vacuum pump discharge samples were analyzed for the presence of hydrocarbons using OVA and GC/PID analyses. During Test A, OVA readings at the pump discharge (precarbon) indicated total hydrocarbon concentrations from the well of 136 ppm. These samples were analyzed using a Thermo Electron Instruments Model 712 Total Hydrocarbon Analyzer equipped with a FID, calibrated to benzene. GC/PID analyses during Test A indicated TCE concentrations of 9 ppm and 17 ppm in the discharge from the well at times of 0.5 and 0.8 hours respectively. A sample from the post carbon sampling port indicated a total hydrocarbon concentration of 70 ppm on the OVA. GC/PID readings from the post-carbon exhaust were non-detectable, indicating the presence of methane or other compounds not adsorbed by carbon and/or not detected by the PID. Also, toluene and xylene concentrations were observed to be as high as 16 and 20 ppm, respectively in the pre-carbon GC/PID analysis.

During Test B, OVA readings at the pump discharge (pre-carbon) indicated a total hydrocarbon concentration from the well of 218 ppm. GC/PID analyses during Test B indicated pre-carbon TCE concentrations ranging from 25 ppm to 29 ppm. Also, toluene and xylene concentrations as high as 78 and 110 ppm were measured in the pre-carbon discharge.

1.8 Modeling Approach

Vapex utilized proprietary analytical and numerical air flow models to evaluate vadose zone soil and air flow parameters and to simulate vapor extraction system performance to establish optimal vapor extraction system configurations and flow rates. The physical characteristics of each vacuum well/vapor probe system, the vacuum pressure data and the air flow rates obtained during the field pilot testing were used as inputs to determine the air permeability tensor of the soil strata through which the air flow occurs. Utilizing a model, values for the relative horizontal intrinsic permeability (K_r) and the relative vertical intrinsic permeability (K_z) were determined for the soil strata of concern. Once the air permeability tensor was determined, the model was used in the simulation mode to obtain the pressure distribution associated with given extraction system configurations. This allowed determination of the expected air flow paths, air flow rates, and the achievable effective radius of influence of a vacuum well or system of wells.

Due to the shallow vadose zone and the nature of the soil surface cover, the system was modeled utilizing a one dimensional radially symmetric analysis. Because there were no pressure readings in Test A, the modeling was performed on the Test B data set.

1.9 Modeling Results and Discussion

Data from Test B were used by Vapex as input to the one

dimensional radially symmetric analytical model to determine the weighted average for the relative horizontal intrinsic air permeability (K_r). The physical system and the boundary conditions at Linemaster produce essentially radial flow. Therefore, an evaluation of the vertical intrinsic air permeability (K_z) was not required. The relative horizontal intrinsic air permeability was 5.5×10^{-9} cm^2, which is indicative of a low air permeability.

The Vapex model was used to determine the effective radius of influence that would be achievable at VW2 at a flow rate of 5 cfm. This simulation indicates that the achievable effective radius of influence of 5 cfm is approximately 10 to 15 feet. Simulations utilizing higher flow rates indicate that the radius of influence does not increase significantly. The operating vacuum however, increases significantly at higher flow rates.

Although the model indicates that a air flow rate up to 10 cfm is achievable for VW2, the local water table mounding resulting from the vacuum would induce ground-water infiltration. If the water table could be lowered, flow rates of 20 to 30 cfm may be feasible. Vapex estimated that with water table depression and proper screen placement, a radius of influence of 20 feet could be achieved at a 20 to 30 cfm flow rate.

1.10 Conclusions

The analysis of the data with the Vapex flow model using information generated during the pilot test demonstrate a potential zone of influence of 10 to 15 feet radially from the extraction well (VW2). The data demonstrate that venting is physically feasible. The low permeability site soils combined with the shallow water table, however, will limit achievable air flow rates and minimize the affected soil volume of a full scale vapor extraction system.

The off-gas TCE concentrations generated from the pilot test show a range of 17 to 29 ppm. However, the total identified VOC discharge concentrations ranged from 139 to 217 ppm. The discharge concentrations are lower than would be expected based on soil gas concentrations obtained from VP1 and VP2 as shown in Table 1-1. It is possible that the relatively low TCE and VOC discharge concentrations are due to two situations.

The first impediment to effective removal of organic vapors is the saturated condition of the soil in the stratum(a) with the highest amount (mass) of contaminants. Because the air cannot move through the saturated soil freely, the vapor extraction process is inefficient.

The second reason for lower soil gas concentrations is that the extracted air must pass through the relatively uncontaminated vadose zone. During this travel, the mass of contaminant contained in the air extracted from the saturated stratum is diluted by relatively clean air extracted from the vadose zone.

Air flow modeling indicates that a flow rate of 10 cfm is achievable at VW2. Due to the local ground-water mounding caused by the induced vacuum, however, ground-water flux into the vapor extraction system would be expected at flow rates in excess of 5 cfm. Pilot test discharge sampling indicated that if a flow rate of 5 cfm were employed at VW2, the initial total VOC removal rate would be approximately one pound per day.

Soil vapor extraction applied, without depressing or controlling the water table, would remediate only a portion of the affected soils. A combined soil vapor extraction and ground-water dewatering/treatment system is necessary for the complete remediation of soils that exhibit VOC contamination in Zone 1.

APPENDIX C
LABORATORY VACUUM EXTRACTION TEST RESULTS

FEASIBILITY STUDY REPORT
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
AUGUST 1992

THE UNIVERSITY OF CONNECTICUT

The School of Engineering
Environmental Research Institute
Box U-210
The Longley Building
Route 44
Storrs, CT 06269-3210
(203) 486-4015
FAX (203) 486-2269

March 16, 1992

Mr. D. Bramley
Fuss O'Neill Consulting Engineers Inc.
146 Hartford Rd.
Manchester, CT 06040

Dear Mr. Bramley:

Please find enclosed 2 sheets of analytical results for the vapor extracted soil samples (99 and 108). The soil samples were analyzed with low level method following Method 5030 in "Test Methods for Evaluating Solid Waste" (USEPA, Nov. 1986). The detection limits, as indicated in reports, are less than 5 ppb (μg/kg). No significant amount of target compounds were found. The recoveries of matrix spike standards are in the accepted ranges and summarized as following:

Compounds spiked 50 ng in 1 g soil	Recoveries % 99 vented	108 vented
1,1-dichloroethene	110	84
Benzene	103	82
Trichloroethene	114	89
Toluene	82	69
Chlorobenzene	107	87

Please review these data. If you have any question please feel free to call me.

Sincerely yours,

Liu, Shili
Laboratory Manager
Ph. D. of Chemistry

cc: R. Carley
Encls: 2 reports

VOLATILE ORGANIC COMPOUND ANALYTICAL REPORT
SAMPLE ID: F&O-99 AFTER VENT SAMPLE MATRIX: SOIL
TIME RECEIVED: 3-4-92 PREP METHOD: LOW LEVEL
TIME ANALYZED: 3-4-92 DIL. FACTOR 4
ANALYTICAL METHOD: GC/MS
GC/MS DATA FILE: VOC11\3601004
DATE REPORTED:3-13-92 REPORT FILE: VOCS009

Compound Name	CAS #	MDL PPB	RESULT PPB
Dichlorodifluoromethane	00075-71-8	4	ND
Chloromethane	00074-87-3	4	ND
Vinyl chloride	00075-01-4	4	ND
Bromomethane	00074-83-9	4	ND
Chloroethane	00075-00-3	4	ND
Trichlorofluoromethane	00075-69-4	4	ND
1,1-Dichloroethene	00075-35-4	2	ND
Methylene chloride	00075-09-2	2	3.1
trans-1,2-Dichloroethene	00156-60-5	2	ND
1,1-Dichloroethane	00075-34-3	2	ND
cis-1,2-Dichloroethene	00156-59-4	2	ND
2,2-Dichloropropane	00590-20-7	2	ND
Bromochloromethane	00074-97-5	2	ND
Chloroform	00067-66-3	2	8.8
1,1,1-Trichloroethane	00071-55-6	2	ND
1,1-Dichloropropene	00563-58-6	2	ND
Carbon tetrachloride	00056-23-5	2	ND
Benzene	00071-43-2	2	ND
1,2-Dichloroethane	00107-06-2	2	ND
Trichloroethene	00079-01-6	2	ND
1,2-Dichloropropane	00078-87-5	2	ND
Dibromomethane	00074-95-3	2	ND
Bromodichloromethane	00075-27-4	2	ND
cis-1,3-Dichloropropene	10061-01-5	2	ND
Toluene	00108-88-3	2	2.6
trans-1,3-Dichloropropene	10061-02-6	2	ND
1,1,2-Trichloroethane	00079-55-0	2	ND
1,3-Dichloropropane	00142-28-9	2	ND
Tetrachloroethene	00127-18-4	2	ND
Dibromochloromethane	00124-48-1	2	ND
1,2-Dibromoethane	00106-93-4	2	ND
Chlorobenzene	00108-90-7	2	ND
1,1,1,2-Tetrachloroethane	00630-20-6	2	ND
Ethylbenzene	00100-41-4	2	ND
m-Xylene+p-Xylene	01330-20-7	2	7.5
o-Xylene	00095-47-6	2	2.6
Styrene	00100-42-5	2	ND
Bromoform	00075-25-2	2	ND
Isopropylbenzene	00098-82-8	2	ND
1,1,2,2-Tetrachloroethane	00079-34-5	2	ND
1,2,3-Trichloropropane	00096-18-4	2	ND
Bromobenzene	00108-86-1	2	ND
n-Propylbenzene	00103-65-1	2	ND
2-Chlorotoluene	00095-49-8	2	ND
1,3,5-Trimethylbenzene	00108-67-8	2	ND
4-Chlorotoluene	00106-43-4	2	ND
tert-Butylbenzene	00098-06-6	2	ND
1,2,4-Trimethylbenzene	00095-63-6	2	3.5
sec-Butylbenzene	00135-98-8	2	ND
p-Isopropyl toluene	00099-87-6	2	ND
1,3-Dichlorobenzene	00541-73-1	2	ND
1,4-Dichlorobenzene	00106-46-7	2	ND
n-Butylbenzene	00104-51-8	2	ND
1,2-Dichlorobenzene	00095-50-1	2	ND
1,2-Dibromo-3-chloropropane	00096-12-8	4	ND
1,2,4-Trichlorobenzene	00120-82-1	2	ND
Hexachlorobutadiene	00087-68-3	4	ND
Naphthalene	00091-20-3	2	ND
1,2,3-Trichlorobenzene	00087-61-6	4	ND

VOLATILE ORGANIC COMPOUND ANALYTICAL REPORT
SAMPLE ID: F&O-108AFTER VENTI SAMPLE MATRIX: SOIL
TIME RECEIVED: 3-4-92 PREP METHOD: LOW LEVEL
TIME ANALYZED: 3-4-92 DIL. FACTOR 5
ANALYTICAL METHOD: GC/MS
GC/MS DATA FILE: VOC11\3801006
DATE REPORTED:3-13-92 REPORT FILE: VOCS010

		MDL	RESULT
Compound Name	CAS #	PPB	PPB
Dichlorodifluoromethane	00075-71-8	5	ND
Chloromethane	00074-87-3	5	ND
Vinyl chloride	00075-01-4	5	ND
Bromomethane	00074-83-9	5	ND
Chloroethane	00075-00-3	5	ND
Trichlorofluoromethane	00075-69-4	5	ND
1,1-Dichloroethene	00075-35-4	2	ND
Methylene chloride	00075-09-2	2	3.8
trans-1,2-Dichloroethene	00156-60-5	2	ND
1,1-Dichloroethane	00075-34-3	2	ND
cis-1,2-Dichloroethene	00156-59-4	2	ND
2,2-Dichloropropane	00590-20-7	2	ND
Bromochloromethane	00074-97-5	2	ND
Chloroform	00067-66-3	2	11.0
1,1,1-Trichloroethane	00071-55-6	2	ND
1,1-Dichloropropene	00563-58-6	2	ND
Carbon tetrachloride	00056-23-5	2	ND
Benzene	00071-43-2	2	ND
1,2-Dichloroethane	00107-06-2	2	ND
Trichloroethene	00079-01-6	2	ND
1,2-Dichloropropane	00078-87-5	2	ND
Dibromomethane	00074-95-3	2	ND
Bromodichloromethane	00075-27-4	2	ND
cis-1,3-Dichloropropene	10061-01-5	2	ND
Toluene	00108-88-3	2	4.8
trans-1,3-Dichloropropene	10061-02-6	2	ND
1,1,2-Trichloroethane	00079-55-0	2	ND
1,3-Dichloropropane	00142-28-9	2	ND
Tetrachloroethene	00127-18-4	2	ND
Dibromochloromethane	00124-48-1	2	ND
1,2-Dibromoethane	00106-93-4	2	ND
Chlorobenzene	00108-90-7	2	ND
1,1,1,2-Tetrachloroethane	00630-20-6	2	ND
Ethylbenzene	00100-41-4	2	3.3
m-Xylene+p-Xylene	01330-20-7	2	19.0
o-Xylene	00095-47-6	2	6.7
Styrene	00100-42-5	2	ND
Bromoform	00075-25-2	2	ND
Isopropylbenzene	00098-82-8	2	ND
1,1,2,2-Tetrachloroethane	00079-34-5	2	ND
1,2,3-Trichloropropane	00096-18-4	2	ND
Bromobenzene	00108-86-1	2	ND
n-Propylbenzene	00103-65-1	2	ND
2-Chlorotoluene	00095-49-8	2	ND
1,3,5-Trimethylbenzene	00108-67-8	2	ND
4-Chlorotoluene	00106-43-4	2	ND
tert-Butylbenzene	00098-06-6	2	ND
1,2,4-Trimethylbenzene	00095-63-6	2	19.0
sec-Butylbenzene	00135-98-8	2	ND
p-Isopropyl toluene	00099-87-6	2	ND
1,3-Dichlorobenzene	00541-73-1	2	ND
1,4-Dichlorobenzene	00106-46-7	2	ND
n-Butylbenzene	00104-51-8	2	ND
1,2-Dichlorobenzene	00095-50-1	2	ND
1,2-Dibromo-3-chloropropane	00096-12-8	5	ND
1,2,4-Trichlorobenzene	00120-82-1	2	ND
Hexachlorobutadiene	00087-68-3	5	ND
Naphthalene	00091-20-3	2	6.2
1,2,3-Trichlorobenzene	00087-61-6	5	ND

THE UNIVERSITY OF CONNECTICUT

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ERI U-210

February 26, 1992

Mr. D. Bramley
Fuss O'Neill Consulting Engineers Inc.
146 Hartford Rd.
Manchester, CT 06040

Dear Mr. Bramley:

Please find enclosed preliminary bench scale soil vapor extraction testing report for the two soil samples (99 and 108) you sent to us. The report includes 3 sets of data, two sets of GC-MS analytical data for extracted vapor and soil, one for each soil, and summary of the changes of analytes concentrations in extracted vapor for two soil samples. All the data meet our quality control criteria in the proposed QA plan. As the trichloroethene (TCE) concentrations of both untreated soil sample were very low, near to the detection limit, the reported concentrations are associated with larger uncertainty. However, analytical results for extracted vapor show the concentrations of TCE and other compounds substantially decreasing during vapor extraction experiment. The bench scale soil vapor extraction tests for these two samples indicate that under the laboratory conditions, TCE and other compounds can be removed from the soil sample. Please review these data and let me know how you would like the report finalized.

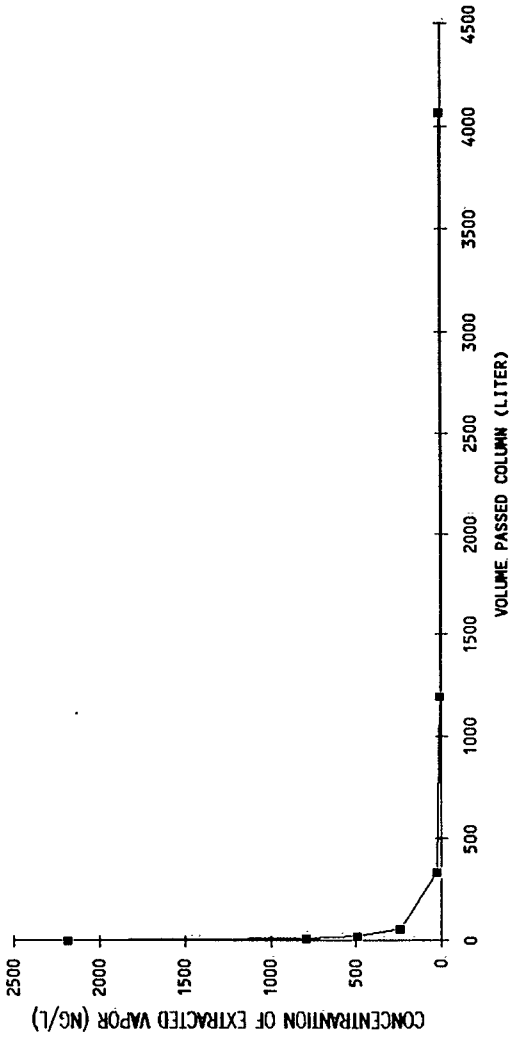
Sincerely yours,

Liu, Shili
Laboratory Manager
Ph. D. of Chemistry

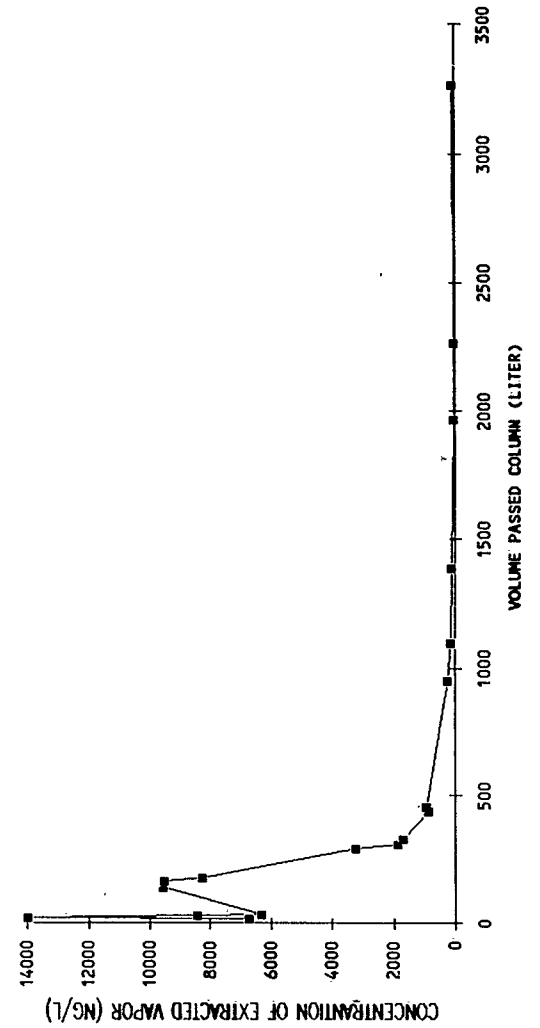
Vapor Extraction Bench Scale Experiment			
Soil Sample information: 373911204-99 Fr			
Mass: 1656g			
Date	Time		
MM/DD	HH:MM	VOLUME (L)	TCE (ng/L)
1/23/92	10:20		
1/23/92	10:45	0	2182
1/23/92	11:59	12	787.6
1/23/92	12:59	24	489.6
1/23/92	15:11	60	239.8
1/24/92	14:27	336	25.5
1/27/92	14:50	1200	4.96
2/6/92	13:00	4068	7.34
2/6/92	13:00	4068	7.72

COL4TCE.XLC

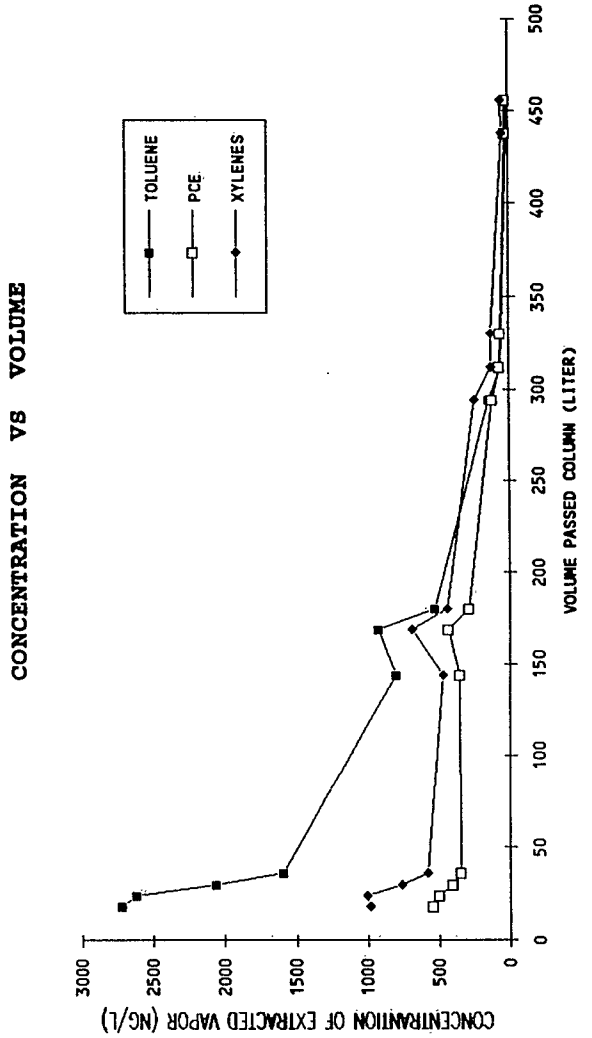
CONCENTRATION VS VOLUME FOR TCE



Vapor Extraction Bench Scale Experiment Data Sheet						
Soil Sample information: 373911205-108 From F&O Engineer						
Mass: 1638g						
Date	Time		EXTRACTED VAPOR CONC.(ng/L)			
MM/DD/YY	HH:MM	VOLUME	TCE	TOLUENE	PCE	XYLENES
1/28/92	9:45	0				
1/28/92	12:06	18	6720	2720	542	987
1/28/92	13:06	24	13968	2616	499.4	1009.6
1/28/92	14:10	30	8432	2062	408.4	761.4
1/28/92	15:10	36	6316	1592	348.6	581
1/29/92	9:11	144	9562	804	355.2	468.6
1/29/92	13:47	168	9536	925	437	691.2
1/29/92	15:33	180	8262	530	288.8	439.2
1/30/92	10:13	294	3224	142	117.4	242
1/30/92	13:18	312	1856	64	69.2	123.8
1/30/92	16:09	330	1673	53	60.2	125.3
1/31/92	10:27	438	854	16	22.4	46.5
1/31/92	13:31	456	921	18	24	54.5
2/3/92	11:22	954	233.4			
2/4/92	11:09	1098	148.9			
2/6/92	11:12	1386	103.8			
2/10/92	12:32	1968	46			
2/12/92	14:06	2268	45.8			
2/19/92	12:30	3264	78.1			



COL5TCE.XLC



COL5REST.XLC

Vapor Extraction Bench Scale Experiment Data Sheet						
Soil Sample information: 373911204-99 From F&O Engin						
Mass: 1656g		Column ID: 3 in. (7.62cm)			Height: 20.5 cmm	
Date	Time	Flow rate	Press. Dif	Sample Vol	Anal. Time	Data file
MM/DD	HH:MM	ml/min.	in. water	ml	HH:MM	
1/23/92	9:45	lab blank		50	9:45	BNA4A01A.D
1/23/92	10:20	200	60	started		
1/23/92	10:45	200	60	50	10:45	BNA4A02A.D
1/23/92	11:59	200	53	50	11:59	BNA4A03A.D
1/23/92	12:59	200	44	50	12:59	BNA4A04A.D
1/23/92	15:11	200	13	50	15:11	BNA4A05A.D
1/24/92	13:25	lab blank		50	13:25	BNA4A06A.D
1/24/92	14:27	200	4	50	14:27	BNA4A07A.D
1/27/92	9:39	lab blank		50	9:39	BNA4A08A.D
1/27/92	10:37	200	6	50	10:37	BNA4A09A.D
1/27/92	11:55	NBS Cal Gas		1000	11:55	BNA4A10A.D
1/27/92	14:50	200	4	1000	14:50	BNA4A12A.D
2/6/92	13:00	200	4	1000	14:39	BNA4A13A.D
2/6/92	13:00	200	4	1000	16:07	BNA4A14A.D
Flow rate vs Press.differencebefore experiment (packing desity:121 pcf)						
		20	8			
		90	30			
		150	47			
		200	60			
		385	95			

BNH4A01A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : LAB. BLK.	Canister ID Number:				
TIME RECEIVED: 01-23-92 09:42	Relative Humidity(%):				
TIME ANALYZED: 01-23-92 09:42	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):				
GC/MS DATA FILE: BNH4A01A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A01A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 01-27-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40				U
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00	1.17			BJ
00095-50-1 1,2-Dichlorobenzene	147.00	1.51			BJ
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	119.1	99.8%	
Surrogate 2 Toluene-d8		94.3	93.5	99.1%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	124.3	91.8%	

BNH4A02A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911204-99	Canister ID Number:				
TIME RECEIVED: 01-23-92 10:45	Relative Humidity(%):				
TIME ANALYZED: 01-23-92 10:45	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH4A02A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A02A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 01-27-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	109.1	2182	399.2	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	4.13	82.6	21.6	J
00127-18-4 Tetrachloroethene	165.85	0.87	17.3	2.5	J
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16	1.39	27.9	6.3	J
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00	1.02	20.5	3.3	BJ
00095-50-1 1,2-Dichlorobenzene	147.00	1.32	26.3	4.3	BJ
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	121.8	102.1%	
Surrogate 2 Toluene-d8		94.3	93.6	99.2%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	112.6	83.2%	

BNH4A03A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911204-99	Canister ID Number:				
TIME RECEIVED: 01-23-92 11:59	Relative Humidity(%):				
TIME ANALYZED: 01-23-92 11:59	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH4A03A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A03A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 01-28-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	39.4	787.6	144.1	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	1.10	22.0	5.7	J
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00	0.75	15.0	2.5	BJ
00095-50-1 1,2-Dichlorobenzene	147.00	0.98	19.6	3.2	BJ
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	126.0	105.6%	
Surrogate 2 Toluene-d8		94.3	95.0	100.7%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	114.8	84.8%	

BNH4A04A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911204-99	Canister ID Number:				
TIME RECEIVED: 01-23-92 12:59	Relative Humidity(%):				
TIME ANALYZED: 01-23-92 12:59	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH4A04A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A04A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 01-28-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	24.5	489.6	89.6	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	0.63	12.5	3.3	J
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00	0.53	10.6	1.7	BJ
00095-50-1 1,2-Dichlorobenzene	147.00	0.65	13.1	2.1	BJ
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	125.0	104.8%	
Surrogate 2 Toluene-d8		94.3	93.1	98.7%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	107.5	79.4%	

BNH4A05A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911204-99	Canister ID Number:				
TIME RECEIVED: 01-23-92 15:11	Relative Humidity(%):				
TIME ANALYZED: 01-23-92 15:11	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH4A05A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A05A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 01-28-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	12.0	239.8	43.9	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00	0.69	13.9	2.3	BJ
00095-50-1 1,2-Dichlorobenzene	147.00	0.85	17.1	2.8	BJ
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	127.0	106.5%	
Surrogate 2 Toluene-d8		94.3	93.6	99.2%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	113.9	84.1%	

BNH4A06A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : LAB. BLK.	Canister ID Number:				
TIME RECEIVED: 01-24-92 13:25	Relative Humidity(%):				
TIME ANALYZED: 01-24-92 13:25	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):				
GC/MS DATA FILE: BNH4A06A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A06A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 01-30-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40				U
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	148.7	124.6%	
Surrogate 2 Toluene-d8		94.3	107.4	113.9%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	79.0	58.3%	

BNH4A07A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911204-99	Canister ID Number:				
TIME RECEIVED: 01-24-92 14:27	Relative Humidity(%):				
TIME ANALYZED: 01-24-92 14:27	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH4A07A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A07A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 01-30-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	1.3	25.5	4.7	J
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	146.3	122.6%	
Surrogate 2 Toluene-d8		94.3	100.5	106.6%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	74.5	55.0%	

BNH4A08A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : LAB. BLK.	Canister ID Number:				
TIME RECEIVED: 01-27-92 0:39	Relative Humidity(%):				
TIME ANALYZED: 01-27-92 09:39	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):				
GC/MS DATA FILE: BNH4A08A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A08A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 01-30-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40				U
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00	0.86			BJ
00095-50-1 1,2-Dichlorobenzene	147.00	1.13			BJ
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	144.2	120.9%	
Surrogate 2 Toluene-d8		94.3	104.1	110.4%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	92.8	68.6%	

BNH4A10A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : NBS GAS	Canister ID Number:			5339	
TIME RECEIVED: 01-27-92 11:55	Relative Humidity(%):				
TIME ANALYZED: 01-27-92 11:55	Dryer Use (Yes/No):			YES	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			1.0	
GC/MS DATA FILE: BNH4A10A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A10A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 01-30-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93	19.03	19.0	5.4	
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39	21.99	22.0	4.4	
00071-55-6 1,1,1-Trichloroethane	133.42	30.65	30.7	5.5	
00056-23-5 Carbon tetrachloride	153.83	27.94	27.9	4.4	
00071-43-2 Benzene	78.11	13.28	13.3	4.1	
00107-06-2 1,2-Dichloroethane	98.96	19.64	19.6	4.8	
00079-01-6 Trichloroethene	131.40	23.8	23.8	4.4	
00078-87-5 1,2-Dichloropropane	113.00	25.52	25.5	5.4	
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	16.02	16.0	4.2	
00127-18-4 Tetrachloroethene	165.85	27.22	27.2	3.9	
00108-90-7 Chlorobenzene	112.60	18.32	18.3	3.9	
00100-41-4 Ethylbenzene	106.16	18.83	18.8	4.3	
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16	19.42	19.4	4.4	
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00	1.85	1.8	0.3	BJ
00095-50-1 1,2-Dichlorobenzene	147.00	2.80	2.8	0.5	BJ
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	125.2	104.9%	
Surrogate 2 Toluene-d8		94.3	88.6	94.0%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	87.0	64.2%	

BNH4A12A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911204-99	Canister ID Number:			5343	
TIME RECEIVED: 01-27-92 14:50	Relative Humidity(%):				
TIME ANALYZED: 01-27-92 14:50	Dryer Use (Yes/No):			YES	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			1.0	
GC/MS DATA FILE: BNH4A12A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A12A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 01-30-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42	0.55	0.5	0.1	J
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	4.96	4.96	0.9	J
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	0.58	0.6	0.2	J
00127-18-4 Tetrachloroethene	165.85	1.03	1.0	0.1	J
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16	0.91	0.9	0.2	J
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00	0.68	0.7	0.1	BJ
00095-50-1 1,2-Dichlorobenzene	147.00	0.93	0.9	0.2	BJ
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	141.0	118.2%	
Surrogate 2 Toluene-d8		94.3	98.0	103.9%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	100.2	74.0%	

BNH4A13A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911204-99	Canister ID Number:			5343	
TIME RECEIVED: 02-06-92 13:00	Relative Humidity(%):				
TIME ANALYZED: 02-06-92 14:39	Dryer Use (Yes/No):			YES	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			1.0	
GC/MS DATA FILE: BNH4A13A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A13A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-10-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93	0.60	0.6	0.2	J
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	7.34	7.34	1.3	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	1.61	1.6	0.4	J
00127-18-4 Tetrachloroethene	165.85	4.94	4.9	0.7	J
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	0.56	0.6	0.1	J
01330-20-7 m-Xylene and/or p-Xylene	106.16	2.48	2.5	0.6	J
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	129.8	108.8%	
Surrogate 2 Toluene-d8		94.3	93.5	99.2%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	115.8	85.5%	

BNH4A14A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911204-99	Canister ID Number:			5343	
TIME RECEIVED: 02-06-92 13:00	Relative Humidity(%):				
TIME ANALYZED: 02-06-92 16:07	Dryer Use (Yes/No):			YES	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			1.0	
GC/MS DATA FILE: BNH4A14A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH4A14A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-10-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93	0.60	0.6	0.2	J
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	7.72	7.72	1.4	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	1.72	1.7	0.4	J
00127-18-4 Tetrachloroethene	165.85	5.07	5.1	0.7	J
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	0.58	0.6	0.1	J
01330-20-7 m-Xylene and/or p-Xylene	106.16	2.79	2.8	0.6	J
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10	0.68	0.7	0.2	J
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	127.7	107.0%	
Surrogate 2 Toluene-d8		94.3	90.7	96.2%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	98.7	72.9%	

VOLATILE ORGANIC COMPOUND ANALYTICAL REPORT			
SAMPLE ID: F&O-99 AFTER VENTI	SAMPLE MATRIX: SOIL		
TIME RECEIVED: 2-7-92	PREP METHOD: METHANOL EXTRACT		
TIME ANALYZED: 2-11-92	DIL. FACTOR	909	
ANALYTICAL METHOD: GC/MS			
GC/MS DATA FILE: VOC11\0301004			
DATE REPORTED: 2-20-92	REPORT FILE: VOCS004		
		MDL	RESULT
Compound Name	CAS #	PPB	PPB
Dichlorodifluoromethane	00075-71-8	910	ND
Chloromethane	00074-87-3	910	ND
Vinyl chloride	00075-01-4	910	ND
Bromomethane	00074-83-9	910	ND
Chloroethane	00075-00-3	910	ND
Trichlorofluoromethane	00075-69-4	910	ND
1,1-Dichloroethene	00075-35-4	450	ND
Methylene chloride	00075-09-2	450	ND
trans-1,2-Dichloroethene	00156-60-5	450	ND
1,1-Dichloroethane	00075-34-3	450	ND
cis-1,2-Dichloroethene	00156-59-4	450	ND
2,2-Dichloropropane	00590-20-7	450	ND
Bromochloromethane	00074-97-5	450	ND
Chloroform	00067-66-3	450	ND
1,1,1-Trichloroethane	00071-55-6	450	ND
1,1-Dichloropropene	00563-58-6	450	ND
Carbon tetrachloride	00056-23-5	450	ND
Benzene	00071-43-2	450	ND
1,2-Dichloroethane	00107-06-2	450	ND
Trichloroethene	00079-01-6	450	ND
1,2-Dichloropropane	00078-87-5	450	ND
Dibromomethane	00074-95-3	450	ND
Bromodichloromethane	00075-27-4	450	ND
cis-1,3-Dichloropropene	10061-01-5	450	ND
Toluene	00108-88-3	450	ND
trans-1,3-Dichloropropene	10061-02-6	450	ND
1,1,2-Trichloroethane	00079-55-0	450	ND
1,3-Dichloropropane	00142-28-9	450	ND
Tetrachloroethene	00127-18-4	450	ND
Dibromochloromethane	00124-48-1	450	ND
1,2-Dibromoethane	00106-93-4	450	ND
Chlorobenzene	00108-90-7	450	ND
1,1,1,2-Tetrachloroethane	00630-20-6	450	ND
Ethylbenzene	00100-41-4	450	ND
m-Xylene	00108-38-3	450	ND
p-Xylene	00106-42-3	450	ND
Styrene	00100-42-5	450	ND
Bromoform	00075-25-2	450	ND
Isopropylbenzene	00098-82-8	450	ND
o-Xylene	00095-47-6	450	ND
1,1,2,2-Tetrachloroethane	00079-34-5	450	ND
1,2,3-Trichloropropane	00096-18-4	450	ND
Bromobenzene	00108-86-1	450	ND
n-Propylbenzene	00103-65-1	450	ND
2-Chlorotoluene	00095-49-8	450	ND
1,3,5-Trimethylbenzene	00108-67-8	450	ND
4-Chlorotoluene	00106-43-4	450	ND
tert-Butylbenzene	00098-06-6	450	ND
1,2,4-Trimethylbenzene	00095-63-6	450	ND
sec-Butylbenzene	00135-98-8	450	ND
p-Isopropyl toluene	00099-87-6	450	ND
1,3-Dichlorobenzene	00541-73-1	450	ND
1,4-Dichlorobenzene	00106-46-7	450	ND
n-Butylbenzene	00104-51-8	450	ND
1,2-Dichlorobenzene	00095-50-1	450	ND
1,2-Dibromo-3-chloropropane	00096-12-8	910	ND
1,2,4-Trichlorobenzene	00120-82-1	450	ND
Hexachlorobutadiene	00087-68-3	910	ND
Naphthalene	00091-20-3	450	ND
1,2,3-Trichlorobenzene	00087-61-6	910	ND

VOLATILE ORGANIC COMPOUND ANALYTICAL REPORT			
SAMPLE ID: F&O-99 BEFORE VENT	SAMPLE MATRIX: SOIL		
TIME RECEIVED: 1-6-92	PREP METHOD: METHANOL EXTRACT		
TIME ANALYZED: 1-15-92	DIL. FACTOR	909	
ANALYTICAL METHOD: GC/MS			
GC/MS DATA FILE: VOC10\4101009			
DATE REPORTED: 2-20-92	REPORT FILE: VOCS001		
		MDL	RESULT
Compound Name	CAS #	PPB	PPB
Dichlorodifluoromethane	00075-71-8	910	ND
Chloromethane	00074-87-3	910	ND
Vinyl chloride	00075-01-4	910	ND
Bromomethane	00074-83-9	910	ND
Chloroethane	00075-00-3	910	ND
Trichlorofluoromethane	00075-69-4	910	ND
1,1-Dichloroethene	00075-35-4	450	ND
Methylene chloride	00075-09-2	450	ND
trans-1,2-Dichloroethene	00156-60-5	450	ND
1,1-Dichloroethane	00075-34-3	450	ND
cis-1,2-Dichloroethene	00156-59-4	450	ND
2,2-Dichloropropane	00590-20-7	450	ND
Bromochloromethane	00074-97-5	450	ND
Chloroform	00067-66-3	450	ND
1,1,1-Trichloroethane	00071-55-6	450	ND
1,1-Dichloropropene	00563-58-6	450	ND
Carbon tetrachloride	00056-23-5	450	ND
Benzene	00071-43-2	450	ND
1,2-Dichloroethane	00107-06-2	450	ND
Trichloroethene	00079-01-6	450	636.4
1,2-Dichloropropane	00078-87-5	450	ND
Dibromomethane	00074-95-3	450	ND
Bromodichloromethane	00075-27-4	450	ND
cis-1,3-Dichloropropene	10061-01-5	450	ND
Toluene	00108-88-3	450	ND
trans-1,3-Dichloropropene	10061-02-6	450	ND
1,1,2-Trichloroethane	00079-55-0	450	ND
1,3-Dichloropropane	00142-28-9	450	ND
Tetrachloroethene	00127-18-4	450	ND
Dibromochloromethane	00124-48-1	450	ND
1,2-Dibromoethane	00106-93-4	450	ND
Chlorobenzene	00108-90-7	450	ND
1,1,1,2-Tetrachloroethane	00630-20-6	450	ND
Ethylbenzene	00100-41-4	450	ND
m-Xylene	00108-38-3	450	ND
p-Xylene	00106-42-3	450	ND
Styrene	00100-42-5	450	ND
Bromoform	00075-25-2	450	ND
Isopropylbenzene	00098-82-8	450	ND
o-Xylene	00095-47-6	450	ND
1,1,2,2-Tetrachloroethane	00079-34-5	450	ND
1,2,3-Trichloropropane	00096-18-4	450	ND
Bromobenzene	00108-86-1	450	ND
n-Propylbenzene	00103-65-1	450	ND
2-Chlorotoluene	00095-49-8	450	ND
1,3,5-Trimethylbenzene	00108-67-8	450	ND
4-Chlorotoluene	00106-43-4	450	ND
tert-Butylbenzene	00098-06-6	450	ND
1,2,4-Trimethylbenzene	00095-63-6	450	ND
sec-Butylbenzene	00135-98-8	450	ND
p-Isopropyl toluene	00099-87-6	450	ND
1,3-Dichlorobenzene	00541-73-1	450	ND
1,4-Dichlorobenzene	00106-46-7	450	ND
n-Butylbenzene	00104-51-8	450	ND
1,2-Dichlorobenzene	00095-50-1	450	ND
1,2-Dibromo-3-chloropropane	00096-12-8	910	ND
1,2,4-Trichlorobenzene	00120-82-1	450	ND
Hexachlorobutadiene	00087-68-3	910	ND
Naphthalene	00091-20-3	450	ND
1,2,3-Trichlorobenzene	00087-61-6	910	ND

Vapor Extraction Bench Scale Experiment Data Sheet						
Soil Sample information: 373911205-108 From F&O En						
Mass: 1638g		Column ID: 2.88 in. (7.3cm)			Height: 17.0 cm	
Date	Time	Flow rat	Press. Di	Sample Vol	Anal. Time	Data file
MM/DD/YY	HH:MM	ml/min.	in. water	ml	HH:MM	
1/28/92	9:45	100	132.5			start ventin
1/28/92	11:01	lab blan	132.5	50	11:01	BNA5A01A.D
1/28/92	12:06	100	132.5	50	12:06	BNA5A02A.D
1/28/92	13:06	100	132.5	50	13:06	BNA5A03A.D
1/28/92	14:10	100	121.44	50	14:10	BNA5A04A.D
1/28/92	15:10	100	121.4	50	15:10	BNA5A05A.D
1/29/92	9:11	lab blan	19	50	9:11	BNA5A06A.D
1/29/92	10:03	100	19	50	10:03	BNA5A07A.D
1/29/92	11:14	lab blan	19	1000	11:14	BNA5A08A.D
1/29/92	12:37	NBS Cal		1000	12:37	BNA5A09A.D
1/29/92	13:47	100	18	50	13:37	BNA5A10A.D
1/29/92	15:33	100	17	50	15:33	BNA5A11A.D
1/30/92	9:20	lab blan	17	50	9:20	BNA5A12A.D
1/30/92	10:13	100	17	50	10:13	BNA5A13A.D
1/30/92	13:18	100	17	50	13:18	BNA5A14A.D
1/30/92	16:09	100	16	50	16:09	BNA5A15A.D
1/31/92	9:24	lab blan	13	50	9:24	BNA5A16A.D
1/31/92	10:27	100	13	50	10:27	BNA5A17A.D
1/31/92	13:31	100	12	50	13:31	BNA5A18A.D
1/31/92	15:44	NBS Cal		1000	15:44	BNA5A19A.D
2/3/92	10:22	Lab Blank		50	10:22	BNA5A20A.D
2/3/92	11:22	100	7	50	11:22	BNA5A21A.D
2/3/92	13:15	100	7	50	13:15	BNA5A22A.D
2/4/92	11:09	100	6	50	11:09	BNA5A23A.D
2/6/92	9:00	lab blank		50	9:00	BNA5A24A.D
2/6/92	11:12	100	5	50	11:12	BNA5A25A.D
2/6/92	13:21	NBS Cal Gas		1000	13:21	BNA5A26A.D
2/10/92	9:20	lab Blank		50	9:20	BNA5A27A.D
2/10/92	12:32	100	5	50	12:32	BNA5A28A.D
2/12/92	14:06	100	5	1000	14:06	BNA5A29A.D
2/19/92	12:30	100	5	1000	14:32	BNA5A30A.D
Flow rate vs Press.difference before experiment (packing desity:144 pcf)						
		90	137			
		135	163			
		215	171			
		265	185			

BNH5A01A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : LAB. BLK.	Canister ID Number:				
TIME RECEIVED: 01-28-92 11:01	Relative Humidity(%):				
TIME ANALYZED: 01-28-92 11:01	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):				
GC/MS DATA FILE: BNH5A01A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A01A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	1.38			BJ
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	134.7	112.9%	
Surrogate 2 Toluene-d8		94.3	95.8	101.5%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	92.1	68.1%	

BNH5A02A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 01-28-92 12:06	Relative Humidity(%):				
TIME ANALYZED: 01-28-92 12:06	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A02A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A02A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	336.0	6720	1229.4	B
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	138.10	2762	720.7	
00127-18-4 Tetrachloroethene	165.85	27.09	541.8	78.5	
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	9.39	187.7	42.5	
01330-20-7 m-Xylene and/or p-Xylene	106.16	49.34	986.8	223.5	
00095-47-6 o-Xylene	106.16	5.53	110.6	25.0	
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	132.5	111.1%	
Surrogate 2 Toluene-d8		94.3	96.9	102.8%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	107.4	79.3%	

BNH5A03A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 01-28-92 13:06	Relative Humidity(%):				
TIME ANALYZED: 01-28-92 13:06	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A03A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A03A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	698.4	13968	2555.5	B
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	130.80	2616	682.6	
00127-18-4 Tetrachloroethene	165.85	24.97	499.4	72.4	
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	9.62	192.4	43.6	
01330-20-7 m-Xylene and/or p-Xylene	106.16	50.48	1009.6	228.6	
00095-47-6 o-Xylene	106.16	5.49	109.8	24.9	
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	134.4	112.7%	
Surrogate 2 Toluene-d8		94.3	93.8	99.5%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	90.4	66.8%	

BNH5A04A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 01-28-92 14:10	Relative Humidity(%):				
TIME ANALYZED: 01-28-92 14:10	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A04A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A04A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	421.6	8432	1542.6	B
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	103.10	2062	538.0	
00127-18-4 Tetrachloroethene	165.85	20.42	408.4	59.2	
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	6.94	138.8	31.4	
01330-20-7 m-Xylene and/or p-Xylene	106.16	38.07	761.4	172.4	
00095-47-6 o-Xylene	106.16	3.99	79.9	18.1	J
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	133.9	112.2%	
Surrogate 2 Toluene-d8		94.3	91.2	96.7%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	112.8	83.3%	

BNH5A05A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 01-28-92 15:10	Relative Humidity(%):				
TIME ANALYZED: 01-28-92 15:10	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A05A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A05A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	315.8	6316	1155.5	B
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	79.58	1592	415.3	
00127-18-4 Tetrachloroethene	165.85	17.43	348.6	50.5	
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	5.10	101.9	23.1	
01330-20-7 m-Xylene and/or p-Xylene	106.16	29.05	581.0	131.6	
00095-47-6 o-Xylene	106.16	2.76	55.2	12.5	J
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	127.7	107.0%	
Surrogate 2 Toluene-d8		94.3	88.6	93.9%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	92.4	68.2%	

BNH5A06A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : LAB. BLK.	Canister ID Number:				
TIME RECEIVED: 01-29-92 09:11	Relative Humidity(%):				
TIME ANALYZED: 01-29-92 09:11	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):				
GC/MS DATA FILE: BNH5A06A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A06A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40				U
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	133.3	111.7%	
Surrogate 2 Toluene-d8		94.3	94.8	100.5%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	110.1	81.3%	

BNH5A07A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 01-29-92 10:03	Relative Humidity(%):				
TIME ANALYZED: 01-29-92 10:03	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A07A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A07A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	478.1	9562	1749.4	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	40.20	804	209.8	
00127-18-4 Tetrachloroethene	165.85	17.76	355.2	51.5	
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	4.04	80.7	18.3	
01330-20-7 m-Xylene and/or p-Xylene	106.16	23.43	468.6	106.1	
00095-47-6 o-Xylene	106.16	1.78	35.5	8.0	J
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	131.2	110.0%	
Surrogate 2 Toluene-d8		94.3	92.8	98.4%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	117.6	86.9%	

BNH5A08A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : Canister Blank	Canister ID Number:			5346	
TIME RECEIVED: 01-29-92 11:14	Relative Humidity(%):				
TIME ANALYZED: 01-29-92 11:14	Dryer Use (Yes/No):			YES	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			1.00	
GC/MS DATA FILE: BNH5A08A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A08A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40				U
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	130.8	109.6%	
Surrogate 2 Toluene-d8		94.3	90.0	95.5%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	101.1	74.7%	

BNH5A09A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : NBS GAS	Canister ID Number:			5339	
TIME RECEIVED: 01-29-92 12:37	Relative Humidity(%):				
TIME ANALYZED: 01-29-92 12:37	Dryer Use (Yes/No):			YES	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			1.0	
GC/MS DATA FILE: BNH5A09A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A09A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93	16.80	16.80	4.76	
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39	22.29	22.29	4.49	
00071-55-6 1,1,1-Trichloroethane	133.42	28.76	28.76	5.18	
00056-23-5 Carbon tetrachloride	153.83	28.94	28.94	4.52	
00071-43-2 Benzene	78.11	13.34	13.34	4.11	
00107-06-2 1,2-Dichloroethane	98.96	18.88	18.88	4.59	
00079-01-6 Trichloroethene	131.40	23.89	23.89	4.37	
00078-87-5 1,2-Dichloropropane	113.00	21.81	21.81	4.64	
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	16.10	16.10	4.20	
00127-18-4 Tetrachloroethene	165.85	34.18	34.18	4.95	
00108-90-7 Chlorobenzene	112.60	23.29	23.29	4.97	
00100-41-4 Ethylbenzene	106.16	21.41	21.41	4.85	
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16	20.80	20.80	4.71	
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	133.8	112.2%	
Surrogate 2 Toluene-d8		94.3	92.1	97.7%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	113.8	84.0%	

BNH5A10A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108		Canister ID Number:			
TIME RECEIVED: 01-29-92 13:47		Relative Humidity(%):			
TIME ANALYZED: 01-29-92 13:47		Dryer Use (Yes/No):		NO	
ANALYTICAL METHODS: Method 1400		Sample Volume (L):		0.050	
GC/MS DATA FILE: BNH5A10A.D		Sample Tmperature(C°):		20.0	
REPORT FILE: BNH5A10A		Sample Press. (mmHg):		760.0	
DATE REPORTED: 02-07-92		Calibration (Int/Ext):		Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	476.8	9536	1744.6	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	46.27	925	241.5	
00127-18-4 Tetrachloroethene	165.85	21.86	437.2	63.4	
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	6.15	122.9	27.8	
01330-20-7 m-Xylene and/or p-Xylene	106.16	34.56	691.2	156.5	
00095-47-6 o-Xylene	106.16	3.18	63.6	14.4	J
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	135.9	113.9%	
Surrogate 2 Toluene-d8		94.3	99.3	105.3%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	127.2	93.9%	

BNH5A11A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 01-29-92 15:33	Relative Humidity(%):				
TIME ANALYZED: 01-29-92 15:33	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A11A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A11A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	413.1	8262	1511.5	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	26.49	530	138.2	
00127-18-4 Tetrachloroethene	165.85	14.44	288.8	41.9	
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	3.46	69.2	15.7	J
01330-20-7 m-Xylene and/or p-Xylene	106.16	21.96	439.2	99.5	
00095-47-6 o-Xylene	106.16	1.78	35.7	8.1	J
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	138.8	116.3%	
Surrogate 2 Toluene-d8		94.3	92.8	98.4%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	119.4	88.2%	

BNH5A12A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : LAB. BLK.	Canister ID Number:				
TIME RECEIVED: 01-30-92 09:20	Relative Humidity(%):				
TIME ANALYZED: 01-30-92 09:20	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):				
GC/MS DATA FILE: BNH5A12A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A12A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40				U
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	127.7	107.0%	
Surrogate 2 Toluene-d8		94.3	91.3	96.8%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	129.2	95.4%	

BNH5A13A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 01-30-92 10:13	Relative Humidity(%):				
TIME ANALYZED: 01-30-92 10:13	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A13A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A13A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	161.2	3224	589.8	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	7.11	142	37.1	
00127-18-4 Tetrachloroethene	165.85	5.87	117.4	17.0	
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	1.68	33.7	7.6	J
01330-20-7 m-Xylene and/or p-Xylene	106.16	12.10	242.0	54.8	
00095-47-6 o-Xylene	106.16	0.88	17.5	4.0	J
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	133.8	112.2%	
Surrogate 2 Toluene-d8		94.3	93.7	99.3%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	126.6	93.5%	

BNH5A14A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 01-30-92 13:18	Relative Humidity(%):				
TIME ANALYZED: 01-30-92 13:18	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A14A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A14A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	92.8	1856	339.5	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	3.22	64	16.8	J
00127-18-4 Tetrachloroethene	165.85	3.46	69.2	10.0	J
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	0.87	17.4	3.9	J
01330-20-7 m-Xylene and/or p-Xylene	106.16	6.19	123.8	28.0	
00095-47-6 o-Xylene	106.16				J
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	134.6	112.8%	
Surrogate 2 Toluene-d8		94.3	95.1	100.9%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	113.8	84.0%	

BNH5A15A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 01-30-92 16:09	Relative Humidity(%):				
TIME ANALYZED: 01-30-92 16:09	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A15A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A15A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	83.7	1673	306.1	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	2.63	53	13.7	J
00127-18-4 Tetrachloroethene	165.85	3.01	60.2	8.7	J
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	0.84	16.8	3.8	J
01330-20-7 m-Xylene and/or p-Xylene	106.16	6.27	125.3	28.4	
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	136.6	114.5%	
Surrogate 2 Toluene-d8		94.3	95.5	101.2%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	128.8	95.1%	

BNH5A16A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : LAB. BLK.	Canister ID Number:				
TIME RECEIVED: 01-31-92 09:24	Relative Humidity(%):				
TIME ANALYZED: 01-31-92 09:24	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):				
GC/MS DATA FILE: BNH5A16A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A16A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40				U
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	130.5	109.4%	
Surrogate 2 Toluene-d8		94.3	93.8	99.4%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	132.9	98.2%	

BNH5A17A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 01-31-92 10:27	Relative Humidity(%):				
TIME ANALYZED: 01-31-92 10:27	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A17A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A17A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	42.7	854	156.2	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	0.80	16	4.2	J
00127-18-4 Tetrachloroethene	165.85	1.12	22.4	3.2	J
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16	2.33	46.5	10.5	J
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	131.0	109.8%	
Surrogate 2 Toluene-d8		94.3	89.6	95.0%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	110.1	81.3%	

BNH5A18A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 01-31-92 13:31	Relative Humidity(%):				
TIME ANALYZED: 01-31-92 13:31	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A18A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A18A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	46.1	921	168.5	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	0.92	18	4.8	J
00127-18-4 Tetrachloroethene	165.85	1.20	24.0	3.5	J
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16	2.73	54.5	12.4	J
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	136.6	114.5%	
Surrogate 2 Toluene-d8		94.3	95.8	101.5%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	120.3	88.8%	

BNH5A19A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : NBS GAS	Canister ID Number:			5339	
TIME RECEIVED: 01-31-92 15:44	Relative Humidity(%):				
TIME ANALYZED: 01-31-92 15:44	Dryer Use (Yes/No):			YES	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			1.0	
GC/MS DATA FILE: BNH5A19A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A19A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-07-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93	16.44	16.44	4.65	
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39	21.55	21.55	4.34	
00071-55-6 1,1,1-Trichloroethane	133.42	28.59	28.59	5.15	
00056-23-5 Carbon tetrachloride	153.83	28.94	28.94	4.52	
00071-43-2 Benzene	78.11	12.90	12.90	3.97	
00107-06-2 1,2-Dichloroethane	98.96	18.83	18.83	4.57	
00079-01-6 Trichloroethene	131.40	24.52	24.52	4.49	
00078-87-5 1,2-Dichloropropane	113.00	21.64	21.64	4.60	
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	16.65	16.65	4.34	
00127-18-4 Tetrachloroethene	165.85	33.26	33.26	4.82	
00108-90-7 Chlorobenzene	112.60	20.95	20.95	4.47	
00100-41-4 Ethylbenzene	106.16	19.64	19.64	4.45	
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16	18.48	18.48	4.18	
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	130.4	109.3%	
Surrogate 2 Toluene-d8		94.3	94.3	100.0%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	115.5	85.3%	

BNH5A20A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : LAB. BLK.	Canister ID Number:				
TIME RECEIVED: 02-03-92 10:22	Relative Humidity(%):				
TIME ANALYZED: 02-03-92 10:22	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):				
GC/MS DATA FILE: BNH5A20A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A20A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-1492	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40				U
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	124.2	104.1%	
Surrogate 2 Toluene-d8		94.3	87.9	93.2%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	110.6	81.7%	

BNH5A21A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 02-03-92 11:22	Relative Humidity(%):				
TIME ANALYZED: 02-03-92 11:22	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A21A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A21A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-14-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	11.7	233.0	42.6	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
-00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	123.2	103.3%	
Surrogate 2 Toluene-d8		94.3	87.0	92.3%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	112.6	83.2%	

BNH5A22A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 02-03-92 13:15	Relative Humidity(%):				
TIME ANALYZED: 02-03-92 13:15	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A22A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A22A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-14-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	10.4	207.4	37.9	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	127.5	106.9%	
Surrogate 2 Toluene-d8		94.3	87.5	92.8%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	103.2	76.2%	

BNH5A23A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS						
SAMPLE ID : 373911205-108	Canister ID Number:					
TIME RECEIVED: 02-04-92 11:09	Relative Humidity(%):					
TIME ANALYZED: 02-04-92 11:09	Dryer Use (Yes/No):				NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):				0.050	
GC/MS DATA FILE: BNH5A23A.D	Sample Tmperature(C°):				20.0	
REPORT FILE: BNH5A23A	Sample Press. (mmHg):				760.0	
DATE REPORTED: 02-14-92	Calibration (Int/Ext):				Int.	
	CONCENTRATION					
CAS No. / Compound	MW	ng	ng/L	ppb		Q
00075-35-4 1,1-Dichloroethene	96.94					U
00075-15-0 Carbon disulfide	76.14					U
00067-64-1 Acetone	58.08					U
00075-09-2 Methylene chloride	84.93					U
00107-13-1 Acrylonitrile	53.03					U
00156-60-5 trans-1,2-Dichloroethene	96.94					U
00075-34-3 1,1-Dichloroethane	98.96					U
00078-93-3 2-Butanone (MEK)	72.14					U
00067-66-3 Chloroform	119.39					U
00071-55-6 1,1,1-Trichloroethane	133.42					U
00056-23-5 Carbon tetrachloride	153.83					U
00071-43-2 Benzene	78.11					U
00107-06-2 1,2-Dichloroethane	98.96					U
00079-01-6 Trichloroethene	131.40	7.4	148.9	27.2		
00078-87-5 1,2-Dichloropropane	113.00					U
00080-62-6 Methyl methacrylate	100.05					U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16					U
00108-88-3 Toluene	92.13					U
00127-18-4 Tetrachloroethene	165.85					U
00108-90-7 Chlorobenzene	112.60					U
00100-41-4 Ethylbenzene	106.16					U
01330-20-7 m-Xylene and/or p-Xylene	106.16					U
00095-47-6 o-Xylene	106.16					U
00100-42-5 Styrene	104.10					U
00541-73-1 1,3-Dichlorobenzene	147.00					U
00095-50-1 1,2-Dichlorobenzene	147.00					U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)		
Surrogate 1 1,2-Dichloroethane-d4		119.3	133.7	112.1%		
Surrogate 2 Toluene-d8		94.3	91.1	96.6%		
Surrogate 3 1,4-Bromofluorobenzene		135.4	111.4	82.3%		

BNH5A24A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : LAB. BLK.	Canister ID Number:				
TIME RECEIVED: 02-06-92 09:00	Relative Humidity(%):				
TIME ANALYZED: 02-06-92 09:00	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):				
GC/MS DATA FILE: BNH5A24A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A24A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-14-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40				
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	127.1	106.5%	
Surrogate 2 Toluene-d8		94.3	86.8	92.0%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	114.1	84.3%	

BNH5A25A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 02-06-92 11:12	Relative Humidity(%):				
TIME ANALYZED: 02-06-92 11:12	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A25A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A25A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-14-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	5.2	103.8	19.0	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	129.5	108.5%	
Surrogate 2 Toluene-d8		94.3	90.3	95.7%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	120.7	89.1%	

BNH5A26A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : NBS GAS	Canister ID Number:			5339	
TIME RECEIVED: 02-06-92 13:21	Relative Humidity(%):				
TIME ANALYZED: 02-06-92 13:21	Dryer Use (Yes/No):			YES	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			1.0	
GC/MS DATA FILE: BNH5A26A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A26A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-14-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93	15.75	15.75	4.46	
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39	21.36	21.36	4.30	
00071-55-6 1,1,1-Trichloroethane	133.42	27.87	27.87	5.02	
00056-23-5 Carbon tetrachloride	153.83	29.70	29.70	4.64	
00071-43-2 Benzene	78.11	12.66	12.66	3.90	
00107-06-2 1,2-Dichloroethane	98.96	19.13	19.13	4.65	
00079-01-6 Trichloroethene	131.40	24.30	24.30	4.45	
00078-87-5 1,2-Dichloropropane	113.00	20.38	20.38	4.34	
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	15.58	15.58	4.07	
00127-18-4 Tetrachloroethene	165.85	32.24	32.24	4.67	
00108-90-7 Chlorobenzene	112.60	20.75	20.75	4.43	
00100-41-4 Ethylbenzene	106.16	19.17	19.17	4.34	
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16	17.98	17.98	4.07	
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	133.4	111.8%	
Surrogate 2 Toluene-d8		94.3	93.0	98.6%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	112.3	82.9%	

BNH5A27A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : LAB. BLK.	Canister ID Number:				
TIME RECEIVED: 02-10-92 09:20	Relative Humidity(%):				
TIME ANALYZED: 02-10-92 09:20	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):				
GC/MS DATA FILE: BNH5A27A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A27A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-14-92	Calibration (Int/Ext):			Int.	
		CONCENTRATION			
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40				U
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	132.8	111.3%	
Surrogate 2 Toluene-d8		94.3	95.4	101.2%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	108.7	80.3%	

BNH5A28A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:				
TIME RECEIVED: 02-10-92 12:32	Relative Humidity(%):				
TIME ANALYZED: 02-10-92 12:32	Dryer Use (Yes/No):			NO	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			0.050	
GC/MS DATA FILE: BNH5A28A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A28A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-14-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93				U
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	2.3	46.0	8.4	J
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13				U
00127-18-4 Tetrachloroethene	165.85				U
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16				U
01330-20-7 m-Xylene and/or p-Xylene	106.16				U
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	137.0	114.8%	
Surrogate 2 Toluene-d8		94.3	94.7	100.5%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	110.9	81.9%	

BNH5A29A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:			5340	
TIME RECEIVED: 02-12-92 14:06	Relative Humidity(%):				
TIME ANALYZED: 02-12-92 14:06	Dryer Use (Yes/No):			YES	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			1.00	
GC/MS DATA FILE: BNH5A29A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A29A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-14-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93	1.66	1.7	0.5	J
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42				U
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	45.8	45.8	8.4	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	1.34	1	0.3	J
00127-18-4 Tetrachloroethene	165.85	2.37	2.4	0.3	J
00108-90-7 Chlorobenzene	112.60				U
00100-41-4 Ethylbenzene	106.16	0.61	0.6	0.1	J
01330-20-7 m-Xylene and/or p-Xylene	106.16	1.36	1.4	0.3	J
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	115.7	97.0%	
Surrogate 2 Toluene-d8		94.3	89.8	95.2%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	114.9	84.9%	

BNH5A30A.XLS

AMBIENT AIR VOLATILE ORGANICS ANALYSIS RESULTS					
SAMPLE ID : 373911205-108	Canister ID Number:			5341	
TIME RECEIVED: 02-19-92 12:30	Relative Humidity(%):				
TIME ANALYZED: 02-19-92 14:32	Dryer Use (Yes/No):			YES	
ANALYTICAL METHODS: Method 1400	Sample Volume (L):			1.00	
GC/MS DATA FILE: BNH5A30A.D	Sample Tmperature(C°):			20.0	
REPORT FILE: BNH5A30A	Sample Press. (mmHg):			760.0	
DATE REPORTED: 02-14-92	Calibration (Int/Ext):			Int.	
	CONCENTRATION				
CAS No. / Compound	MW	ng	ng/L	ppb	Q
00075-35-4 1,1-Dichloroethene	96.94				U
00075-15-0 Carbon disulfide	76.14				U
00067-64-1 Acetone	58.08				U
00075-09-2 Methylene chloride	84.93	9.78	9.8	2.8	J
00107-13-1 Acrylonitrile	53.03				U
00156-60-5 trans-1,2-Dichloroethene	96.94				U
00075-34-3 1,1-Dichloroethane	98.96				U
00078-93-3 2-Butanone (MEK)	72.14				U
00067-66-3 Chloroform	119.39				U
00071-55-6 1,1,1-Trichloroethane	133.42	1.00	1.0	0.2	J
00056-23-5 Carbon tetrachloride	153.83				U
00071-43-2 Benzene	78.11				U
00107-06-2 1,2-Dichloroethane	98.96				U
00079-01-6 Trichloroethene	131.40	78.1	78.1	14.3	
00078-87-5 1,2-Dichloropropane	113.00				U
00080-62-6 Methyl methacrylate	100.05				U
00108-10-1 4-Methyl-2-pentanone (MIBK)	100.16				U
00108-88-3 Toluene	92.13	3.38	3	0.9	J
00127-18-4 Tetrachloroethene	165.85	6.12	6.1	0.9	J
00108-90-7 Chlorobenzene	112.60	2.52	2.5	0.5	J
00100-41-4 Ethylbenzene	106.16	0.56	0.6	0.1	J
01330-20-7 m-Xylene and/or p-Xylene	106.16	2.11	2.1	0.5	J
00095-47-6 o-Xylene	106.16				U
00100-42-5 Styrene	104.10				U
00541-73-1 1,3-Dichlorobenzene	147.00				U
00095-50-1 1,2-Dichlorobenzene	147.00				U
Surrogate Standards Recoveries			Rec(ng)	Rec(%)	
Surrogate 1 1,2-Dichloroethane-d4		119.3	128.1	107.4%	
Surrogate 2 Toluene-d8		94.3	91.9	97.5%	
Surrogate 3 1,4-Bromofluorobenzene		135.4	119.8	88.5%	

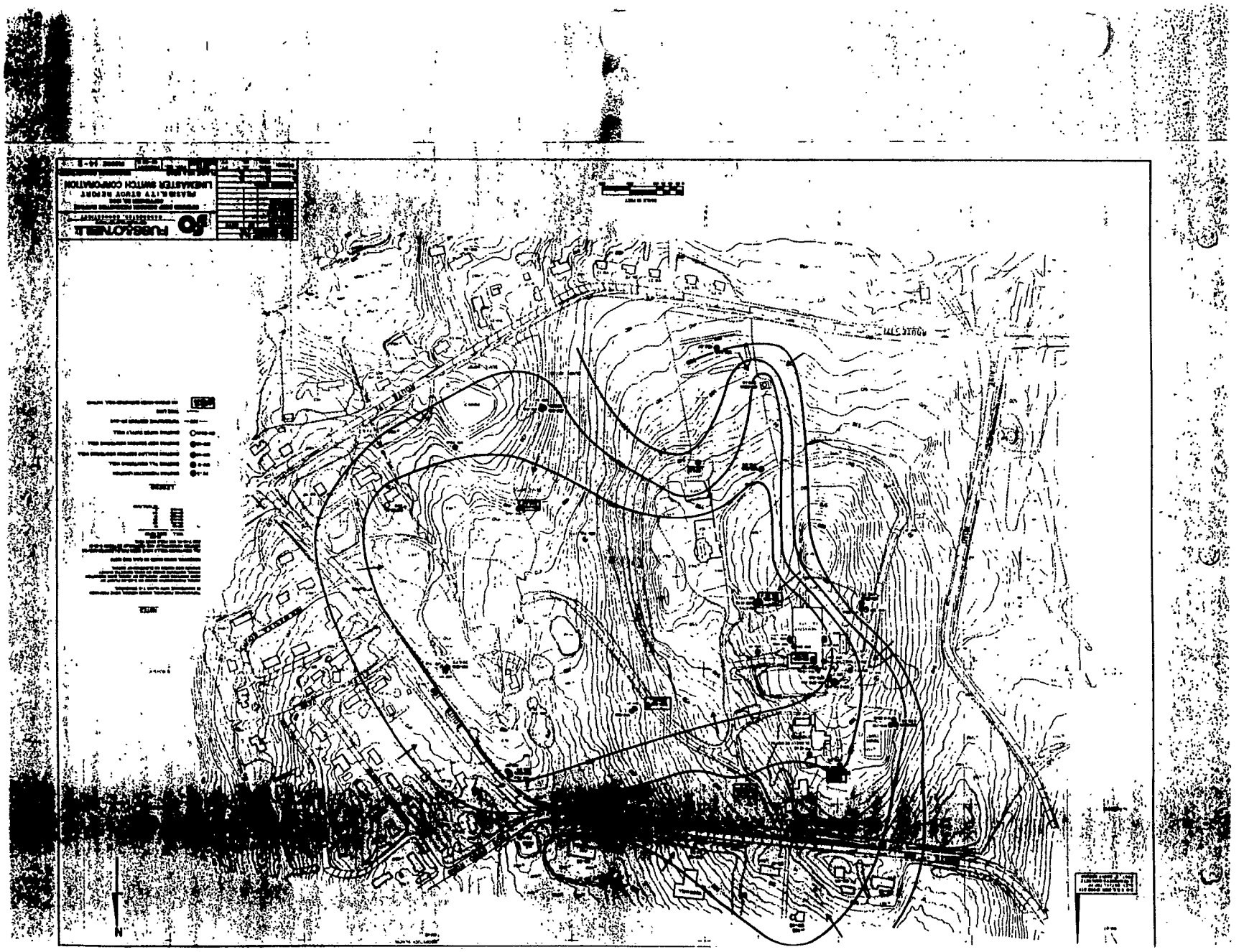
VOLATILE ORGANIC COMPOUND ANALYTICAL REPORT			
SAMPLE ID:F&O-108 BEFORE VENT	SAMPLE MATRIX: SOIL		
TIME RECEIVED: 1-6-92	PREP METHOD: METHANOL EXTRACT		
TIME ANALYZED: 1-15-92	DIL. FACTOR	833	
ANALYTICAL METHOD: GC/MS			
GC/MS DATA FILE: VOC10\4201010			
DATE REPORTED: 2-20-92	REPORT FILE: VOCS004		
		MDL	RESULT
Compound Name	CAS #	PPB	PPB
Dichlorodifluoromethane	00075-71-8	830	ND
Chloromethane	00074-87-3	830	ND
Vinyl chloride	00075-01-4	830	ND
Bromomethane	00074-83-9	830	ND
Chloroethane	00075-00-3	830	ND
Trichlorofluoromethane	00075-69-4	830	ND
1,1-Dichloroethene	00075-35-4	420	ND
Methylene chloride	00075-09-2	420	ND
trans-1,2-Dichloroethene	00156-60-5	420	ND
1,1-Dichloroethane	00075-34-3	420	ND
cis-1,2-Dichloroethene	00156-59-4	420	ND
2,2-Dichloropropane	00590-20-7	420	ND
Bromochloromethane	00074-97-5	420	ND
Chloroform	00067-66-3	420	ND
1,1,1-Trichloroethane	00071-55-6	420	ND
1,1-Dichloropropene	00563-58-6	420	ND
Carbon tetrachloride	00056-23-5	420	ND
Benzene	00071-43-2	420	ND
1,2-Dichloroethane	00107-06-2	420	ND
Trichloroethene	00079-01-6	420	1525.0
1,2-Dichloropropane	00078-87-5	420	ND
Dibromomethane	00074-95-3	420	ND
Bromodichloromethane	00075-27-4	420	ND
cis-1,3-Dichloropropene	10061-01-5	420	ND
Toluene	00108-88-3	420	ND
trans-1,3-Dichloropropene	10061-02-6	420	ND
1,1,2-Trichloroethane	00079-55-0	420	ND
1,3-Dichloropropane	00142-28-9	420	ND
Tetrachloroethene	00127-18-4	420	ND
Dibromochloromethane	00124-48-1	420	ND
1,2-Dibromoethane	00106-93-4	420	ND
Chlorobenzene	00108-90-7	420	ND
1,1,1,2-Tetrachloroethane	00630-20-6	420	ND
Ethylbenzene	00100-41-4	420	ND
m-Xylene	00108-38-3	420	ND
p-Xylene	00106-42-3	420	ND
Styrene	00100-42-5	420	ND
Bromoform	00075-25-2	420	ND
Isopropylbenzene	00098-82-8	420	ND
o-Xylene	00095-47-6	420	ND
1,1,2,2-Tetrachloroethane	00079-34-5	420	ND
1,2,3-Trichloropropane	00096-18-4	420	ND
Bromobenzene	00108-86-1	420	ND
n-Propylbenzene	00103-65-1	420	ND
2-Chlorotoluene	00095-49-8	420	ND
1,3,5-Trimethylbenzene	00108-67-8	420	ND
4-Chlorotoluene	00106-43-4	420	ND
tert-Butylbenzene	00098-06-6	420	ND
1,2,4-Trimethylbenzene	00095-63-6	420	ND
sec-Butylbenzene	00135-98-8	420	ND
p-Isopropyl toluene	00099-87-6	420	ND
1,3-Dichlorobenzene	00541-73-1	420	ND
1,4-Dichlorobenzene	00106-46-7	420	ND
n-Butylbenzene	00104-51-8	420	ND
1,2-Dichlorobenzene	00095-50-1	420	ND
1,2-Dibromo-3-chloropropane	00096-12-8	830	ND
1,2,4-Trichlorobenzene	00120-82-1	420	ND
Hexachlorobutadiene	00087-68-3	830	ND
Naphthalene	00091-20-3	420	ND
1,2,3-Trichlorobenzene	00087-61-6	830	ND

VOLATILE ORGANIC COMPOUND ANALYTICAL REPORT			
SAMPLE ID: F&O-108 AFTER VENT	SAMPLE MATRIX: SOIL		
TIME RECEIVED: 2-14-92	PREP METHOD: METHANOL EXTRACT		
TIME ANALYZED: 2-20-92	DIL. FACTOR	694	
ANALYTICAL METHOD: GC/MS			
GC/MS DATA FILE: VOCT1\2101003			
DATE REPORTED: 2-20-92	REPORT FILE: VOCS004		
		MDL	RESULT
Compound Name	CAS #	PPB	PPB
Dichlorodifluoromethane	00075-71-8	690	ND
Chloromethane	00074-87-3	690	ND
Vinyl chloride	00075-01-4	690	ND
Bromomethane	00074-83-9	690	ND
Chloroethane	00075-00-3	690	ND
Trichlorofluoromethane	00075-69-4	690	ND
1,1-Dichloroethene	00075-35-4	350	ND
Methylene chloride	00075-09-2	350	ND
trans-1,2-Dichloroethene	00156-60-5	350	ND
1,1-Dichloroethane	00075-34-3	350	ND
cis-1,2-Dichloroethene	00156-59-4	350	ND
2,2-Dichloropropane	00590-20-7	350	ND
Bromochloromethane	00074-97-5	350	ND
Chloroform	00067-66-3	350	ND
1,1,1-Trichloroethane	00071-55-6	350	ND
1,1-Dichloropropene	00563-58-6	350	ND
Carbon tetrachloride	00056-23-5	350	ND
Benzene	00071-43-2	350	ND
1,2-Dichloroethane	00107-06-2	350	ND
Trichloroethene	00079-01-6	350	ND
1,2-Dichloropropane	00078-87-5	350	ND
Dibromomethane	00074-95-3	350	ND
Bromodichloromethane	00075-27-4	350	ND
cis-1,3-Dichloropropene	10061-01-5	350	ND
Toluene	00108-88-3	350	ND
trans-1,3-Dichloropropene	10061-02-6	350	ND
1,1,2-Trichloroethane	00079-55-0	350	ND
1,3-Dichloropropane	00142-28-9	350	ND
Tetrachloroethene	00127-18-4	350	ND
Dibromochloromethane	00124-48-1	350	ND
1,2-Dibromoethane	00106-93-4	350	ND
Chlorobenzene	00108-90-7	350	ND
1,1,1,2-Tetrachloroethane	00630-20-6	350	ND
Ethylbenzene	00100-41-4	350	ND
m-Xylene	00108-38-3	350	ND
p-Xylene	00106-42-3	350	ND
Styrene	00100-42-5	350	ND
Bromoform	00075-25-2	350	ND
Isopropylbenzene	00098-82-8	350	ND
o-Xylene	00095-47-6	350	ND
1,1,2,2-Tetrachloroethane	00079-34-5	350	ND
1,2,3-Trichloropropane	00096-18-4	350	ND
Bromobenzene	00108-86-1	350	ND
n-Propylbenzene	00103-65-1	350	ND
2-Chlorotoluene	00095-49-8	350	ND
1,3,5-Trimethylbenzene	00108-67-8	350	ND
4-Chlorotoluene	00106-43-4	350	ND
tert-Butylbenzene	00098-06-6	350	ND
1,2,4-Trimethylbenzene	00095-63-6	350	ND
sec-Butylbenzene	00135-98-8	350	ND
p-Isopropyl toluene	00099-87-6	350	ND
1,3-Dichlorobenzene	00541-73-1	350	ND
1,4-Dichlorobenzene	00106-46-7	350	ND
n-Butylbenzene	00104-51-8	350	ND
1,2-Dichlorobenzene	00095-50-1	350	ND
1,2-Dibromo-3-chloropropane	00096-12-8	690	ND
1,2,4-Trichlorobenzene	00120-82-1	350	ND
Hexachlorobutadiene	00087-68-3	690	ND
Naphthalene	00091-20-3	350	ND
1,2,3-Trichlorobenzene	00087-61-6	690	ND

APPENDIX D
CALCULATIONS

FEASIBILITY STUDY REPORT
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
DECEMBER 1992

LINEMASTER SWITCH
ADMINISTRATIVE RECORD



FUSS&O'NEILL
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
DMD	5/22/92			B6088/Z6

SHEET NO. of

LINEMASTER SWITCH

VOLUME OF SOIL IN ZONE 1

FO - # 110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
DDAy	5/22/92	MJD	6-12-92	86-88/26

Linemaster Switch : Quantity of Soil in Zone 1

SHEET NO. of

SUMMARY SHEET

Vol of Soil in Dry Well & Paint Shed Area

say 26,000 cy (Sheet 2)

Vol of Soil underneath the building in Zone 1

say 15,500 cy (Sheet 3)

TOTAL Vol of Soil in the Zone 1 Area

41,500 cy

Vol of SAT. Soil in Dry Well & Paint Shed area

say 22,500 cy (Sheet 6)

Vol of SAT. Soil under the building

say 15,000 cy

TOTAL Vol of SAT. Soil in Zone 1.

37,500 cy

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	5-20-92		5/21/92	86-88

LineMaster Zone 1 Area Calculations (Planimeter)

SHEET NO. 1 of

1" = 30'
(1")² = 900 ft²

Total Area, zone 1 – 30.77, 30.79, 30.80 — 30.79 × 900 = 27,711 ft²

Building Area within Zone 1 – 12.04, 12.16, 12.12 — 12.11 × 900 = 10,890 ft²

Paint shed area within Zone 1 – 5.02, 4.97, 5.08 — 5.02 × 900 = 4518 ft²

Dry well area within Zone 1 – 13.68, 13.57, 13.67 — 13.64 × 900 = 12276 ft²

	Average Bedrock surface elevation		G.W. Elevation
–	MW-20sb	525	525.52
–	MW-10 t	525	554.93
–	MW-4 t	<519	544.76
	MW-26 t	524	544.10
–	MW-16 sb	521	518.67
	MW-23 t	—	563.75
	25 t	—	564.34
	24 t	—	563.35
	GW-10 sb	532	
	MW-EPA-A sb	501	534.94
	MW-17 sb	511	541.63
	OW-1 t	525	560.87
	-2 t	527	561.43
	-3 t	524	558.62
	-4 t	526	557.66 (5594)
	-5 t	525	558.12
	-6 t	526	560.04
	OW-7 t	524	557.93
	DW-1 t	525	562.80
	DW-2 t	527	560.55
	DW-3 t	529	561.49
	DW-4 t	527	557.85

525.9

* Table 4-1 Summary of well Completion Details and Water level meas. table

50 - #110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	5-20-92	DSK	5/21/92	86-88

Linemaster

SHEET NO. 2 of

ZONE 1 Calculations

Ground surface elevations Average - 567'

MW-105b	568.40
MW-10 t	568.64
MW-4t	554.77
OW-1 t	568.1
2t	567.5
3t	567.9
4t	565.2
5t	565.5
6t	565.5
7t	564.0
DW-1t	568.71
DW-2t	567.6
-3t	567.0
-4t	564.5
MW-106b	568.92
MW-23t	570.09
-24t	566.11
-25t	570.91

Total Volume of soil 567 - 526 = 41 Feet Average thickness

Saturated thickness 559 - 526 = 33 feet

T.T.L Volume = 27,711 x 41 = 1,136,151 ft³ 42,080 c.y.

ZONE 1 Area - Bldg. Area = 16821 → 16800 ft² ✓
Paintshed area + Dry well area = 16794

Volume of soil in zone 1 not including area below building:

16800 x 41 = 688,800 ft³ 25511 c.y. ✓ OK

Say 26,000 c.y.

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
DMY	5/22/92	MJD	6-12-92	86-88/28

LINEMASTER SWITCH: ZONE 1 AREA

SHEET NO. 3 of

- DETERMINE the quantity of soil underneath the the part of the Linemaster building in the Zone 1 area.
- ELEVATIONS - Ref NOV 1991 CONTOUR MAP.
- AVG GRND ELEV in Dry well area = 565
  paint shed area = 567
  } AVG = 566

The garage is the only Bsmt area of this portion of the building.

- Except for the garage say the bottom of footing of the first floor is @ 566 - 4 ft = ELEV 562
- Bottom ELEV of garage → say 556 ±
- AVG Bedrock ELEV under BUILDING

  SAY $\frac{525 \text{ (Dry well area)} + 521 \text{ (paint shed area)}}{2}$ = 523

  say 523

- AVG G.W. ELEV under the building

  say $\frac{559 + 562}{2} = 560.5$ SAY 560

- From 5/20/92 planimeter of building area w/in Zone 1 (by MJD)

  Area = 10,890 ft²
  − 1590 ft² = 20 × 53 garage
  9,300 ft² w/out garage

- Vol of soil under garage (ELEV = 556 : Assume soil is saturated)

  = 1590 ft² × (556 − 523) × 1/27 = 1943 CY

- Vol of soil UNDER building (ELEV 556) w/out garage.

  = 9300 ft² × (562 − 523) × 1/27 = 13,433. CY

  } 15,376 CY UNDER BUILDING IN Zone 1

- Vol of SAT soil under Building

  = 10,890 ft² × (560 − 523) × 1/27 = 14,923 CY = SAT Soil UNDER BUILDING.

  SAY 15,050 CY

FO-8110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
DDay	5/21/92	MJD	6-12-92	8688/26

Linemaster: Calculation of Soil in the Zone 1 Area. (Done to check calculation by MJD)

SHEET NO. 4 of

& G.WATER

(I) AVG Bedrock Elevation in Dry Well Area

Well	Bedrock Elev
mw-10s	525
mw-10t	525
ow-1t	525
-2t	527
-3t	524
-4t	526
-5t	525
-6t	526
ow-7t	324

AVG = 525

AVG = 559 ± see 5/20/92 Calcs by MJD

∴ in Dry Well area

AVG Bedrock Elev = 525
AVG G.W. Elev = 559

(II) AVG Bedrock & G.W. Elev in Paint Shed Area

Well	Bedrock		GW	
mw-23t	—	Shed AVG = 521	563.75	Shed AVG = 562.35
-16t	—		559	
-16sb	521		—	
-25t	—		564.3	

∴ in Dry Well area

Shed AVG Bedrock Elev = 521
AVG GW Elev = 562

(III) AVG Bedrock & GW Elev under the building
Except for GW-10dd there is no shallow bedrock or GW info for the area underneath the Linemaster building

∴ Assume Bedrock & GW elev under the building is an AVG between the Bedrock & GW elevations in the dry well & paint shed area

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
DDing		MJD	6-12-92	86-88

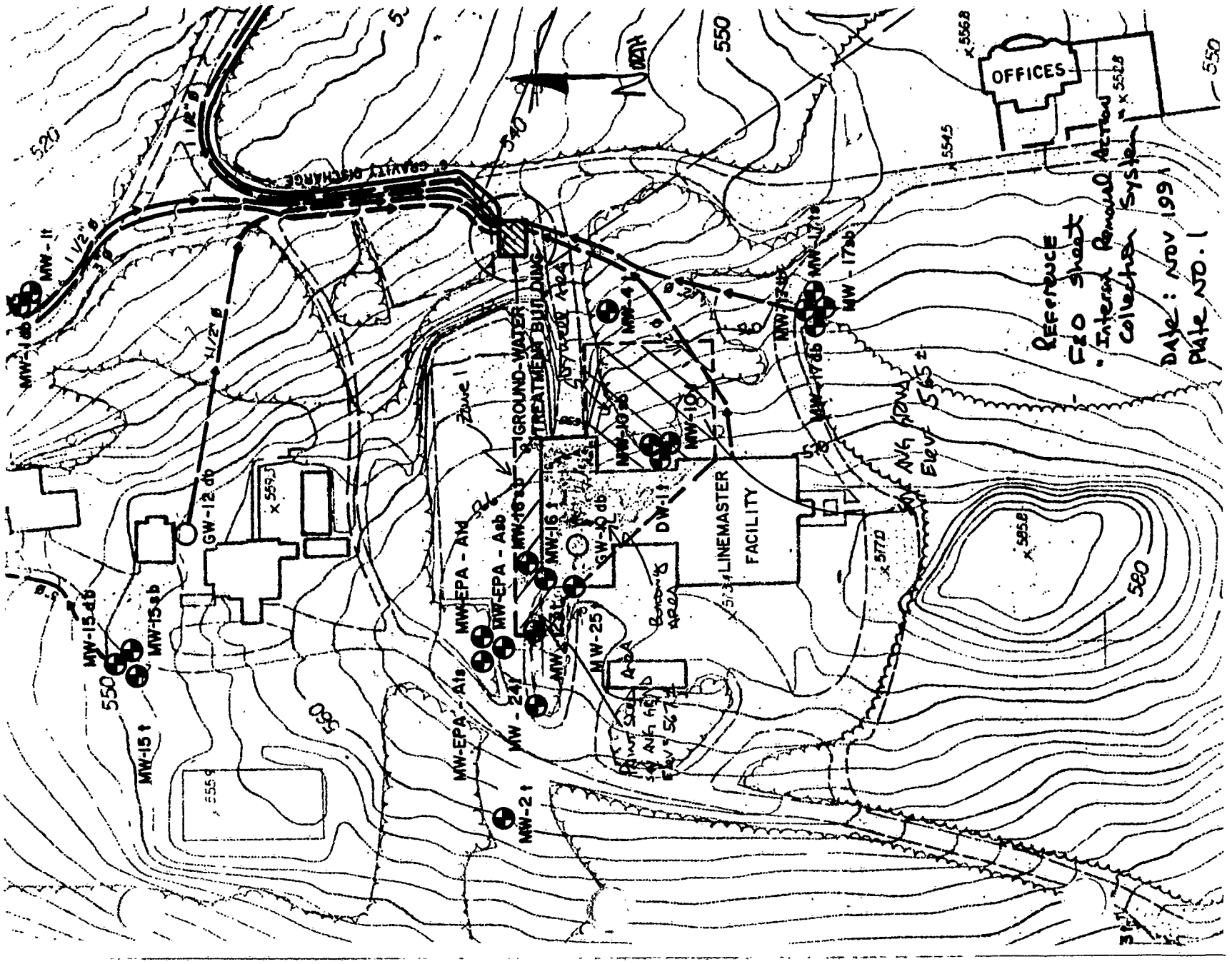
SHEET NO. 6 of

- for dry well area, based on contour map
  say AVG Grnd Surf Elev = $\frac{569+560}{2}$ = 564.5
  say 565
- for paint shed area, based on contour map
  say AVG Grnd Surf Elev = $\frac{570+564}{2}$ = 567

(H)
- Vol of soil in Dry well area = 565 - 525 = 40' of soil
  12,276 ft² × 40 ft = 491,040 ft³
- Vol of soil in paint shed area = 567 - 521 = 46' of soil
  4518 ft² × 46 ft = 207,828 / 207,874 ft³
- TOTAL vol of soil w/out Building = 698,914 ft³
  = 25,885 cy ✓
  ✓ checks w/ calcs of MJD (5/20/92)

(H)
- Vol of saturated soil in Dry Well
  GW @ 559 - 525 = 34'
  12,276 ft² × 34' = 417,384 ft³
- Vol of sat. soil in paint shed area
  562 - 521 = 41'
  4518 ft² × 41 = 185,238 ft³
- TOTAL vol of SAT soil w/out Building = 602622 ft³
  = 22,319.3 cy
  say 22,000 cy

FO-#110



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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
JTO	6/3/92			8608B/21

SHEET NO. of

LINEMASTER SWITCH

POROSITY CALCULATION

FO-#110

FUSS&O'NEILL consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
JTD	6/23/92	DDA	6/26/92	86-00(21)

LINEMASTER SWITCH CORP.

SHEET NO. 1 of 1

POROSITY CALCULATIONS – DATA FROM MILLER ENG. 12/24/91
METHOD BY " " 12/24/91

DRY DENSITY = 125.3 lbs/ft3 (AVERAGED) ✓
MOISTURE CONTENT = 11.4% (AVERAGED) ✓
ASSUME SPECIFIC GRAVITY 2.68 TILL 2.66 – 2.71 ✓

SPECIFIC GRAVITY = DENSITY ÷ UNIT WEIGHT H_2O

$= \frac{\text{WEIGHT}}{Vs} \div$ UNIT WEIGHT H_2O

$Vs = \frac{\text{WEIGHT}}{\text{SPECIFIC GRAVITY}} \div$ UNIT WEIGHT H_2O

$= \frac{125.3 \text{ lbs}}{2.68} \div \frac{62.4 \text{ lbs}}{\text{ft}^3}$

$= .75 \text{ ft}^3$

$V_T = V - V_S = 1 - .75 = .25$

$\text{POROSITY} = \frac{\text{VOL. VOIDS}}{\text{VOL. SAMPLE}} = \frac{.25}{1} \times 100 = 25\%$

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
DMD	6/11/92			86088/26

SHEET NO. of

LINEMASTER SWITCH

QUANTITY OF WATER IN ZONE 1 TILL

FO - #110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
DDAY	6/11/92	MJD	6-12-92	86-88/26

LINEMASTER SWITCH : Quantity of Water in Zone 1 till.

SHEET NO. of

- Calculate the quantity of water (gallons) in the SATURATED soil of the Zone 1 area.

per 5/22/92 CALC of CONT. soil in the Zone 1 area the total vol of SAT. soil in the Zone 1 area is 37,500cy

Assume porosity $n = \frac{V_v}{V_T} = 0.3$ for the till in the Zone 1 area

V_v = vol of voids

V_T = vol of voids + vol of soil. = total volume

Assume V_v are 100% full of water in saturated soil.

$V_T = 37,500 cy$

$\therefore V_v = (0.3)(37,500 cy) = 11,250 cy$ of WATER

$11,250 cy \times \frac{27 cf}{cy} \times \frac{7.48 gal}{cf} = 2.272 \times 10^6 gal$ of water for $n=0.3$

The porosity calculated using Miller Engineering 12/24/91 soil analysis

$\frac{.258 + .216 + .21}{3} = 0.228 = n$

$V_v = 0.228(37,500 cy) \times \frac{27 cf}{cy} \times \frac{7.48 gal}{cf} = 1.727 \times 10^6 gal$

for $n = .25$ $V_v = 0.25(37,500) \times 27 \times 7.48 = 1.893 \times 10^6$

SAY quantity of water in the SAT soil of Zone 1 = $1.8 \times 10^6 gal$ for $n = 0.228$

6/26/92 use $n = .25$ AS CALC. by JTO (see Attached 6/23/92 comp)

$\therefore$ SAY Qty of water in SAT soil = $1.9 \times 10^6 gal$

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
DJM	6/1/92	MJD	6-12-92	86-19/26

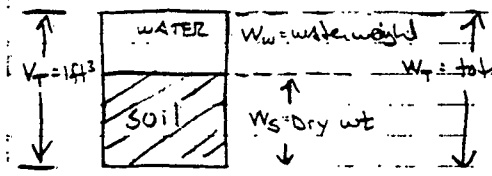
SHEET NO. of

6/22/92 per Miller Engineering - even if soil sample was collected from a 100% SAT. zone of soil you cannot guarantee that the sample analyzed @ the LAB is 100% saturated due to possible losses of water from the soil during sampling procedures.

Determine an average porosity value from the density calculations performed by Miller Engineering for soil samples from DW-3±, OW-2±, OW-1±.

From 12/24/91 Analysis by Miller Engineering

SAMPLE	WET DENSITY (PCF)	DRY DENSITY (PCF)
DW-3± (18'-20')	141.7	125.6
OW-2± (27'-29')	135.2	121.7
OW-1± (28'-30')	141.6	128.5



porosity = vol of void's / total volume

M_w = mass water
V_T = TOT. Volume
V_w = Vol water
G_s = Specific gravity
ρ_w = Density water
e = void Ratio

(1) for DW-3± Assume soil is 100% SATURATED ∴ the vol of voids = vol of WATER therefore vol of WATER / total volume = porosity

$V_w = \frac{M_w}{G\,\rho_w} = \frac{141.7\text{ lbs} - 125.6\text{ lbs}}{(1.)(62.4\text{ lbs/CF})} = 0.258\text{ CF} = V_v$

since total volume = 1 CF, porosity = V_v for this case

$V_T = V_V + V_S$

$V_S = V_T - V_V = 1 - .258 = .742\text{ CF} = V_S$

$e = \frac{V_v}{V_s} = \frac{.258}{.742} = 0.3477$ $\quad n = \frac{e}{1+e} = \frac{0.3477}{1+0.3477} = 0.258$ = porosity

(2) for OW-2±

$V_w = \frac{135.2 - 121.7}{(1)(62.4)} = 0.216$ $\quad V_S = 1 - .216 = .784$

$e = \frac{.216}{.784} = .275$ $\quad n = .275/1+.275 = 0.216$ = porosity

(3) for OW-1± $V_w = \frac{141.6 - 128.5}{(1)(62.4)} = 0.21$ $\quad V_S = 1 - .21 = .79$

$e = \frac{.21}{.79} = 0.266$ $\quad n = \frac{.266}{1+.266} = 0.21$ porosity

6/4/92

FO-#110

FUSS&O'NEILL consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
JTO	7/29/92	JLS	7/29/92	06-08

SHEET NO. 1 of 1

LINEMASTER SWITCH

VOLUME OF GROUND WATER REMOVABLE BY PUMPING AT ZONE 1

- VOLUME OF SATURATED SOIL AT ZONE 1 = 37,500 yd^3 (6/11/92 MEMO BY P.DAY)

- ASSUME SPECIFIC YIELD OF 0.06 (GROUND WATER HYDROLOGY, TODD, 1980)

$S_y = \frac{W_y}{V}$ (TODD, 1980)

S_y = SPECIFIC YIELD

W_y = VOLUME OF WATER DRAINED

V = VOLUME OF SOIL OR ROCK UNIT

$W_y = (0.06)(37{,}500\ yd^3)$

$= 2250\ yd^3 \times \frac{27\ ft^3}{yd^3} \times \frac{7.48\ gal}{ft^3} = 454{,}410\ gal$

$\sim 500{,}000$ gal IN ONE PULE VOLUME

FO-#110

MILLER ENGINEERING, INC.

GEOTECHNICAL / SOIL BORINGS / ENVIRONMENTAL / CONCRETE / STEEL / ROOFING / ASPHALT INSPECTION

Mail all correspondence to:
100 SHEFFIELD ROAD • P.O. BOX 4776 • MANCHESTER, NEW HAMPSHIRE 03108 • TELEPHONE (603) 668-8016 • FAX (603) 668-8641

December 24, 1991

Mr. James Olsen
FUSS & O'NEILL, INC.
146 Hartford Road
Manchester, CT 06040

Re: Soil Testing for
Line Master Switch Corporation
Woodstock, CT Project No. 10485.01

Dear Mr. Olsen:

The purpose of this letter is to present to you the results of tests performed on soil samples delivered to our laboratory on December 12, 1991. Copies of the chain of custody records that arrived with each sample are attached to this letter.

Three (3) quasi-undisturbed samples, labeled L-91965 A through C, were delivered in 2.5-inch inside diameter plastic tubes. Each tube end was sealed with duct tape.

After extrusion from the plastic tubes, density and moisture content determinations, grain size analyses and hydrometer analyses were performed on each sample. These tests were performed in conformance with applicable ASTM standards.

Density determinations were made after extrusion of each sample from their respective tubes. In this manner, accurate measurements of each sample could be taken to calculate the wet density. Two or three specimens were obtained from each tube for moisture content determinations. The average moisture content was used to calculate the dry density. Results of density testing are as follows:

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130 EAST MAIN ST. • P.O. BOX 11 • NORTHBOROUGH, MASSACHUSETTS 01532 • TEL. (508) 393-2607 • FAX (508) 393-8490
21 MARKARLYN STREET • P.O. BOX 1087 • AUBURN, MAINE 04210 • TEL. (207) 786-4249 • FAX (207) 777-1822

Sample No.	Laboratory No.	Moisture Content (%)	Wet Density (pcf)	Dry Density (pcf)	
373911205-117	91965-A	12.8	141.7	125.6	DW-3t (18'-20')
373911204-97	91965-B	11.1	135.2	121.7	OW-2t (27'-29')
373911205-111	91965-C	10.2	141.6	128.5	OW-1t (28'-30')

11.4%

Results of the grain size distribution analyses are attached to this letter. These results are presented graphically and tabularly.

We trust that the contents of this letter are consistent with your present needs and expectations. Should you have any questions or if we can be of further assistance to you on this project, please do not hesitate to contact us.

Very truly yours,

MILLER ENGINEERING, INC.

Frank K. Miller

Frank K. Miller, Jr., P.E.
Senior Geotechnical Engineer

FKM:paz

FUSS&O'NEILL INC
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7/13/92			86088/26

SHEET NO. of

LINEMASTER SWITCH

QUANTITY OF WATER IN BEDROCK AQUIFER

FO-# 110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7-13-92	JAJ	7-13-92	86-88

Linemaster

SHEET NO. of

Calculations of the amount of groundwater in the bedrock aquifer.

Site area 85.55 acres (Al Aitken planimeter)

* 1.25 Area of influence (-JTO)

106.9

106.9 acres x 43560 sf/acre = 4658197.5 sf

Average depth of bedrock aquifer = 400 ft (-JTO)

Total volume of bedrock aquifer (area x depth) =
1863279000

1.86×10^9 ft³

Effective porosity 0.005 — 1 % (-JTO)

Volume of groundwater in bedrock aquifer = effective porosity x bedrock volume

0.00005 x 1.86×10^9 = 93000 ft³

0.01 x 1.86×10^9 = 18,600,000 ft³

7.48 gallons = 1 ft³

Total volume of groundwater 695,640 — 139,128,000 gallons

1 Pore Volume : 7.0×10^5 — 1.4×10^8 gallons

2 Pore Volumes : 1.4×10^6 — 2.8×10^8 "

3 Pore Volumes : 2.1×10^6 — 4.2×10^8 "

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	6-7/92			8608826

SHEET NO. of

LINEMASTER SWITCH

REMOVAL OF TCE FROM SOIL

FO - # 110

FUSS&O'NEILL consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	6/22/92	HEK	1/16/92	86-88

Linemaster - Soil Vapor Extraction — SHEET NO. #1 of

Concentrations of TCE in the groundwater were determined (through sampling) at all of the existing wells on the site. A grid was set up over the site and X, Y coordinates for each existing well were determined. Equations were created by Herb Klei which calculated the concentration of TCE in the soil at a given TCE concentration in the groundwater.

TCE conc. in water $\frac{ug}{l_{water}}$ x porosity 0.3 $\frac{L\ water}{L\ soil}$ x

0.7 $\frac{L\ water\ remaining\ in\ soil\ after\ dewatering}{L\ water\ in\ soil}$ x $\frac{1000\ ng}{1\ ug}$

x $\frac{1\ L\ soil}{2310\ g\ soil}$ = $\frac{ng}{g}$ TCE conc in soil = q

The concentration of TCE in the soil vapor was then determined by the concentration of TCE in the soil from equation derived by Herb Klei.

$q = 518(C_g)^{1/1.85}$ or $C_g = \left(\frac{q}{518}\right)^{1.85}$

where q = TCE conc. in soil $\frac{ng}{g}$

C_g = TCE conc. in soil vapor $\frac{ng}{ml}$

The soil vapor concentration calculated at each existing well was then input into 'Surfer' software and a topographical map of TCE concentrations over the site was generated.

The X, Y coordinates of the proposed soil vapor extraction wells were overlayed onto this TCE conc. map. A soil vapor concentration was determined for each proposed well.

FO-#1.10

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consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	6/22/92	HEK	7/16/92	86-88

Linemaster - Soil vapor Extraction — SHEET NO. 2 of

Values for Linemaster soils determined by Herb Klei:

ρ_b (soil density) = 2.31 gm/cm³ or g/mL

K_f = 518 porosity = 0.3

E_{void} = 0.144 (lower than porosity because of the water left in the soil after it is drained)

Q (Flowrate at each well) = 10 CFM

A (area of influence) = $2\pi RH$ R (radius of influence) = 15 feet

H (height of screened section) = 35 feet

v = velocity through soils $v = \frac{Q/A}{E_v}$

$$v = \frac{10/(2\pi \cdot 15 \cdot 35)}{0.144} \times \frac{60\,min}{1\,hr} \times \frac{24\,hr}{1\,day} = 30.3\ ft/day$$

$q = 518(C_g)^{1/1.85}$ $\frac{dq}{dC} = \frac{518}{1.85}(C_g)^{\frac{1}{1.85}-1}$ $\frac{1}{1.85} - 1 = -0.46$

v_* = equilibrium front velocity

$$v_* = \frac{v}{\left[1 + \frac{\rho_b}{E_v}\left(\frac{dq}{dC}\right)\right]} = \frac{30.3}{\left[1 + \frac{2.31}{0.144}\left(\frac{518}{1.85}(C_g)^{-0.46}\right)\right]}$$

$$v_* = \frac{30.3}{\left[1 + 4492(C_g)^{-0.46}\right]}$$

T_* = time it takes for equilibrium to pass through area of influence

$T_* = \frac{R_I}{v_*}$ R_I = 15 feet

M_t = Total mass of TCE removed from each well during equilibrium

Flowrate × Concentration TCE in soil vapor × Time

FO-#110

FUSS&O'NEILL consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	6/22/92	HEK	7/16/92	86-88

Linemaster - Soil Vapor Extraction — SHEET NO. 3 of

$$M_1 = \frac{Q\ ft^3}{min} \times \frac{60\ min}{1\ hr} \times \frac{24\ hr}{1\ day} \left(1440\ \frac{ft^3}{day}\right) \times$$

$$\frac{C_g\ ng}{ml} \times \frac{1000\ ml}{L} \times \frac{3.785\ L}{1\ gallon} \times \frac{7.48\ gallons}{1\ ft^3} = \frac{ng}{ft^3}$$

$$\times \frac{1\ g}{10^9\ ng} \times \frac{1\ lb}{453.5\ g} \times T_x\ days = \boxed{lbs}$$

$$Q \times C_g \times T_x \times 1440 \times 1000 \times 3.785 \times 7.48 \times \frac{1}{10^9} \times \frac{1}{453.5}$$

$$M_1 = 0.00008989 \times Q(CFM) \times C_g(\%vol) \times T_x(days)$$

Herb Klei derived an equation to determine the amount of TCE that would be removed from each well after equilibrium stage was passed.

$$M_2 = \int_{t_*}^{t} Q\,C\,dt \qquad \text{where } C = K t^{\frac{n}{1-n}}$$

if $t = t_*$ $C = C_0$ then,

$$C_0 = K t_*^{\frac{n}{1-n}} \text{ and } K = \frac{C_0}{t_*^{\frac{n}{1-n}}}$$

$$C = \frac{C_0}{t_*^{\frac{n}{1-n}}} t^{\frac{n}{1-n}} = C_0 \left(\frac{t}{t_*}\right)^{\frac{n}{1-n}} \qquad \text{for } t \geq t_*$$

$$M_2 = Q C_0 \int_{t_*}^{t} \left(\frac{t}{t_*}\right)^{\frac{n}{1-n}} dt \qquad \left(\frac{1}{t_*}\right)^{\frac{n}{1-n}} \int = \frac{t^{\frac{n}{1-n}+1}}{\frac{n}{1-n}+1} \div \frac{t^{\frac{1}{1-n}}}{\frac{1}{1-n}}$$

$$= Q C_0 (1-n) \left(\frac{1}{t_*}\right)^{\frac{n}{1-n}} t^{\frac{1}{1-n}} \Big|_{t_*}^{t}$$

$$= Q C_0 (1-n) \left(\frac{1}{t_*}\right)^{\frac{n}{1-n}} \left[t^{\frac{1}{1-n}} - t_*^{\frac{1}{1-n}} \right]$$

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	6/22/92	HEK	7/16/92	86-88

Linemaster - Soil Vapor Extraction — SHEET NO. 4 of

Calculating M_2 for given time intervals t = 30, 60, 90 ... 300 days

For each well, will need values of Q, C_o, t_*, and t

Q = Flowrate CFM
C_o = initial gas concentration g/ml

t_* = equilibrium front time days
t = given time frame days (t_* + 30, 60, 90...)

Equation used for M_2 in table:

$$Q \times 1440 \times C_o \times 62.0E-9 \times (1-n) \times (1/t_*)^{(n/(1-n))} \times \left(t^{(1/(1-n))} - t_*^{(1/(1-n))} \right)$$

$n = 1.85$ (Determined by Herb Klein) $\quad \frac{n}{1-n} = \frac{1.85}{1-1.85} = -2.1765$

$\frac{1}{1-1.85} = -1.1765$ $\quad 1-n = -0.85$

$$M_2 = Q \times 1440 \times C_o \times 62.0E-9 \times (-0.85) \times \left(\frac{1}{t_*}\right)^{(-2.1765)} \times \left(T^{(-1.1765)} - T_*^{(-1.1765)} \right)$$

Each well has a different equilibrium time t_*, so t above is not the same for each well.
To find the amount of TCE removed from all proposed wells at the "same time" requires adding M_1 and M_2 and setting (t_* + additional time) equal for each well.

Total TCE removed from the wells is determined at a real time of 30, 60, 90 ... 300 days and a final 900 day point.

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7/6/92	HFEIL	7/16/92	86-088

SHEET NO. 5 of

Linemaster

1)

TCE $\frac{Mass_{initial} - Mass_{removed}}{Zone\ 1\ Soil\ Mass} \leq 5\ ppb \left(\frac{ug}{kg}\right) \quad \frac{5}{10^9}$

Zone 1 Soil Mass

Zone 1 soil mass $= 2.3\ g/cm^3 \times \frac{1000\ cm^3}{L} \times \frac{3.785\ L}{gal} \times \frac{7.48\ gal}{ft^3} \times \frac{1\ lb}{453.5\ gm}$

density $= 144.2\ lbs/ft^3$

Total volume of soil in Zone 1 (From DaveDay, Summary sheet 5/22/92)

$41,500\ c.y. \times \frac{27\ ft^3}{1\ c.y.} = 1,120,500\ ft^3$

Soil mass $= 144.2 \times 1,120,500 = 1.62 \times 10^8$ lbs.

$Mass_{initial}$ (Surfer grid (-150, -50) to (150, 150))

5,000 lbs. of TCE (4332 + 362 = 4694)

$-Mass_{removed} \leq (5 \times 10^{-9})$ TTL Soil Mass $-$ TCE initial Mass

$TCE\ Mass_{removed} \geq TCE\ Mass_{initial} - (5 \times 10^{-9})$ TTL soil mass

$TCE\ Mass_{removed} \geq 5000 - (5 \times 10^{-9})\ 1.62 \times 10^8 = 5000 - 0.81 = 4999.19$ lbs.

Example

Mass removed after 300 days = 4331.7

$\frac{4694 - 4331.7}{1.62 \times 10^8} = 2\ ppb$

(5 ppb limit allows less than 1 lb. of TCE in the soil in Zone 1 area)

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7/6/92	HKIL	7/16/92	86-88

Linemaster

SHEET NO. 3 of

2)

Smallest grid containing the Zone 1 area (-150, -50) to (150, 150)

200 x 300 = 60,000 Ft^2 x 40' = 2,400,000 ft^3

2.31 gm/cm^3 = soil density Soil mass = 144.2 x 2,400,000

144.2 lb/ft^3 = 346,080,000 lbs.

TCE Mass initial ≅ 5000 lbs.

TCE Mass removed ≅ TCE mass initial − (5 x 10^{-9})(346 mil)

− 1.73

TCE mass removed ≅ 4998.3

(Allows less than 2 lbs. of TCE remaining in soil 200'x300' area)

* TCE removed after 900 days = 4696 lbs.

(which is greater than Mass initial = 4694)

Calculations show it should take approximately 900 days to reach 5 ppb of TCE.

FO-#110

TABLE 1
TCE ANALYSIS OF PROPOSED
SOIL VAPOR EXTRACTION WELLS
FEASIBILITY STUDY REPORT
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
AUGUST 1992

WELL ID	X (ft)	Y (ft)	GAS CONC. (ng/ml)	MEDIA VELOCITY (ft/day)	EQUIL. FRONT VELOCITY (ft/day)	CLEANUP TIME (days)	FLOWRATE (CFM)	TCE REMOVED (M1) (lbs.)
SV-1	-127	128	100	30.3	0.056	267.9	10	24.1
SV-2	-127	100	100	30.3	0.056	267.9	10	24.1
SV-3	-85	115	100	30.3	0.056	267.9	10	24.1
SV-4	-75	83	250	30.3	0.085	175.9	10	39.5
SV-5	-50	115	500	30.3	0.117	128.0	10	57.5
SV-6	-45	85	900	30.3	0.153	97.8	10	79.1
SV-7	-45	50	1400	30.3	0.188	79.9	10	100.6
SV-8	-20	115	1200	30.3	0.175	85.7	10	92.5
SV-9	-15	85	1900	30.3	0.216	69.5	10	116.7
SV-10	-15	55	3000	30.3	0.266	56.4	10	152.2
SV-11	-15	20	1750	30.3	0.208	72.2	10	113.5
SV-12	15	102	2150	30.3	0.228	65.7	10	126.9
SV-13	15	65	3000	30.3	0.266	56.4	10	152.2
SV-14	15	40	3750	30.3	0.294	51.0	10	171.8
SV-15	15	10	1000	30.3	0.161	93.2	10	83.8
SV-16	15	-20	1650	30.3	0.202	74.1	10	109.9
SV-17	45	67	2350	30.3	0.238	63.1	10	133.2
SV-18	45	40	2300	30.3	0.236	63.7	10	131.7
SV-19	45	10	1600	30.3	0.200	75.2	10	108.1
SV-20	45	-20	1650	30.3	0.202	74.1	10	109.9
SV-21	75	66	1400	30.3	0.188	79.9	10	100.6
SV-22	75	38	1250	30.3	0.178	84.2	10	94.6
SV-23	75	10	1250	30.3	0.178	84.2	10	94.6
SV-24	75	-20	1200	30.3	0.175	85.7	10	92.5
SV-25	102	68	600	30.3	0.127	117.8	10	63.5
SV-26	102	39	600	30.3	0.127	117.8	10	63.5
SV-27	102	10	850	30.3	0.149	100.4	10	76.7
SV-28	102	-20	850	30.3	0.149	100.4	10	76.7
						TOTAL TCE REMOVED		2616.0

P86\86088\TCEREM1B.WK1

TABLE 2
TCE ANALYSIS OF PROPOSED
SOIL VAPOR EXTRACTION WELLS
FEASIBILITY STUDY REPORT
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
AUGUST 1992

WELL ID	TCE REMOVED 30 days	TCE REMOVED 60 days	TCE REMOVED 90 days	TCE REMOVED 120 days	TCE REMOVED 150 days	TCE REMOVED 180 days	TCE REMOVED 210 days	TCE REMOVED 240 days	TCE REMOVED 270 days	TCE REMOVED 300 days	TCE REMOVED 900 days
SV-1	2.7	5.4	8.1	10.8	13.5	16.2	18.9	21.6	24.3	26.6	39.6
SV-2	2.7	5.4	8.1	10.8	13.5	16.2	18.9	21.6	24.3	26.6	39.6
SV-3	2.7	5.4	8.1	10.8	13.5	16.2	18.9	21.6	24.3	26.6	39.6
SV-4	6.7	13.5	20.2	27.0	33.7	40.4	45.8	49.8	52.8	55.2	68.1
SV-5	13.5	27.0	40.5	53.9	65.8	73.7	79.1	83.0	86.1	88.4	101.4
SV-6	24.3	48.5	72.8	93.5	105.7	113.5	118.9	122.9	125.9	128.3	141.3
SV-7	37.8	75.5	111.7	133.0	145.2	153.0	158.5	162.5	165.5	167.9	180.9
SV-8	32.4	64.7	96.8	118.1	130.3	138.2	143.6	147.6	150.6	153.0	166.0
SV-9	51.2	102.5	145.1	166.4	178.7	186.5	192.0	196.0	199.0	201.4	214.4
SV-10	80.9	161.2	206.7	228.1	240.4	248.3	253.7	257.7	260.8	263.1	276.3
SV-11	47.2	94.4	135.6	156.9	169.1	177.0	182.4	186.4	189.4	191.8	204.9
SV-12	58.0	116.0	160.3	181.6	193.9	201.7	207.2	211.2	214.2	216.6	229.7
SV-13	80.9	161.2	206.7	228.1	240.4	248.3	253.7	257.7	260.8	263.1	276.3
SV-14	101.1	197.3	242.9	264.3	276.6	284.5	290.0	294.0	297.0	299.4	312.6
SV-15	27.0	53.9	80.9	102.1	114.2	122.1	127.5	131.5	134.5	136.9	149.9
SV-16	44.5	89.0	129.0	150.3	162.5	170.4	175.8	179.8	182.8	185.2	198.3
SV-17	63.4	126.7	171.9	193.2	205.5	213.3	218.8	222.8	225.8	228.2	241.3
SV-18	62.0	124.0	169.0	190.4	202.6	210.5	215.9	219.9	223.0	225.3	238.4
SV-19	43.1	86.3	125.6	146.9	159.1	167.0	172.4	176.4	179.5	181.8	194.9
SV-20	44.5	89.0	129.0	150.3	162.5	170.4	175.8	179.8	182.8	185.2	198.3
SV-21	37.8	75.5	111.7	133.0	145.2	153.0	158.5	162.5	165.5	167.9	180.9
SV-22	33.7	67.4	100.7	121.9	134.1	142.0	147.4	151.4	154.4	156.8	169.8
SV-23	33.7	67.4	100.7	121.9	134.1	142.0	147.4	151.4	154.4	156.8	169.8
SV-24	32.4	64.7	96.8	118.1	130.3	138.2	143.6	147.6	150.6	153.0	166.0
SV-25	16.2	32.4	48.5	64.7	76.9	84.7	90.1	94.1	97.1	99.5	112.5
SV-26	16.2	32.4	48.5	64.7	76.9	84.7	90.1	94.1	97.1	99.5	112.5
SV-27	22.9	45.8	68.8	89.0	101.2	109.0	114.5	118.4	121.5	123.8	136.8
SV-28	22.9	45.8	68.8	89.0	101.2	109.0	114.5	118.4	121.5	123.8	136.8
	1042.3	2078.3	2913.3	3416.9	3726.5	3929.6	4074.0	4181.5	4265.3	4331.7	4696.9

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TABLE 3
TCE ANALYSIS IN AQUEOUS TILL LAYER
FEASIBILITY STUDY REPORT
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
AUGUST 1992

Well No	X	Y	Average Conc	Porosity	Density	Phase Depth	Mass TCE/ Area	SOIL CONC.	GAS CONC.
	ft	ft	ug/l	Vv/Vs	lb/ft3	ft	lb/ft2	ng/g	ng/ml
DW-1t	9	12	160000	0.3	140	39	0.086304	14545.5	478.1
MW-10t	22	5	400000	0.3	140	38	0.20632	36363.6	2604.5
MW-4t	140	58	27000	0.3	140	39	0.013686	2454.5	17.8
MW-1t	165	570	3.5	0.3	140	38	3.78E-06	0.3	0.0
MW-6t	605	265	690	0.3	140	18	0.000231	62.7	0.0
MW-11t	550	630	26	0.3	140	20	1.04E-05	2.5	0.0
MW-18t	1080	485	0	0.3	140	25	0	0.0	0.0
MW-12t	1315	130	0	0.3	140	13	0	0.0	0.0
MW-17td	140	-120	16.0	0.3	140	28	8.33E-06	1.5	0.0
MW-17ts	155	-125	4.7	0.3	140	37	3.33E-06	0.4	0.0
MW-8t	930	-840	7.9	0.3	140	2	2.94E-07	0.7	0.0
MW-3t	-435	-375	0	0.3	140	8	0	0.0	0.0
MW-16t	-95	115	49000	0.3	140	37	0.033722	4454.5	53.6
MW-23t	-140	130	43000	0.3	140	38	0.030392	3909.1	42.1
MW-24t	-205	130	4.2	0.3	140	31	2.42E-06	0.4	0.0
MW-2t	-305	160	2.8	0.3	140	35	1.82E-06	0.3	0.0
MW-EPA-Ats	-170	175	32000	0.3	140	52	0.03095	2909.1	24.3
MW-EPA-Atd	-145	175	750	0.3	140	36	0.00053	68.2	0.0
MW-25t	-100	90	11	0.3	140	32	6.55E-06	1.0	0.0
MW-15t	-170	480	74	0.3	140	60	0.00011	6.7	0.0
MW-27t	-140	685	0	0.3	140	61	0	0.0	0.0
MW-26t	5	40	540000	0.3	140	21	0.210924	49090.9	4537.8
RO-1A	465	110	0	0.05	145	0	0	0.0	0.0
RO-1B	465	150	0	0.05	145	0	0	0.0	0.0
RO-1C	505	130	0	0.05	145	0	0	0.0	0.0
RO-1D	565	45	0	0.05	145	0	0	0.0	0.0
RO-1E	620	-130	0	0.05	145	0	0	0.0	0.0
RO-1F	650	-335	0	0.05	145	0	0	0.0	0.0
RO-1G	640	-390	0	0.05	145	0	0	0.0	0.0
RO-1H	595	-340	0	0.05	145	0	0	0.0	0.0
RO-1I	575	-240	0	0.05	145	0	0	0.0	0.0
RO-1J	535	-10	0	0.05	145	0	0	0.0	0.0
RO-2A	-35	-225	0	0.05	145	0	0	0.0	0.0
RO-2B	5	-290	0	0.05	145	0	0	0.0	0.0
RO-2C	10	-360	0	0.05	145	0	0	0.0	0.0
RO-2D	-10	-425	0	0.05	145	0	0	0.0	0.0
RO-2E	-35	-380	0	0.05	145	0	0	0.0	0.0
RO-2F	-40	-265	0	0.05	145	0	0	0.0	0.0
RO-3A	-100	-250	0	0.05	145	0	0	0.0	0.0
RO-3B	-70	-310	0	0.05	145	0	0	0.0	0.0
RO-3C	-75	-365	0	0.05	145	0	0	0.0	0.0
RO-3D	-90	-315	0	0.05	145	0	0	0.0	0.0
RO-4A	40	-665	0	0.05	145	0	0	0.0	0.0
RO-4AB	25	-710	0	0.05	145	0	0	0.0	0.0
RO-4C	-30	-785	0	0.05	145	0	0	0.0	0.0
RO-4D	-70	-790	0	0.05	145	0	0	0.0	0.0
RO-4E	-65	-740	0	0.05	145	0	0	0.0	0.0
RO-4F	-10	-675	0	0.05	145	0	0	0.0	0.0
RO-5A	-400	-620	0	0.05	145	0	0	0.0	0.0
RO-5B	-350	-685	0	0.05	145	0	0	0.0	0.0
RO-5C	-435	-855	0	0.05	145	0	0	0.0	0.0
RO-5D	-480	-890	0	0.05	145	0	0	0.0	0.0
RO-5E	-540	-870	0	0.05	145	0	0	0.0	0.0
RO-5F	-515	-725	0	0.05	145	0	0	0.0	0.0
MW-28T	-265	-95	0	0.3	140	28	0	0.0	0.0
MW-29T	-355	335	0	0.3	140	29	0	0.0	0.0
MW-30TS	-110	10	0	0.3	140	23	0	0.0	0.0
MW-30TD	-110	15	0	0.3	140	31	0	0.0	0.0
MW-10TS	20	10	220000	0.3	140	35	0.14322	20000.0	861.8

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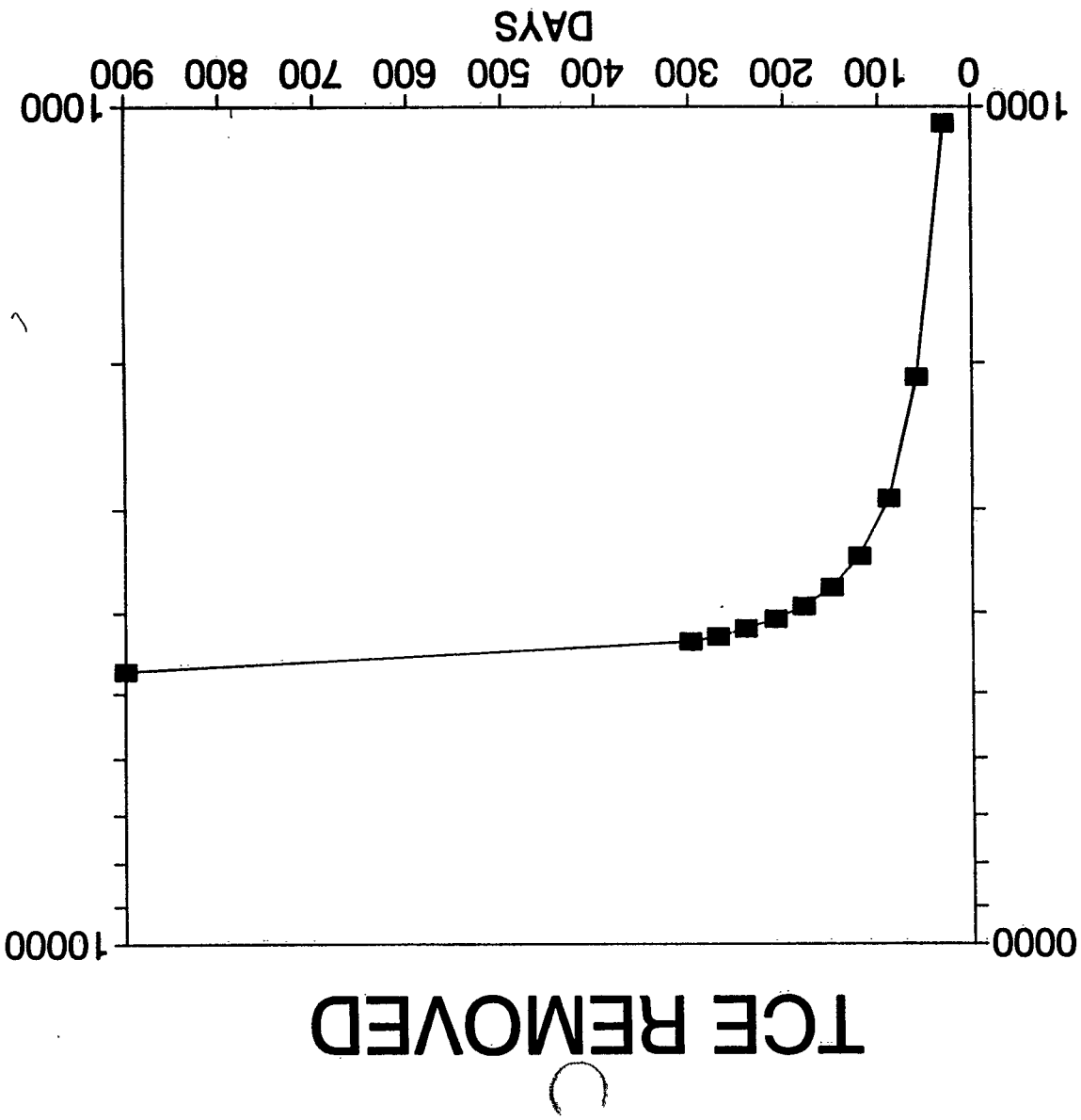

PROJECT NO. 86088/26 | SHEET NO. of

DATE

CHECKED BY

DATE 4/22

PREPARED BY HEK

FUSS&O'NEILL consulting engineers

TIME FOR NATURAL ATTENUATION

FUSS&O'NEILL consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
HEK	11/2/92	MJD	11/3/92	86-088

SHEET NO. 1 of 3

NATURAL ATTENUATION

Although a variety of mechanisms can participate in the natural attenuation of the TCE, dilution and biological activity were considered to be major ones and were considered independently for the till aqueous phase. In both cases attenuation to the 5 ppb level will take hundreds to thousands of years.

Figure 9-6 shows the maximum TCE concentration in the saturated till to be 2.4×10^{-1} / 8a = 8×10^{-3} lb/ft³ = 128 mg/l and is assumed to be completely mixed in the vertical direction throughout the 30 feet depth. The time to have the concentration reach 5 ppb with the complete mixing assumption in the vertical direction and no lateral dispersion becomes,

$$t = \frac{-T \ln C/C_o}{R_o \alpha}$$

$$= \frac{-30 \text{ ft}}{0.83 \text{ ft/year} \times 0.2} \ln\left(\frac{5 \times 10^{-3}}{128}\right)$$

$$= 1834 \text{ years.}$$

Since the lateral transport in the till is controlled by the low hydraulic conductivity, the radius of contamination will increase by,

$$r = r_o + \frac{K\left(\frac{dh}{dr}\right)}{n_T} t$$

$$= r_o + \frac{1.13(.108)}{0.3} t$$

$$= r_o + 0.407\, t \quad \text{where } t \text{ yrs.}$$

For $t = 1834$ years $r - r_o = 746$ ft.
Therefore the radius of contamination in the till would increase from approximately 350 ft to 1100 ft over 1834 years.

FO-#110

FUSS&O'NEILL consulting engineers	PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
	HEK	11/2/92	MSD	11/3/92	86-088

SHEET NO. 2 of 3

No Action Analysis

If no vertical mixing is assumed to occur in the future, and the contaminated TCE water in the till layer leaves by "plug flow" into the bedrock, the time to purge out the TCE from the 30 foot thick layer becomes,

$$t = \frac{\tau n_T}{R_0 \alpha}$$

$$= \frac{30 \times 0.3}{0.83 \times 0.2}$$

$$= 54 \text{ years}$$

The field condition will likely be between the completely mixed and plug flow assumptions.

The amount of time for biological decomposition alone to reduce the TCE to the 5 ppb level can be estimated if the aqueous phase is completely mixed in the vertical direction. Relying upon Monod kinetics, without any inhibition and using reported values for the constants, the time (days) for biological remediation to 5 ppb becomes,

$$t = \frac{-k_{s2}}{-k_2 X_A} \ln\left(\frac{C_2}{C_2^\circ}\right) + \frac{(C_2^\circ - C_2)}{k_2 X_A}$$

where k_{s2} = TCE saturation constant = 2 mg/l

$$k_2 = \frac{\text{mg TCE}}{\text{mg cell-day}} = 0.007$$

C_2° = initial TCE liquid concentration = 128 mg/l

C_2 = final TCE liquid concentration = 5×10^{-3} mg/l

X_A = cell concentration = 0.035 mg/l

$$= \frac{-2}{.007(.035)} \ln\left(\frac{.005}{128}\right) + \frac{(128 - .005)}{.007(.035)}$$

$$= 605287/365 = 1658 \text{ years}$$

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
HEK	11/2/92	MJD	11/3/92	86-088

SHEET NO. 3 of 3

No Action Analysis

Substitution of these literature values, show that the time for bioremediation alone without any external nutrient, substrate, or oxygen assistance could be around 1658 years. Therefore, for the completely mixed assumption, the hydraulic dilution and the bioremediation times are roughly equivalent and around 1600 to 1800 years.

Reference

Roberts, P.V., et. al., "In-Situ Aquifer Restoration of Chlorinated Aliphatics by Methanotropic Bacteria", EPA/600/2-89/003 (July, 1989d) p. 174, 187, 188

FUSS&O'NEILL Inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7-15-92	DLB	7/17/92	86-88/26

SHEET NO. 1 of

Linemaster - Cost Estimates

SC-1 : NO ACTION

Site security fence - Linemaster would use architecturally appropriate fence.

Approximately $50/L.F.

50/LF x 600 LF = $30,000 (installed, including gates)

Weekly Security Checks

1 hour/week x 52 weeks/year x $25/hr = 1300

approximately $1500

* (Cost estimates from DLB)

FUSS&O'NEILL inc
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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7-15-92	DLB	7/17/92	86-88/26

SHEET NO. 2 of

Linemaster - Cost estimates

SC-1 & NO ACTION

Well	Sampling Frequency	Analysis
GW-10db, MW-1db, MW-6db, MW-8db, MW-11db, MW-15db, MW-17db, MW-19sb, POND3of 9	Monthly first 6 months, then quarterly.	8240 or 524.2 and Arsenic
All deep bedrock wells (14 wells), intermittent stream at Route 171 17	Quarterly	8240 or 524.2 and Arsenic
MW-1sb, MW-6sb, MW-7sb, MW-8sb, MW-9sb, MW-10t, MW-10sb, MW-11sb, MW-16sb, MW-16t, MW-17sb, MW-17ts, MW-17td, MW-20sb, MW-EPA-Ats, MW-EPA-Atd, MW-EPA-Ash 17	Semiannually	8240 or 524.2 and Arsenic
All other Monitoring Wells 20	Annually	8240 or 524.2 and Arsenic

Lab Costs:

9 wells x $200/sample x 1 samples/well x 4 quarters/year = $ 7,200

17 wells x $200/sample x 3 samples/well x 4 quarters/year = 40,800

17 wells x $200/sample x 1 samples/well x 2 (twice)/year = 6,800

20 wells x $200/sample x 1 sample/well x 1 event/year = 4,000

58,800

Labor (sampling): say 60,000

9 wells $40/hr x 16 hrs/quarter x 4 quarters = $ 2,560

17 wells $40/hr x 40 hrs/quarter x 4 quarters = 6,400

17 wells 40/hr x 16 hrs/quarter x 2 (twice)/yr = 1,280

20 wells 40/hr x 40 hrs/quarter x 1 event/yr = 1,600

11,840

say 12000

72000

Total Cost of Sampling and Analysis $ 75,000/yr.

(- Cost estimates from DLB)

FO-#110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
DLB	7/13/92	MJP	7/15/92	86088/26

SHEET NO. 3 of

SC-1: No Action

5-Year Review Cost

Data Analysis & Report

Technician	40 h x $40/hr	=	1600
Hydro/geo	40h x $55/hr	=	2200
Eng	40h x 55/hr	=	2200
PM	40h x $75/hr	=	3000
Assoc Princ	20 h x $90/hr	=	1800
			14,800

Use $15,000 for typing, printing etc.

Public Meetings

Preparation	Geo/Eng	40 h x $55/hr	=	$2200
	PM/Assoc	24 h x 85/hr	=	2040
	Drafting	16 h x 40	=	640
	Printing			500
Meeting	$25/h x $30/h x 8h		=	1400
				6780
		say		$6,000

Present Worth

5y	0.8219	21,000	= 17,259
10y	0.6756		14,187
15y	0.5553		11,661
20y	0.4564		9,584
25y	0.3751		7,877
30y	0.3083		6,474
			67,044
		say	$67,000

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7-15-92	DLB	7/17/92	86-88/26

Linemaster - Costestimates — SHEET NO. 4 of

SC-2 : CONTAINMENT

Zone I security fence — same as SC-1 fence

RCRA CAP *

Excavate & dispose of existing material
2000 c.y. x $20/cy = $40,000

Topsoil (515 cy) $10/cy = 5150 say $6,000 x 1.5 installed = 9,000

Filter Fabric (1500 yd²) $5/yd² = 7500 x 2 for installation = 15,000

Fine sand (500 cy) $10/cy = 5000 x 2 for installation = 10,000

Synthetic liner (1450 yd²) $5/yd² = 7250 ~ 7500 x 2 install = 15,000

Clay layer (930 cy) $20/cy = 18600 ~ 19000 x 2 install = 38,000

Seed, Fertilize, and Mulch (incl. labor) ≅ 1,000

* Cost estimates from Terry Hinchey/Dean Audet, previous projects

Weekly Security Checks — same as SC-1

Sampling and Analysis — same as SC-1

Data Analysis and Report Preparation — same as SC-1

Public meetings — same as SC-1

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7-8-92 REV 11/2/92	DLB	7/17/92	86-88/26

SHEET NO. 5 of

Linemaster - Cost estimates

SC-3 : Vacuum Extraction

Zone 1 Security fence — Same as SC-1

Vacuum Extraction system

Control buildings	$7,500/ea x 2 bldgs. =	15,000
Vacuum pumps	2 @ $15,000 ea	30,000
assume will need 2-25 HP including controls		
Carbon Filters - 2 - 2000 lb. systems $8000/ea - installed		16,000
Air piping system - assume all 4" ø		
650 feet x $25/ft = 16250.		20,000
say 23,000 including saw cutting concrete floor		
Water piping system - assume all 4" ø		
400 feet x $25/ft = 10,000		12,000
say 12,000 including saw cutting floor		
Extraction wells		
35 wells x $3500/well (includes valves, etc.)		125,000
Protective boxes 35 x $300/ea = 12,250		15,000
		140,000
Site cleanup (restoration)		
12,000 SF x $2/SF		24,000

(Cost estimates from DLB)

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	5-26-92	DLB	7/17/92	86-88 fc

Linemaster — SC-3: Vacuum Extraction — SHEET NO. 6 of

Pumps (Dewatering)

QED | GroundWater Specialists

Pneumatic Pumps — Draw-Down Pumping
Gradient Control Total fluids pumping
low flow pumping

Pulse Pumps:
Alpha - basic pump for TTL fluids
Need a controller - Pulselink Modular Controllers - PulseSenders
one per well or two pumps close together
WellMaster - level controller one per well needed
Remote well operator - controls up to six wells

Solo pump - no controls needed; simpler to specify, install
total fluids pump that runs itself - one needed for each well.

Description	unit price	Quantity	Total
Pulse Pump	$495.00	40	19800
Inlet screen for pump	$60.00	40	2400
Pulse sender	$1295.00	7	9065
Remote well operator	$145.00	40	5800
Weather proof enclosure	245.00	20	4900
for pulselink modules			
4" well cap for 2" pumps (pump depth adjustable)	85.00	40	3400
Controller exhaust valve (when using remote well operator)	98.00	40	3920
In-well Pump Exhaust valve	98.00	40	3920
Total			53205
		say	55,000

* Costs taken from QED letter to Jim Olson dated April 23, 1992.

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7-15-92	DLB	7/17/92	86-88 /26
	w 11/2/92			SHEET NO. 7 of

Linemaster - Cost estimates

SC-3 : Vacuum Extraction

O & M COSTS

Assume 3 yr. operation spaced over ten years.

Power 50HP * 0.75 * 24hr/day * 365 days * $0.08 = 26,280/yr
26,280 * 3/10 ≅ 7,900/yr say $8,000/yr

Maintenance 8 hr/week * $25/hr * 52 week/yr = 10,400/yr
10,400 * 3/10 = 3000

Sampling and Analysis (gas)

Year 1 12 samples * $200/sample + $100/event collection = $3600
Year 2-10 4 samples * 200/sample + 100/event = 1200/yr

Plus monitoring well sampling same as before (SC-1) 75,000

Present worth of O&M (10 yrs) 4% Discount Rate

Power $8000 * 8.111 = $64,888 say $65,000

Maintenance 3000/yr * 8.111 = 24333 say $24,300

Sampling and Analysis (gas)

1200 * 8.111 = 9733 say 10,000 + 3600 (1st year) = 13600

Operation of system (10 yrs.) - Present worth $102,900
plus carbon 2000
104,900
say $105,000

(Cost estimates from DLB)

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7-15-92	DLB	7/17/92	86-88

SHEET NO. 8 of

Linemaster - Cost Estimates

SC-3 Vacuum Extraction

Replacement Costs

Carbon: 1 vessel/yr 2000 lbs. x $1.50/lb = 3000 x 3 yrs. = 9000

over ten years, $1,000/yr.

Disposal consideration - $2/lb * 2000 lbs/yr x 3 yrs. = 12,000

over ten years, 1200/yr.

Use $2000 ttl/yr.

Equipment replacement - use 25% of cost - in Year 5

25% x (30,000 + 55,000) = 21,250 x 0.8219 = 17,465

say 20,000

(vacuum pumps and dewatering pumps)

Five Year Reviews

Data Analysis and Report Preparation - same as SC-1

Public Meetings - same as SC-1

(Cost estimates from DLB)

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7-15-92	DLB	7/17/92	86-88/26
	Rev 11/2/92			

Linemaster- Cost Estimate — SHEET NO. 9 of

SC-4 & Air Sparging

Zone 1 Security fence — same as SC-1

Control buildings — same as SC-3
Vacuum pumps — $20,000 (lower HP)
Carbon filters — same as SC-3
Piping System - Air — same as SC-3
Water — same as SC-3
Injection blowers
2 blowers x $25,000/ea = 50,000

Injection wells
34 wells x 3500 = 119,000
Control boxes 34 x 300/ea = 10,200
129,000

Site Restoration — same as SC-3

O&M Costs

Assume 3 yr. operation over ten years
Power
Injection blowers 2 at 25HP → 80 HP
Extraction blowers 2 at 15HP - lower due to injection creating pathways

80 x 0.75 x 24hr/day x 365 days x $0.08 ≈ $42,000/yr.
34000 x 3% = 12,600/yr use $13,000

Maintenance — same as SC-3

Sampling and Analysis — same as SC-1

(Costs from DLB)

FO-#110

FUSS&O'NEILL Inc
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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7-15-92	DLB	7/17/92	86-88/26

Linemaster - Cost estimates

SHEET NO. 10 of

SC-4 : Air Sparging

Present worth of O&M

Power $13,000/yr × 8.111 = 105,443 use 105,000
Maintenance 3,600/yr × 8.111 = 29,200 use 24,400

Sampling and Analysis (gas) - Same as SC-3

1200 × 8.111 = 9733 say 10,000 + 1st year (3600) = 13600

105,000
24,400
13,600
143,000
+ 2000 carbon → $145,000 Present Worth O&M Operation of System (10 yrs)

Data Analysis and Report Preparation - Same as SC-1
Public Meetings - Same as SC-1

Replacement costs
Fence - Same as SC-1
25% of Equipment

Blowers (20,000 + 50,000) × 0.8219 = 14,380
say 15,000

(Cost estimates from DLB)

FO-#110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7/15/92	DLB	7/17/92	86-88/26

Linemaster - Cost Estimates

SHEET NO. 11 of

SC-5: BIODEGRADATION

Zone 1 Security fence — same as SC-1

Control building (1) — same as SC-3

Biodegradation system

Water injection wells	19 wells x $3500	$66,500
Water extraction wells	30 wells x $2500	75,000
Air injection blower		25,000
Liquid injection pump		10,000
Microorganism purchase and culturing equipment	allow	25,000

Piping

Air -	500' x $25/ft	12,500
	injection points 12 x 1000	12,000
Water - (Injection piping)	500' x $25/ft	12,500
water - (extraction piping)	1000' x $15/ft	15,000

System operation - Assume 10 years

Power - Blowers assume 25HP, Pump 10HP
35 HP x 0.75 x 24 hr/day x 365 days x $0.08 = $18,400

Operation
10 hr/wk x 52 wk/yr x $25/hr = 13,000/yr

Culturing microorganisms say 5,000/yr

Hydrogen peroxide addition allow 5,000/yr
Value depends on effective flow rate

$ 41,000/yr

(Cost estimates from DLB)

FO-#110

FUSS&O'NEILL consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7/15/92	DLB	9/17/92	86-88/26

Linemaster - Cost Estimates

SHEET NO. 12 of

SC-5: BIODEGRADATION

Monitor well sampling

Assume will have to sample 10 wells/month for 1st year

For D.O., VOCs, metals, etc.

Years 1 10 wells x 12 samples/yr x $300/sample = $36,000

For years 2-10 assume quarterly sampling

10 wells x 4 samples/yr x $300/sample = $12,000/yr.

Also "normal" sampling and Analysis - Same as SC-1

DATA analysis and Report Preparation - Same as SC-1

Public Meetings - Same as SC-1

(Cost estimates From DLB)

FO-#110

FUSS&O'NEILL consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7-15-92	DLB	7/17/92	86-88/26

Linemaster - Cost Estimates — SHEET NO. 13 of

SC-6: Incineration

Zone I Security Fence — Same as SC-1

Staging area preparation

clear and grub staging area (120' x 200') = 24000 sf — $2,000

Granular fill 12" deep x 24000 sf = 24000 ft³

24000 x 1/27 = 889 cy x $15/cy = 13333 say — $13,000

Erosion Control barriers 300' x $2/ft — $ 600

Fence 300 ft x $15/ft + gates — $ 4500

~ 20,000

(- DLB) — say 25,000

Soil Excavation

20,000 cy = 35,000 tons

Deep excavation - 40'

Clam shell in sheeting or cofferdam 7-18 cy.

$15/cy x 20,000 cy = $300,000

(- Means '92)

Sheeting / Shoring — 40' Deep Exc. 100 s/ton; 25' Deep Exc. $20/SF

110' length x 4 walls x 40' Deep = 18000 SF x 20 = $360,000

(- Means '92)

Screening

Vibrating screen $6.50/cy x 5,000 cy = $35,000

(- Means '92)

Backfill Excavation $3/cy x 20,000 cy = $60,000 (- Means '92)

Soil/Ash sampling 1 sample / 100 cy ~ 200 samples x $500/sample ~ $100,000

Spread over 3 yrs — PW = 33,333 x 2.7751 ~ 93,000

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7-15-92	DLB	1/17/92	86-88/26

Linemaster - Cost Estimates

SHEET NO. 14 of

SC-6: Incineration

Mobilization/Demobilization of Incinerator $ 25,000

(- DLB)

Incineration (25 tons/hour max; use 100 tpd)

$300/ton x 30,000 tons = $9 million say $10 million

(- O.H. Materials Corp.)

Site Restoration

Topsoil (12000 SF + 24,000 SF) x 0.5 deep / 27 cf/cy = 667 cy

$15/cy x 667 cy = $10,000

Loam, Seed, and Mulch $100/1000 SF x 36000 = $3600

Plantings, etc. allow 10,000

Repave Drive area $10/sy x 1100 sy 11,000

34,600

(- DLB) say $35,000

Weekly Security Checks — same as SC-1

MW Sampling and Analysis — same as SC-1

Data Analysis and Report Preparation — same as SC-1

Public Meetings — same as SC-1

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
DLB	10/29/92			e6088/26

LINEMASTER COST ESTIMATE — SHEET NO. 14A of

SC-7 Thermal Stripping

Fence		$ 30,000
Mobilization/Demobilization	allow	25,000
Staging area prep. - assume same as for incineration		25,000
Excavation related items - assume same as for incineration		
Excavation		300,000
Shoring		360,000
Screening		35,000
Thermal Stripping		
EPA/540/2-91/009		
Synopses of Fed. Demonstrations of Innov. Tech.		
- assume off-gas treatment $87-184/ton		
for 15,600 to 80,000 tons		
@ ~ 40,000 tons use $125/ton		5,000,000
Refill (same as incineration)		60,000
Restoration (same as incineration)		35,000
Subtotal		$ 5,870,000
O&M - assume 5 year period		
weekly security checks, $1,500/yr x 5yr x 1.45%		~ 7,000
soil sampling - assume same as incineration		
1 sample/200 cy ≈ 200 samples x 500/sample		
say 20,000/yr x 1.45%	PW ≈	89,000

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7/15/92	DUS	1/17/92	86-88/26

Linemaster – Cost Estimates

SHEET NO. 15 of

MM-1: NO ACTION

Capital Costs — NONE

O&M Costs

Sampling and Analysis — Same as SC-1

Quarterly	60,000
Semi Annually	8,000
Annually	7,000
	75,000

Five Year Reviews

Data Analysis and Report Preparation — Same as SC-1

Public Meetings — Same as SC-1

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7/15/92	DLB	7/17/92	86-88/26

SHEET NO. 16 of

Linemaster - Cost estimates

MM-4: Air Stripping & Carbon Adsorption

Capital Costs — None — Equipment already installed

O&M Costs

Operation

2 hr/wk × 52 week/yr × $25/hr = $2600 say $3,000

Power - assume effective 12 h/day operation

Blower	1.5 HP	20 HP × 0.75 × 12 h/d × 365 days × $0.08 = $5256/yr
TP#1	5 HP	
TP#2	3 HP	
Wellpumps	10.5 HP	

5256
1152
6408

Heat 10 kw × 8 h/d × 180 days/yr × 0.08 = 1152

Total 6500

Maintenance $5,000
Carbon $2,500

Analyses
monthly 8010/8020 = 12 × 200 = $2400/yr
toxicity $1000/qtr. $4000/yr

say $6500

Equipment Replacement

Carbon replacement - assume 1 filter/2 years 80 cf × 29 pcf × $2/lb = $4640

Total = $20,040 say $25,000

(every 5 yrs.) Transfer pumps 1500/5000 × 15963 = 4789 say $5,000

(one/5 yrs) Well pumps 500/ea 2000 PW

(year 15&30) Blower 500/ea 500 PW

Packing (every 5 yrs.) 5000/ea

× .8219	4110	
.6756	3378	
.5553	2776	
.4564	2282	
.3751	1876	
.3083	1541	
	15,983	say $16,000

(Cost estimates from DLB)

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7/15/92	DLB	7/17/92	86-88/24

SHEET NO. 17 of

Linemaster - Cost estimates

MM-5: UV/oxidation & Carbon Adsorption

Liquid-phase UV system $122,500
(- Table 2 Document RES0718891\86088 : F50)

Freight $14,000

Installation 12,000
(10% of Equipment because most already in place)

O&M COSTS

Power - same pumps as w/air stripper plus 60-150 kW depending on system - 100 kW for estimate

18.5 HP x 0.75 ≅ 14 KW → 114 x 12 hr x 365 d x $0.06 ≅ 30,000
UV Lamps 100 kW (better rate more usage)
Heat @ 0.06 ≅ 1,000
Total $31,000

Operator 4 hr/wk x 52 wk/yr x 25/hr = $5200

Carbon - same as air stripper

Maintenance - 5,000 same as air stripper
Analyses - 6500 same as air stripper

MW sampling and analysis - same as SC-1

Equipment Replacements

UV lamps $1000/yr
Transfer pumps (one/5yr) $1500/ea
Well pumps (one/5yr) 500/ea

Data Analysis and Report Preparation - same as SC-1

Public Meetings - same as SC-1

(cost estimates from DLB)

FO-#110

FUSS&O'NEILL inc
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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
DLB	7/14/92	MJD	7/17/92	26088/26

REV 11/4/92

SHEET NO. 1 of

SENSITIVITY ANALYSIS

Sensitivity Analysis

1. Change Remediation Time to 3yrs; 30 yrs

Alternate SA-3

3 yr Remediation

O&M

Power (SC-3) 20 HP x 0.75 = 24 h/day x 365 d/y x 0.08 = ~~44,280~~ 10,500/yr

Maint (SC-3) 2 h/w x 25 h x 52 w/y = 10,400 /yr

Power	~~44,280~~ 10,500 x 2.7751 =	~~29,130~~ 29,100
Maint	10,400 x 2.7751 =	28,800
Sampling & Analysis		
Year 1		3600
Year 2 & 3	1200/y x 1.8861 x 0.9615 =	2200
		109,530
		~~$ 65,700~~

Doesn't differ from 10 year life because 10 year costs were developed by spreading the 3 year life over 10 years

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
DLB	7/14/92	MJD	7/17/92	86088/26

SENSITIVITY ANALYSIS

SHEET NO. 2 of

30 YR REMEDIATION

Alternative 3A-3

O&M

Power ~~$24,280~~ ~~19,500~~/yr x 17.292 = ~~454,430~~ ~~421,560~~

Maint 10,400/yr x 17.292 = 179,840

~~659,470~~ ~~384,600~~

S&A

year 1 $3600

year 2-30 1200 x 16.984 x 0.9615 = 19,600 (3,600 + 23,200)

Carbon 1 vessel/yr = $3,000/yr x 17.292 = 51,900

~~436,500~~ 709,370

Alternative 3A-4

Power ~~$42,000~~ ~~34,000~~/yr x 17.292 = ~~$726,260~~ ~~587,900~~

Maint 19,400/yr x 17.292 = ~~329,000~~ 179,000

S&A

year 1 3600 — 3,600

year 2-30 — 19,600

Carbon — 51,900

~~842,800~~ 784,160

FO-#110

FUSS&O'NEILL INC
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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
DLB	7/14/92 Rev 11/4/92	MJD	7/17/92	86088/26

SENSITIVITY ANALYSIS

SHEET NO. 3 of

30 YR REMEDIATION

Change in total SA cost

SA-3

Capital - Same

Replacement
- fence (year 16)
- all vacuum equipment 385,000 (year 16) x 0.5553 = 47,200
- GW system - no change − 20,000
27,200

O&M Costs

709,370   105,000 in 10 yr
~~436,500~~ − ~~66,000~~ = ~~370,500~~ 604,400

Base cost $2,152,800   s/b ~~2,170,800~~ 2,409,700
27,200   27,200
604,400 ~~370,500~~   604,400
2,550,500   3,041,300

27,200
370,500
397,700

SA-4

Capital - same

Replacement 70,000 in year 16 = 38,900 − 15,000 = 23,900

O&M
145,000 air stripping sys
981,140 ~~842,800~~ − ~~125,000~~ = ~~717,800~~ 836,200

Base cost 2,380,800 s/b 2,419,900
23,900   741,100
717,800

$3,122,500

2,419,900
23,900
836,200
$3,280,000

FO-#110

FUSS&O'NEILL Inc
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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
DLB	7/14/92	MJD	7/17/92	86088/26

SHEET NO. 4 of

SENSITIVITY ANALYSIS

2. Add Vapor Phase Carbon Treatment to Air Stripper

from Air Permit Application - updated

Gas Phase Equipment say $25,000

Building Modifications say 10,000

Duct work 5,000

Freight 4,000

Installation 10,000

$56,000

O&M Cost

Additional blower

assume 3HP / 12 h/day = 788/yr x 17.29¢ = $13,600

Labor 1 h/wk = $1300/yr x 17.29¢ 22,500

Maintenance say $500/yr 8,600

Carbon use

- from air permit, approximate discharge is 5 lbs of VOCs/day (TCE ~ 4.5 lbs)
- use from Calgon isotherms @ 77° 2.2 lbs/lb TCE use 3 lb/lb because air often will be colder
- = HEK / OHM calculated 5780 lbs TCE in deep bedrock

assume all removed 3 x 5780 = 17,340 lbs carbon

at $2/lb = $34,680 + transportation & regeneration costs include another $2/lb

Assume removal occurs uniformly over 30 years @ 200 lbs/yr carbon use 600 x lbs/yr x $4/lb = 2400/yr

Air Heater 5KW x 12h/day x 365 day/yr x $0.08 = $1800/yr

FO-#110

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
DLB	7/14/92	MJD	7/17/92	86088/26

Rev 11/4/92

SHEET NO. 5 of

SENSITIVITY ANALYSIS

Total O&M Costs - Vapor Phase Carbon Treatment

Present worth

Electric		18,600
Fuels	8800 x 17.292	21,100
Labor		22,500
Maint		8,600
Carbon	2400 x 17.292	41,500
S&A		23,200
		140,500

REPLACEMENT

- assume complete replacement in year 16

25,000 x 0.5553 = 13,900 say $15,000

HM-4

Capital Cost	$ 56,000
Contingencies (25%)	14,000
	70,000
O&M increase	140,500
Replacement increase	15,000
	$ 225,500 increase in air shipping cost for 30 years

Air Sampling

Assume monthly for 1st year then quarterly thereafter - same cost as for 30 - 3 of SC-4

3600 yearly	3,600
1200 thereafter	19,600
	23,200

FO-#110

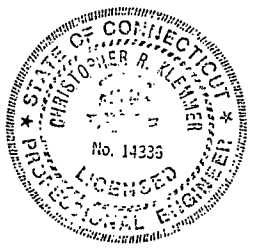
APPENDIX E
DESIGN REPORT:
INTERIM REMOVAL TREATMENT SYSTEM

FEASIBILITY STUDY REPORT
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
AUGUST 1992

86088\DLB0717A.WP

DESIGN REPORT
INTERIM REMOVAL TREATMENT SYSTEM
FOR
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT

DECEMBER, 1991



DLB1212A91\86088
Corres.

TABLE OF CONTENTS

TRANSMITTAL LETTER

FUSS&O'NEILL inc
consulting engineers

December 18, 1991

Ms. Naomi Davidson
Senior Environmental Analyst
Department of Environmental Protection
Water Enforcement Section
165 Capitol Avenue
Hartford, CT 06106

RE: Linemaster Switch Corporation
Interim Removal Treatment System

Dear Ms. Davidson:

In conjunction with your letter of March 1, 1991 requiring that Linemaster implement measures to control the flow of contaminated ground water leaving the site, enclosed are the design plans and supporting documentation for the proposed interim removal treatment system which includes the following:

1. Treatment System Plans
   - Interim Removal Action Collection System
   - Interim Removal Treatment System Details
   - Proposed Outlet and Outlet Structure for Pond 3
   - Elementary Wiring Diagram (6 sheets)
   - Enclosure and Back Panel Layout
   - Enclosure Layout

2. Description of system operation (with Process and Instrument Diagram)

3. Design criteria.

4. Catalog cuts and manufacturers' literature for the components of the system.

5. Emergency discharge request and NPDES permit application.

DLB1212A91\86088
Corres.

146 HARTFORD RD. / MANCHESTER, CT 06040-5921 / TEL: (203) 646-2469, FAX: (203) 643-6313

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As you are aware Linemaster is committed to implement the Interim Treatment System as quickly as possible. Your prompt review of the information enclosed will allow orders to be placed for the equipment and expedite operation of the system. If additional information is required, we will provide it immediately.

Very truly yours,

David L. Bramley

David L. Bramley, P.E.
Senior Environmental Engineer

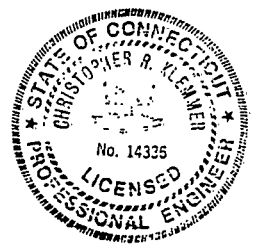
Reviewed by,

Chris Klemmer

Christopher R. Klemmer, P.E.
Associate

enclosure

cc. John Maloney, Linemaster
Gary Kennett, Linemaster
Alfred E. Smith, Esq., Murtha, Cullina, Richter & Pinney
Lucy Conley, US EPA



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DESCRIPTION OF SYSTEM OPERATION

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DESCRIPTION OF SYSTEM OPERATION

The proposed treatment system will use a combination of air stripping and granular activated carbon filtration to achieve the required discharge concentration of 1 ppb total volatile organic compounds at the discharge from the system.

From the individual monitoring wells (MW) and water supply wells (GW), ground water will be pumped, through individual force mains, to an equalization tank in the proposed treatment building. As each line enters the building there will be a sampling tap followed by a flow sensor. This will allow sampling and analysis of each well and will record instantaneous and total flow from each well. A filter will be installed on the line from MW-15db because the suspended solids concentration is high due to the fractured bedrock condition.

The equalization tank will be controlled by low, high and high-high level switches as described in the control description included on the drawings. From the equalization tank Transfer Pump 1 will deliver the flow to the top of the air stripping tower. A sampling tap has been provided to determine the VOC concentration of the equalized flow to the stripper. A flow sensor will indicate the flow rate to the tower.

The air stripping tower is designed to treat a water stream of variable VOC concentration. The anticipated TCE and VOC concentrations expected from the well complex are 3,550 and 4,700 ppb respectively. The air stripper has been designed however, to achieve an effluent VOC concentration of 5 ppb with an influent VOC concentration as high as 40,000 ppb, the concentration possible if only GW-10db was contributing to the system.

The treated water from the tower is returned to a clearwell at the base of the tower. The liquid level in the clearwell is controlled by probes which control the operation of transfer pumps and the air blower. The control description outlines the sequence of operations.

Transfer Pump 2 delivers the flow from the air stripper clearwell to the granular activated carbon filters. This pump operates on the water level in the clearwell. It also contains a sampling tap and flow sensor. The tap will allow collection of a sample to determine the effectiveness of the stripper. The flow sensor will allow recording of instantaneous flow rate as well as total flow through the system for the recording period.

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The carbon filters are designed to operate in series and will be plumbed to allow either filter to function as the primary unit. Flow will enter the primary unit at the top and be forced out the bottom via Transfer Pump 2. The flow will continue under pressure through the secondary unit discharging from the bottom of the unit. Ultimately, the flow will discharge by gravity to Pond 3. To keep both units full when the system is not active, the discharge pipe from the secondary unit will be elevated to the ceiling of the treament building before turning down to the discharge connection in the floor. A sampling tap will be located on the discharge side of both of the filters to determine the effectiveness of the filtration system and to the monitor water quality before it leaves the treatment building and the site.

The Control Sequence is delineated on the detail drawing of the treatment system. The building has been designed and the slab constructed with a 6-inch high containment wall around the perimeter of the slab. This will result in the ability to contain approximately 2,200 gallons of liquid within the building foundation. This is more than twice the volume of the equalization tank and clearwell combined. In addition the control system contains a sensor to detect the presence of as little as 1/32 inch of water on the floor. Should the floor alarm be activated, a signal will stop all the well pumps.

Other alarm conditions include high-high level in either the equalization tank and the clearwell. An alarm under high-high level will stop the entire in sequence as delineated in the Control Description.

An additional safety feature will drain the influent line to the stripping tower if the temperature of the water in the line reaches 35°F. This condition could occur in the winter if Transfer Pump 1 was inoperative. An inline sensor will monitor the water temperature. If the water temperature reaches 35°F a signal will open a normally closed solenoid valve which will drain the influent line back into the equalization tank, a total volume of approximately 22 gallons.

The system has been designed to be simple to operate yet include sufficient control and monitoring functions to assess the effectiveness. The control system will include a programmable controller and a graphic display panel to allow evaluation of the operating status a glance. The programmable controller will permit easy alteration of system parameters to adjust to changing conditions (eg. faster or slower ground-water recharge to the monitoring wells).

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The total daily flow through the treatment system, assuming continuous operation (which is unlikely for all of the wells), is estimated at approximately 130,320 gpd (0.20 cfs). The maximum flow rate through the treatment system as currently designed is 130 gpm (0.29 cfs). The runoff calculated for the area tributary to Pond 3 is approximately 2.7 cfs for the 10-year storm. The total rate of discharge to Pond 3, therefore, is not expected to exceed 3 cfs for the 10-year storm.

The proposed discharge structure and pipe is designed to convey the flow from at least a 10-year recurrence frequency storm, the discharge from the treatment system and the non-contact cooling water from the production facility (approximately 3,600 gallons per day). The throat of the outlet control structure has a capacity of 20.4 cfs. The proposed 12" PVC discharge pipe has a minimum capacity of 5 cfs without a surcharge condition. Thus both the outlet structure and the discharge pipe have sufficient capacity to convey the volume of water that will be discharged to the pond.

The proposed outlet structure will maintain the pond elevation at approximately 474 feet. This elevation was selected for two reasons. First, aesthetically, the appearance of the pond is more pleasing with a greater depth of water. Deeper water also inhibits the growth of nuisance aquatic plants. Second, the elevation of the ground at the southeast edge of the pond is approximately 475 feet. Maintaining a maximum water surface of 474 feet will result in a 1-foot freeboard.

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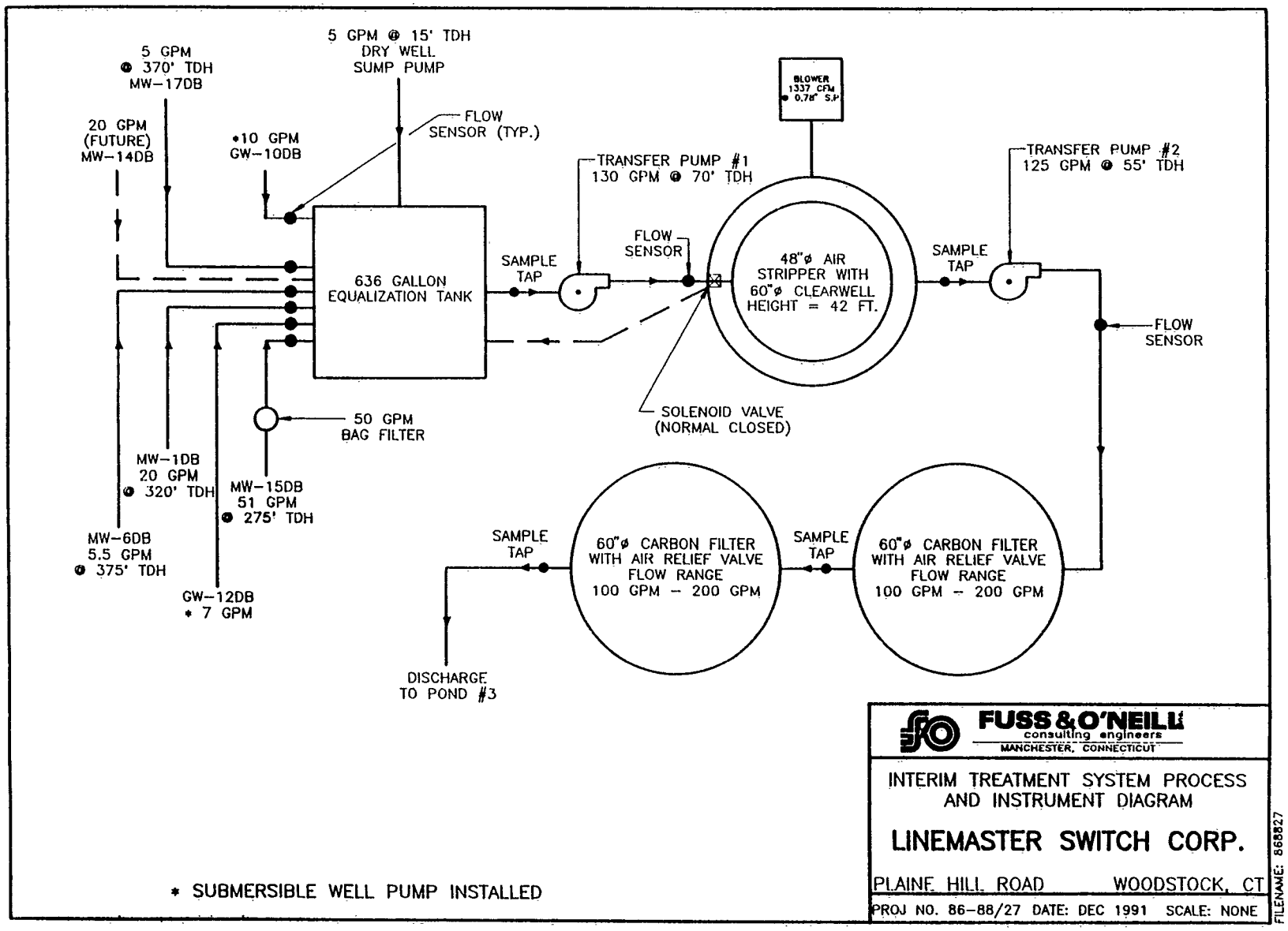
Corres.



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MANCHESTER, CONNECTICUT

INTERIM TREATMENT SYSTEM PROCESS
AND INSTRUMENT DIAGRAM

LINEMASTER SWITCH CORP.

PLAINE HILL ROAD WOODSTOCK, CT

PROJ NO. 86-88/27 DATE: DEC 1991 SCALE: NONE

FILENAME: 868827

DESIGN CRITERIA

LINEMASTER SWITCH CORPORATION
INTERIM REMOVAL ACTION TREATMENT SYSTEM
DESIGN CRITERIA

	Average	Maximum
Flow (gpm)		
MW-1db	20	30
MW-6db	5.5	8
MW-15db	51	74
MW-17db	5	8
GW-10	10	10
GW-12	7	7
Equalization Tank		
Type	Circular, FRP	
Diameter (ft.)	5	
Height (ft.)	4.33	
Capacity (gal)	635	
Transfer Pump 1		
Type	Close-coupled, centrifugal, 5.125" impeller	
Capacity (gpm @ ft TDH)	130 @ 70	
Horsepower	3	
Speed (rpm)	3500	
Motor	Open, drip-proof	
Air Stripper		
Flow (gpm)	130	
Water Temperature (°F min.)	48	
VOC Concentration (ppb)		
Influent	3,550	40,000
Effluent	5	5
Tower		
Height (ft)		42
Diameter (in)		4
Packing		
Type	3.5" Lanpac	
Depth (ft)		33
Clearwell		
Depth (ft)		3.5
Diameter (ft)		5
Capacity (gal)		510
Blower		
Flow (cfm @ in S.P.)	1337 @ 0.78	
Motor	1.5 HP TEFC	

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LINEMASTER SWITCH CORPORATION
INTERIM REMOVAL ACTION TREATMENT SYSTEM
DESIGN CRITERIA (cont'd)

Transfer Pump 2	
Type	Close-coupled, centrifugal, 4.75" impeller
Capacity (gpm @ ft TDH)	125 @ 55
Horsepower	3
Speed (rpm)	3500
Motor	Open, drip-proof
Dry Well Pump	
Type	Sub. sump
Capacity (gpm @ ft TDH)	20 @ 15
Horsepower	1/3
Speed (rpm)	3400
Motor	115V, 1PH
Carbon Filter	
Number	2 (in series)
Type	Culligan HR-60
Diameter (ft)	5
Depth (ft)	5
Capacity (cf ea.)	48
Retention Time (min. total)	5.7
Carbon	
Size (mm)	0.4x1.7
Mesh	12x40
Density (pcf, wet drained)	25
VOC Concentration (ppb)	
Influent	5
Effluent	<1
Anticipated Life	
Primary (days)	333

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PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
DMD	10/1/91 12/4/91	DLB	10/1/91 12/4/91	86-88/27

SHEET NO. 1 of 2

LINEMASTER

MASS BALANCE FOR TCE & VOC LOADING

TCE & VOC concentrations from packer sampling for MW and periodic analyses for GW-10 & 12 dd.

$Q \times C \times 8.34$ = lb/day Q = flow in MGD; C = concentration mg/l

$\frac{gpm \times 1440}{10^6} = MGD \times 8.34 = 0.0120096$

Well Yield	Expected Well Yield (gpm)	TCE conc. mg/l (VOC conc mg/l)	lb/d TCE (lb/d VOC)
MW-1dd	20	0.55 (0.62)	0.0132 (0.0149)
MW-6dd	5.5	2.5 (2.75)	0.1663 (0.1830)
MW-15dd	5	0.31 (0.35)	0.1899 (0.2144)
MW-17dd	5	5.1 (5.9)	0.3062 (0.3543)
GW-10dd	10	29.0 (36.5)	3.4828 (4.3835)
GW-12dd*	7	0.5 (5.0)	0.0420 (0.4203)
MW-14dd**	20	0.004 (0.05)	0.0010 (0.0121)
TOTAL w/MW-14dd	118.5 (0.171 MGD)		4.20 lb TCE/day 5.58 lb VOC/day
w/o MW-14dd	98.5 (0.142 MGD)		4.20 lb TCE/day 5.57 lb VOC/day

* Likely will be developed by MW-15dd or MW-1dd
** Not included in initial design

FUSS&O'NEILL consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
DMD	10/1/91 12/4/91	DLB	10/1/91 12/4/91	86-88/27

LINEMASTER - MASS BALANCE

SHEET NO. 2 of 2

Determine Average Concentration of TCE & VOC to Stripper

C = lb/day x 1/Q x 1/8.34

w/ MW-14D

TCE = 4.20 x 1/0.171 x 1/8.34 = 2.945 mg/l

VOC = 5.58 x 1/0.171 x 1/8.34 = 3913 mg/l

w/o MW-14D

TCE 4.20 x 1/0.142 x 1/8.34 = 3.546 mg/l

VOC 5.57 x 1/0.142 x 1/8.34 = 4.703 mg/l

MAXIMUM VOC concentration assumed to be 40,000 ug/l based on conservative average of 1991 analyses (some samples collected during the GW-10D6 pump test). VOC concentrations ranged from ~28,000 to 59,000 ug/l with an average of approximately 35,000 ug/l

FD #110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MAY	12/13/91	DLB	12/16/91	86-22/2

LINEMASTER : ESTIMATED LIFE OF CARBON FILTER — SHEET NO. of

For HR-60 Culligan CARBON FILTER (Cullar D Plus CARBON)

- VOLUME of CARBON = 48 ft^3
- Density of CARBON = 25 lbs/ft^3
- CARBON USAGE for Q = 125 gpm AND influent TCE = 5 ppb is 0.02 lbs of CARBON per 1000 gal (.02 lbs/1000 gal)

BASED ON the above information determine the anticipated LIFE of the CARBON filter AND CONTACT TIME IN THE FILTER.

$$\text{CONTACT TIME} = \frac{48 \text{ ft}^3}{125 \text{ gpm}} \times \frac{7.48 \text{ gal}}{\text{ft}^3} = 2.87 \text{ min/filter}$$

$$\text{lbs of CARBON in filter} = \frac{25 \text{ lbs}}{\text{ft}^3} \times 48 \text{ ft}^3 = 1200 \text{ lbs}$$

$$1200 \text{ lbs CARBON} \times \frac{1000 \text{ gal}}{0.02 \text{ lbs C}} = 6.0 \times 10^7 \text{ gal}$$

$$\frac{6.0 \times 10^7 \text{ gal}}{125 \text{ gpm}} \times \frac{\text{DAY}}{1440 \text{ min}} = 333.33 \text{ DAYS}$$

SAY 333 DAYS

Therefore, the anticipated life of the primary CARBON filter = 333 days

FO - # 110

Design Data

CULLAR, FILTERS

	MODEL	FLOW RATES: TASTE, ODOR, & ORGANIC REMOVAL[1] FLOW GPM	TASTE, ODOR, & ORGANIC REMOVAL[1] DROP PSI	DECHLORINATION[2] FLOW GPM	DECHLORINATION[2] DROP PSI	BACK WASH GPM	TANK[3] SIZE (IN)	PIPE SIZE: SERVICE (IN)	PIPE SIZE: DRAIN (IN)	MEDIA VOL. STD. FT³	DIMENSIONS[6]: WIDTH IN.	DEPTH IN.	HEIGHT IN.	WEIGHT: SHIP LB.	WEIGHT: OPERAT. LB.	MODEL
HI-FLO 2	PV-12R	5	1.0	8	7	8	12x37	1½	¾	1.4	14	12	53	141	285	PV-12R
	PV-16R	7	1.0	14	4	15	16x48	1½	1	2.8	17	20	65	305	520	PV-16R
HI-FLO 5	HR-20	12	2.0	22	5	20	20x54	1½	1	6.0	21	36	69	670	1,275	HR-20
	HR-24	15	2.0	31	8	30	24x54	1½	1	8.0	25	40	69	835	1,625	HR-24
	HR-30	25	3.0	49	10	50	30x60	2	2½	14.0	31	46	77	1,330	2,525	HR-30
	HR-36	35	4.0	71	10	70	36x60	2	2½	20.0	37	54	84	1,810	3,575	HR-36
HI-FLO 50	HR-42	50	4.0	100	14	90	42x60	2½	2½	24.0	43	51	86	3,200	5,120	HR-42
	HR-48	65	4.0	125	16	130	48x60	2½	3	30.0	49	60	92	4,520	7,120	HR-48
	HR-54	80	6.0	150	18	160	54x60	2½	3	40.0	55	71	94	5,640	9,025	HR-54
	HR-60	100	4.0	200	13	210	60x60	3	3	48.0	61	98	98	6,900	11,160	HR-60

DEPTH FILTERS

	MODEL	FLOW RATES: CONTINUOUS[4] FLOW GPM	CONTINUOUS[4] DROP PSI	PEAK[5] FLOW GPM	PEAK[5] DROP PSI	BACKWASH STD. GPM	BACKWASH QUAD. GPM	TANK[3] SIZE (IN)	PIPE SIZE (IN): INLET & OUTLET	PIPE SIZE (IN): DRAIN	MEDIA VOL. STD. FT³	DIMENSIONS: WIDTH IN.	DEPTH IN.	HEIGHT IN.	WEIGHT: SHIP LB.	WEIGHT: OPERAT. LB.	MODEL
HI-FLO 2	PV-12D	8	2	12	4	10	—	12x37	1½	¾	1.5	14	18	53	222	365	PV-12D
	PV-16D	14	3	21	7	20	—	16x37	1½	1	2.8	17	20	53	410	615	PV-16D
HI-FLO 5	HD-20	22	3	45	10	30	50	20x54	1½	1	6.0	21	36	69	975	1,600	HD-20
	HD-24	31	3	65	16	50	80	24x54	1½	2½	8.0	25	40	69	1,315	2,150	HD-24
	HD-30	49	5	100	16	70	120	30x60	2	2½	13.0	31	46	77	2,015	3,275	HD-30
	HD-36	71	5	140	16	90	160	36x60	2½	2½	19.0	37	54	84	2,970	4,750	HD-36
HI-FLO 50	HD-42	95-142	5-10	190	17	136	226	42x60	3	3	25.0	43	51	86	4,980	6,850	HD-42
	HD-48	125-187	6-10	250	16	188	324	48x60	3	3	34.0	49	62	92	6,300	8,850	HD-48
	HD-54	160-240	5-8	320	13	210	398	54x60	4	3	42.0	55	72	94	8,000	11,290	HD-54
	HD-60	200-300	4-9	400	14	270	430	60x60	4	3	52.0	61	77	98	9,770	13,990	HD-60
	HD-72	290-425	4-9	560	14	400	—	72x60	6	4	75.0	73	88	94	14,150	20,100	HD-72
	HD-84	390-575	4-9	770	14	540	—	84x60	6	4	106.0	85	94	97	19,240	27,300	

(1) Taste, odor, and organic removal based on 5 gpm per square foot of filter area.
(2) Dechlorination flow rate can be set up to 10 gpm per square foot of filter area.
(3) Dimensions are diameter by straight side sheet.
(4) Normal Service Range based on 10 gpm per square foot of filter bed area.
(5) Peak Flow based on 20 gpm per square foot of filter bed area, not recommended for extended periods of time.
(6) Does not include operating and maintenance spaces, ASME code tanks are slightly taller.

NOTE: CONSULT FACTORY FOR WATER RECLAMATION APPLICATIONS.

Multi-Tech™ Systems

Design Data

MODEL	DAILY CAPACITY[1]	SERVICE FLOW RATE PER TANK[2]: NORMAL	SERVICE FLOW RATE PER TANK[2]: MAXIMUM	BACKWASH FLOW RATE[3]	TANK DIAMETER	PIPE SIZE[4]	MODEL
MT-20	0.065 MGD	15 gpm	22 gpm	30 gpm	20 in.	1½ in.	MT-20
MT-24	0.095 MGD	22 gpm	30 gpm	50 gpm	24 in.	1½ in.	MT-24
MT-30	0.150 MGD	35 gpm	50 gpm	70 gpm	30 in.	2 in.	MT-30
MT-36	0.215 MGD	50 gpm	70 gpm	100 gpm	36 in.	2 in.	MT-36
MT-42	0.280 MGD	65 gpm	95 gpm	130 gpm	42 in.	2½ in.	MT-42
MT-48	0.367 MGD	85 gpm	125 gpm	170 gpm	48 in.	3 in.	MT-48
MT-54	0.475 MGD	110 gpm	160 gpm	220 gpm	54 in.	3 in.	MT-54
MT-60	0.580 MGD	135 gpm	190 gpm	270 gpm	60 in.	4 in.	MT-60
MT-72	0.842 MGD	195 gpm	280 gpm	400 gpm	72 in.	4 in.	MT-72
MT-84	1.15 MGD	265 gpm	380 gpm	530 gpm	84 in.	6 in.	MT-84
MT-96	1.52 MGD	350 gpm	500 gpm	700 gpm	96 in.	6 in.	MT-96
MT-120	2.37 MGD	550 gpm	780 gpm	1100 gpm	120 in.	6 in. (8 in.)	MT-120

(1) Daily Capacity based on 24 hour operation of 3 train system operating at normal service flow rate of 7 gpm/ft² per train.
(2) Service flow rates based on 7 gpm/ft² per train. When one train of the 3 train system is in backwash, the remaining 2 trains will operate at 10.5 gpm/ft².
(3) The backwash flow rate of both the clarifier and filter are approximately 14 gpm/ft². The clarifier eductor draws 2-3 cfm/ft² air during the scour cycle for additional mineral bed expansion.
(4) Pipe size selection is based on a maximum velocity of 5 fps at the Normal Service flow rate.
(5) Total water usage per train is 225 gallons per sq ft of filter tank area. This includes 140 gallons of influent water for clarifier backwash and system rinse plus 85 gallons of filtered water for depth filter backwash.

CULLAR D PLUS

GENERAL CHARACTERISTICS

Cullar D Plus is a general purpose granular activated carbon which contains a broad size range of pores capable of adsorbing a variety of molecular weight organics from water. Cullar D Plus is made from coal which is milled, compacted, sized, and steam activated.

PROPERTIES

The following are approximate values for Cullar D Plus:

Mesh Size	12x40
Surface Area (m^2/g)	1000
Moisture (%)	2
Ash (%)	8
Abrasion No.	70
Density (lb/cu.ft.)*	25
Iodine Index	1000
Methylene Blue Index	200
Bed Expansion @ 55°F	
gpm/sq.ft. for 50%	12
gpm/sq.ft. for 30%	8
Pressure Drop @ 55°F (psi/ft)	
@ 3 gpm/sq.ft.	0.2
@ 5 gpm/sq.ft.	0.3
@ 20 gpm/sq.ft.	1.5

*backwashed and drained

CAT. NO.	NET WT. (LBS)
1627-05	15
1627-04	21
1627-06	25
1627-03	35
1627-00	50

NOTE: While suitable for general applications, Cullar D Plus should not be used for medical applications. Consult the factory before using any activated carbon material for medical applications.

12/13/91 CARBON USAGE RATE per CULLIGAN

David Day

Flow Rate Max 125 G.P.M.

TCE		Per 1000 Gal	per 24 hr
	at 1 PPB	0.01 lbs	1.7 lbs
	at 5 PPB	0.02	3.5
	at 10 PPB	0.03	5.2
MTBE			
	at 50 PPB	0.59	102 lbs
	at 100 PPB	0.84	145

More details to report to follow

Rich Iacuniello

CATALOG CUTS

Linemaster Switch Corporation
Interim Removal Treatment System
Equipment List

	EQUIPMENT	MANUFACTURER
1.	Bag Filter	Rosedale Products
2.	Flow Sensor/Totalizer	Signet
3.	Equalization Tank	Ambi
4.	Transfer Pump #1&#2, Sump Pump	Goulds Pumps
5.	Air Stripping Tower & Blower	National Environmental Systems
6.	Solenoid Valve, Temp Switch & Bulb Sensor	Asco
7.	Carbon Filters	Culligan
8.	Lighting	Mercury
9.	Heater	Chromalox

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Corres.

IN-LINE BAG FILTER
(FOR MW-15db)

Strainers or Bag Filters: Your Choice!

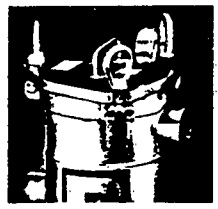
Rosedale strainer/filter housings are made in many sizes, and all can serve as basket strainers (for particle retention down to 74 micron size) or as bag filters (for particle retention down to 1 micron size). In all cases, covers are easily removed, without tools, and the basket or bag is easily cleaned or replaced.

FEATURES

- Large-area, heavy-duty baskets
- Low pressure drops
- Housings are permanently piped
- Covers are O-ring sealed
- Carbon steel, or stainless steel (304 or 316) housings
- All housings are electropolished to resist adhesion of dirt and scale
- Adjustable-height legs, standard on Models 6 and 8; optional extra on Model 4
- Easy to clean
- ASME code stamp for 150 or 300 psi
- Liquid displacers for easier servicing
- Special options include filter bag hold-down devices, sanitary construction, different outlet connections, higher pressure ratings, extra-length legs, heat jacketing, and adapters for holding filter cartridges.
- Multiple-basket and duplex units are available

Dual Stage Straining/ Filtering

All Rosedale Model 8 housings can be supplied with a second, inner basket which is supported on the top flange of the regular basket. Both baskets can be strainers (with or without wire mesh linings) or both can be baskets for filter bags. They can also be mixed; one a strainer basket, the other a filter bag basket. Dual-stage action will increase strainer or filter life and reduce servicing needs.



Covers are secured by three eyenut assemblies. One of them acts as a hinge when cover is opened. Model 4 units can also be ordered with a lighter cover, held in place with a single quick-opening clamp (photo on cover).

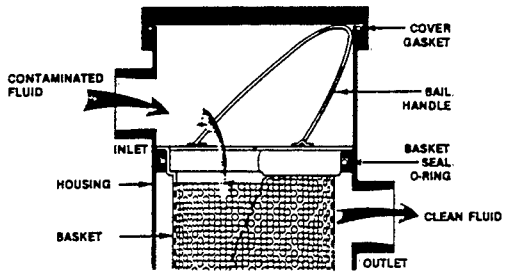
MULTI-BASKET MODELS

Larger units with multiple baskets (from 2 to 17) are also made. They can handle flows from 400 to 3500 gpm. Ask for Catalog MB.

DUPLEX MODELS

Most of the models described here are also available as duplex systems. Two units come piped together with valves to permit continuous use of either unit while servicing the other. One lever actuates all valves simultaneously. Ask for Catalog DF.

Operation

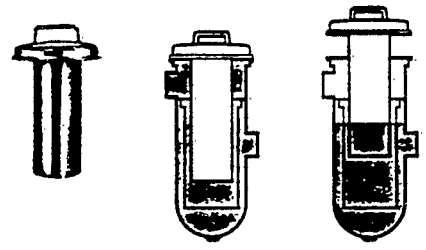


Unfiltered liquid enters the housing above the bag or basket and passes down through them. Solids are contained inside the bag or basket where they're easily and completely removed when the unit is serviced. A hinged basket bail is pushed down by the closed cover, to hold the basket against a positive stop in the housing. It helps prevent bypassing of unfiltered liquid.

Fluid bypass around the basket is prevented by an optional O-ring seal between the basket rim and the housing ID. This seal is required on Model 8 bag filters. Model 4 and 6 bag filters don't need this O-ring because the OD of the filter bag seals against the housing itself, rather than against the ID of the basket rim.

A single cover gasket is used to seal the opening, and covers can be installed and removed without tools.

Liquid Displacer Option



All strainers or filters can be supplied with a liquid displacer. When in use the displacer (a sealed 304 stainless steel cylinder) is inside the strainer basket or filter bag, displacing liquid that would otherwise fill the inner space. When the cover and displacer are removed, the level of liquid within the strainer basket or filter bag is lowered which results in less product loss, and fast, easy changes.

If the weight of the cover-displacer assembly is a concern (the heaviest, on a Model 8-30, is 20 pounds) you can easily detach the displacer.

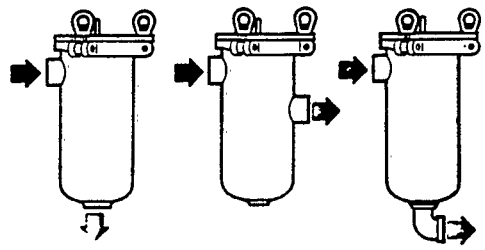
Construction Materials

All housings and other wetted parts not otherwise specified can be ordered in carbon steel. 304 stainless steel, or 316 stainless steel.

Four different materials can be ordered for all seals involved.

All baskets and mesh linings are made of stainless steel. 304 stainless will be supplied with carbon and 304 housings, 316 stainless with 316 housings.

Convenient Piping Arrangements



Style 1
Bottom outlet

Style 2
Side outlet

Style 3
Bottom outlet
with elbow

Many basket options

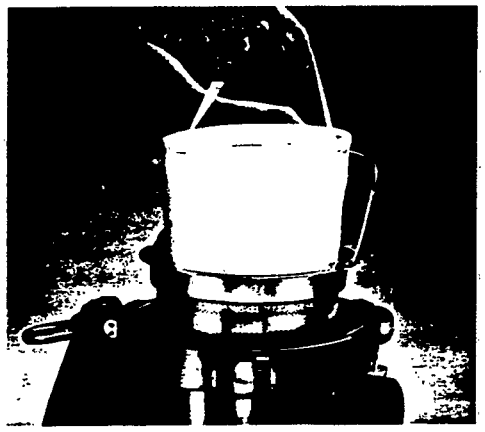
The baskets offered will permit the straining and filtering of a wide variety of fluids, to retain solids of almost any size.

All baskets are easily removed and cleaned. All are made in depths to suit the housing selected.

Plain perforated strainer basket.
Choose from the following perforation sizes: 1/4, 3/16, 9/64, 3/32, and 1/16 inch.

Perforated strainer basket with wire mesh linings.
High quality wire is used, in mesh sizes 20, 30, 40, 50, 60, 70, 90, 100, 150, and 200.

Filter bag basket.
They have 9/64-in.-diameter perforations, for a 51 percent open area. They accept standard size filter bags (see Rosedale Catalog FB).



Choosing a basket strainer or bag filter

Once the choice between **straining** a fluid (removing particles down to 74 micron size) and **filtering** it (removing particles down to one micron) has been made, the choice of which size Rosedale model must be made. All three models (4, 6, and 8) and the baskets and bags that go in them, are of the same basic design. They differ in dimensions, capacities, maximum pressure ratings, and pipe size. Selection is based on these variables.

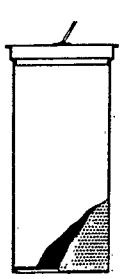
PRESSURE DROP DATA
Basket strainers and bag filters are usually selected so that the pressure drop does not exceed 2 psi, when they are clean. Higher pressure drops may be tolerated when contaminant loading is low.

The pressure drop data is accurate for all housings with strainer or filter bag baskets. When filter bags are added, total pressure drop becomes the sum of the pressure drop as determined by the steps below plus the pressure drop through the bag as defined in Rosedale Filter Bag Catalog FB.

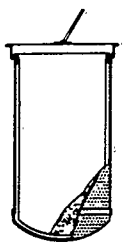
Follow these easy steps:
1. Using the desired pipe size and approximate flow rate, determine the basic pressure drop from the appropriate graph.
2. Multiply the pressure drop obtained in step 1 by the viscosity correction factor found in the accompanying table. This is the adjusted (clean) pressure drop for all baskets, without filter bags.

	Viscosity, cps								
	1 (H_2O)	50	100	200	400	600	800	1000	2000
All unlined baskets	65	.85	1.00	1.10	1.20	1.40	1.50	1.60	1.80
40-mesh lined	73	.95	1.20	1.40	1.50	1.80	1.90	2.00	2.30
60-mesh lined	.77	1.00	1.30	1.60	1.70	2.10	2.20	2.30	2.80
80-mesh lined	93	1.20	1.50	1.90	2.10	2.40	2.60	2.80	3.50
100-mesh lined	1.00	1.30	1.60	2.20	2.40	2.70	3.00	3.30	4.40
200-mesh lined	1.30	1.70	2.10	3.00	3.40	3.90	4.40	5.00	6.80

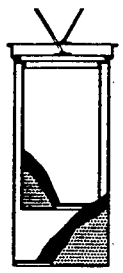
SINGLE-STAGE BASKETS
(all models)



Single-stage perforated strainer basket, with or without wire mesh liner.

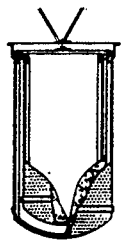


Single-stage filter bag, within perforated basket. Can also be wire mesh lined, or be made entirely of heavy wire mesh.

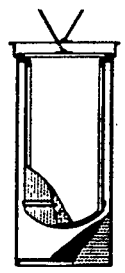


Dual-stage straining can be done with two perforated strainer baskets, with or without wire mesh linings.

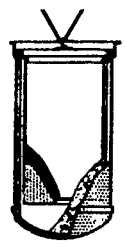
TWO-STAGE BASKETS
(Model 8 only)



Both inner and outer filter bags in this dual-stage configuration can be of the throw-away or cleanable type.



A filter bag within a wire mesh-lined outer basket. Mesh is backstop if bag ruptures or is missing.



A perforated strainer basket (with or without wire mesh lining) inside a filter bag gives effective dual-stage straining-filtering.

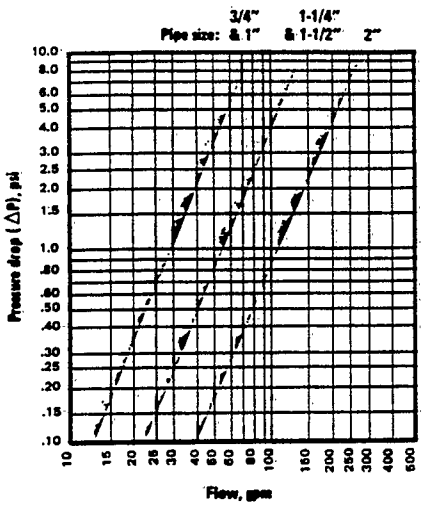
The following model descriptions and flow tables can be used to aid in selection, and make comparisons between the various styles.

Model 4—For flow rates to 50 gpm

- Pipe sizes 3/4 thru 3-inch, NPT or flanged
- Two basket depths: 6 or 12 inches (nominal)
- Three pressure ratings: 200 psi (with clamp cover) and 300 or 500 psi (with eyenut cover)
- ASME code stamp available

BASKET DATA

Depth Nominal (inches)	Diameter (inches)	Surface Area (sq. ft.)	Volume (cu. in.)
6	3.9	0.5	65
12	3.9	1.0	130

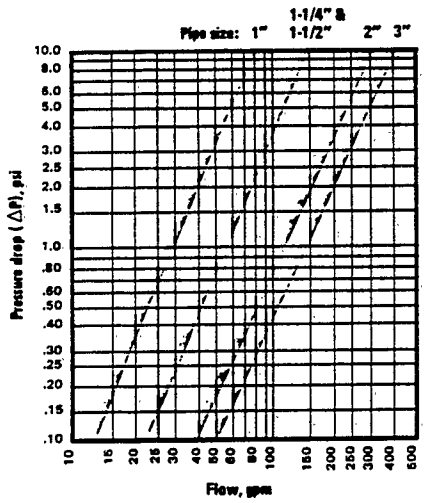


Model 6—For flow rates to 100 gpm

- Delivers 3.4 square feet of basket or bag surface area without need for ASME code construction
- Can be fitted with cartridge filter element adapter
- Pipe sizes 3/4 thru 4-inch, NPT or flanged
- Three basket depths: 12, 18 or 30 inches (nominal)
- Two pressure ratings: 150 psi or 300 psi
- ASME code stamp available

BASKET DATA

Depth Nominal (inches)	Diameter (inches)	Surface Area (sq. ft.)	Volume (cu. in.)
12	5	1.3	235
18	5	2.0	350
30	5	3.4	630

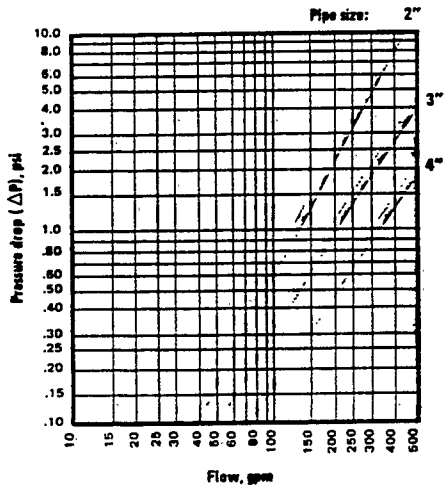


Model 8—For flow rates to 220 gpm

- Can be fitted with an adapter to hold cartridge filter elements
- Pipe sizes 3/4 thru 4-inch, NPT or flanged
- Two basket depths: 15 or 30 inches (nominal)
- Two pressure ratings: 150 or 300 psi
- ASME code stamp available.

BASKET DATA

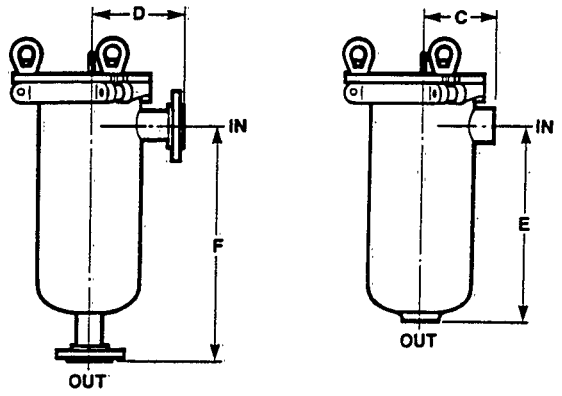
Depth Nominal (inches)	Diameter (inches)	Surface Area (sq. ft.)	Volume (cu. in.)
15	6.7	2.3	500
30	6.7	4.4	1000



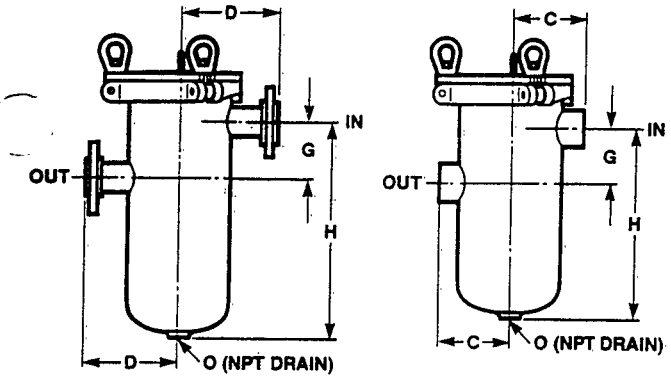
OUTLET STYLES

FLANGED (150 lb. ANSI) THREADED (NPT)

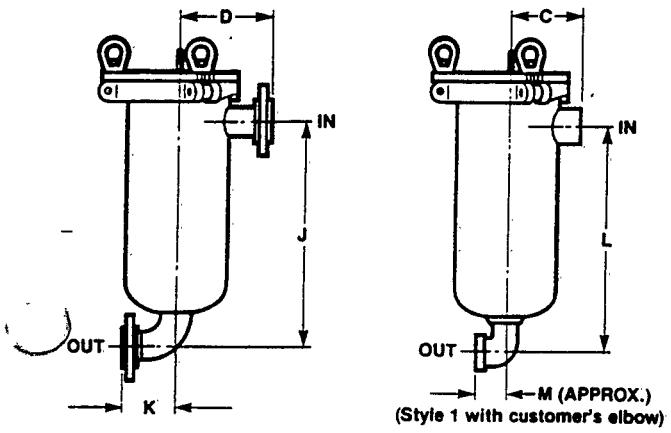
STYLE 1



STYLE 2



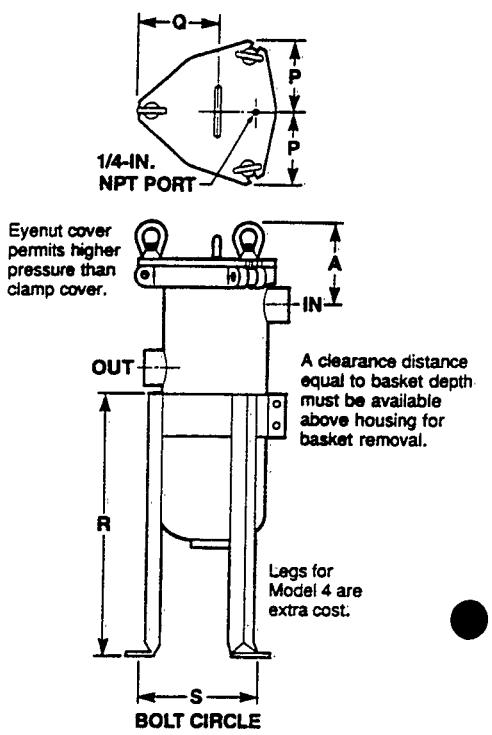
STYLE 3



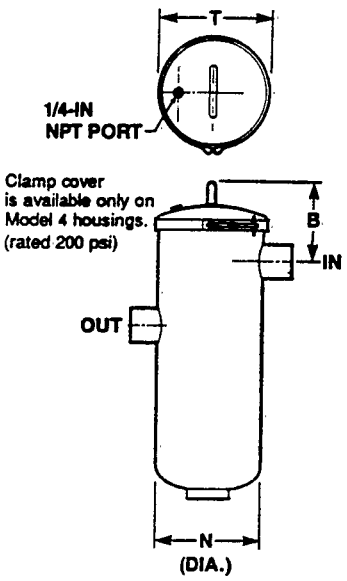
(Style 1 with customer's elbow)

COVER TYPES

EYENUT COVER



CLAMP COVER



DIMENSIONS (IN.)

Model	Pipe Size	A	B	C	D	E	F	G	H	J	K	L	M	N	O	P	Q	R	S	T
4-6	3/4	5.5	5.2	3.5	5.0	10.1	12.0	3.0	10.1	10.4	4.0	11.2	1.3	4.5	1/2	3.5	3.6	14.0	6.8	5.6
	1	5.5	5.2	3.5	5.0	10.1	12.0	3.0	10.1	10.9	4.0	11.5	1.5							
	1-1/4	6.0	5.8	3.5	5.0	9.4	12.0	4.3	9.5	10.5	4.0	11.1	1.8							
	1-1/2	6.0	5.8	3.5	5.0	9.3	12.0	4.3	9.5	10.8	4.0	11.3	2.0							
	2	6.0	5.8	3.5	5.0	9.3	12.0	4.3	9.5	11.6	4.0	11.8	2.3							
4-12	3/4	5.5	5.2	3.5	5.0	16.1	18.0	3.0	16.1	16.4	4.0	17.2	1.3	4.5	1/2	3.5	3.6	14.0	6.8	5.6
	1	5.5	5.2	3.5	5.0	16.1	18.0	3.0	16.1	16.9	4.0	17.5	1.5							
	1-1/4	6.0	5.8	3.5	5.0	15.4	18.0	4.3	15.5	16.5	4.0	17.1	1.8							
	1-1/2	6.0	5.8	3.5	5.0	15.3	18.0	4.3	15.5	16.8	4.0	17.3	2.0							
	2	6.0	5.8	3.5	5.0	15.3	18.0	4.3	15.5	17.6	4.0	17.8	2.3							
6-12	1	6.1		4.3	6.0	17.3	19.8	4.3	17.3	18.1	5.0	18.6	1.5	6.0	3/4	5.0	5.3	18.0	9.5	
	1-1/4	6.1		4.3	6.0	17.3	19.8	4.8	17.3	18.4	5.0	19.0	1.8							
	1-1/2	6.1	N/A	4.3	6.0	17.3	19.8	4.8	17.3	18.8	5.0	19.3	2.0							N/A
	2	6.1		4.3	6.0	17.2	19.7	4.8	17.3	19.6	5.0	19.7	2.3							
	3	7.0		4.3	6.0	18.2	20.7	6.6	18.2	22.0	4.8	21.9	3.1							
6-18	1	6.1		4.3	6.0	23.3	25.8	4.3	23.3	24.1	5.0	24.6	1.5	6.0	3/4	5.0	5.3	18.0	9.5	
	1-1/4	6.1		4.3	6.0	23.3	25.8	4.8	23.3	24.4	5.0	25.0	1.8							
	1-1/2	6.1	N/A	4.3	6.0	23.3	25.8	4.8	23.3	24.8	5.0	25.3	2.0							N/A
	2	6.1		4.3	6.0	23.2	25.7	4.8	23.3	25.6	5.0	25.7	2.3							
	3	7.0		4.3	6.0	24.2	26.7	6.6	24.2	28.0	4.8	27.9	3.1							
6-30	1	5.5		4.3	6.0	35.3	37.8	4.3	35.3	36.1	5.0	36.6	1.5	6.0	3/4	5.0	5.3	18.0	9.5	
	1-1/4	6.0		4.3	6.0	35.3	37.8	4.8	35.3	36.4	5.0	37.0	1.8							
	1-1/2	6.1	N/A	4.3	6.0	35.3	37.8	4.8	35.3	36.8	5.0	37.3	2.0							N/A
	2	6.1		4.3	6.0	35.2	37.7	4.8	35.3	37.6	5.0	37.7	2.3							
	3	7.0		4.3	6.0	36.2	38.7	6.6	36.2	40.0	4.8	39.9	3.1							
8-15	2	6.6		5.9	7.5	20.9	23.5	4.8	21.0	23.2	3.3	23.1	2.3	8.6	1	5.8	6.3	22.0	12.0	
	3	7.4	N/A	6.8	7.5	21.7	24.6	6.6	21.9	25.5	4.8	25.9	3.1							N/A
	4	7.4		6.8	8.6	21.5	25.1	8.4	21.9	26.8	6.3	27.6	3.8							
8-30	2	6.6		5.9	7.5	35.9	38.5	4.8	36.0	38.2	3.3	38.1	2.3	8.6	1	5.8	6.3	22.0	12.0	
	3	7.4	N/A	6.8	7.5	36.7	39.6	6.6	36.9	40.5	4.8	40.9	3.1							N/A
	4	7.4		6.8	8.6	36.5	40.1	8.4	36.9	41.8	6.3	42.6	3.8							

HOW TO ORDER

Build an ordering code as shown in the example. Each option is available only on the model sizes indicated in the colored blocks preceding its description.

Key to blocks: 4 = Model 4; 6 = Model 6; 8 = Model 8

Linemaster : 6 30 3P 2 1SD NC N BN B

																OPTIONAL INNER BASKET
					HOUSING							BASKET				
EXAMPLE:	8	15	3P	1	150	N	C	D	8	S	–	M	200	–	2M	50

MODEL NO.
4 = 4
6 = 6
8 = 8

HOUSING SIZE
4 6 in. = 6
4 6 12 in. = 12
8 15 in. = 15
6 18 in. = 18
6 8 30 in. = 30

PIPE SIZE, NPT & FLANGED[1]
4 6 8 3/4-in. female NPT = 3/4P
4 6 8 1 in. female NPT = 1P
4 6 8 1-1/4-in. female NPT = 1-1/4P
4 6 8 1-1/2-in. female NPT = 1-1/2P
4 6 8 2-in. female NPT = 2P
6 8 3-in. female NPT = 3P
4 6 8 3/4-in. 150-lb. ANSI flange = 3/4F
4 6 8 1-in. 150-lb ANSI flange = 1F
4 6 8 1-1/4-in. 150-lb ANSI flange = 1-1/4F
4 6 8 1-1/2-in. 150-lb ANSI flange = 1-1/2F
4 6 8 2-in. 150-lb ANSI flange = 2F
6 8 3-in. 150-lb ANSI flange = 3F
6 8 4-in. 150-lb ANSI flange = 4F
8 6-in. 150-lb ANSI flange = 6F

OUTLET STYLE
4 6 8 Bottom = 1
4 6 8 Side = 2
4 6 8 Bottom elbow = 3

PRESSURE RATING[2]
4 6 8 300 psi = 300
4 6 8 500 psi = 500
4 200 psi (clamp cover) = 200
6 8 150 psi = 150
6 8 210 psi = 210

ASME CODE STAMP
None = N
4 6 8 Code = UM

HOUSING MATERIAL
4 6 8 Carbon steel = C
4 6 8 304 stainless steel = S
4 6 8 316 stainless steel = 316

FOR MODEL 8 ONLY

OPTIONAL INNER BASKET, MEDIA SIZE
No symbol if type 2B basket was selected
8 Perforation diameters (for type 2P baskets) 1/4, 3/16, 9/64, 3/32, 1/16
8 Mesh sizes (for type 2M and 2BM baskets) 20, 30, 40, 50, 60, 70, 80, 100, 150, 200

OPTIONAL INNER BASKET TYPE
8 2B = Filter bag basket, 9/64 perforations[3]
8 2P = Strainer basket, perforated metal
8 2BM = Filter bag basket, perforated, mesh lined[3]
8 2M = Strainer basket, perforated, mesh lined

BASKET, MEDIA SIZE
No symbol if type B basket was selected
4 6 8 Perforation diameters (for type P baskets) 1/4, 3/16, 9/64, 3/32, 1/16
4 6 8 Mesh sizes (for type M and BM baskets) 20, 30, 40, 50, 60, 70, 80, 100, 150, 200

BASKET TYPE
4 6 8 B = Filter bag basket, 9/64 perforations[3]
4 6 8 P = Strainer basket, perforated metal
4 6 8 BM = Filter bag basket, perforated, mesh lined[3]
4 6 8 M = Strainer basket, perforated, mesh lined
4 6 8 HWM = Filter bag basket, heavy wire mesh[3]

BASKET SEAL
N = No seal (never on Models 4 & 6 bag-type baskets)
4 6 8 S = Seal required (always on Model 8 bag-type baskets)

COVER GASKET
4 6 8 B = Buna N
4 6 8 E = Ethylene Propylene
4 6 8 V = Viton Fluoroelastomer
4 6 8 T = Teflon Fluorocarbon Resin

DISPLACER
N = No displacer
4 6 8 D = Displacer

1. ANSI 150-lb R.F. flanges provided as standard. Other styles and classes available. ANSI B16.5 Pressure-Temperature rating tables determine flange class for ASME code housings. Consult factory.

2. Higher pressure ratings available. Consult factory.
3. Filter bags are specified separately. See Rosedale Filter Bag Catalog FB.

ROSEDALE PRODUCTS, INC.
Box 1085, Ann Arbor, MI 48106
Tel: 313-665-8201 Fax: 313-665-2214

Catalog 468-3 124M590 Litho in USA

HIGH-CAPACITY FILTER BAGS FOR ALL ROSEDALE BAG FILTERS

CONSTRUCTION

Felt Bags

Felt construction is generally chosen where smaller particle retention is required, in the 1 to 100 micron range. It offers higher solids loading capacity than mesh. **General-purpose** felt bags are offered in polyester and polypropylene materials. **Special-purpose** felt bags include **high temperature service** (to 500°F) bags of Nomex nylon or Teflon. For **removal of oil,** bags made of special felted polypropylene microfibers, known as Oil-Adsorb, are available. A size 2 Oil-Adsorb bag will remove approximately a half-pound of oil from a water-oil liquid. It is only available with a 25 micron rating.

If finer filtration is needed in an oil removal task, Rosedale Model 8 filters can be fitted with two bags in series. The inner one an Oil-Adsorb bag and the outer one a finer standard bag. Installed this way, true two-stage filtration is achieved. (Two-stage filtering can be done for longer intervals between servicing.)

Mesh Bags

Mesh is a woven construction, generally used where micron ratings of 5 to 800 (660 to 20 mesh) are required.

Two types are offered. The **multifilament mesh** is a low cost, disposable material, offered in polyester or nylon. **Monofilament mesh** has higher strength, and is available in polypropylene or nylon. (It should be considered cleanable.)

FELT BAG FINISHES & COVERS

Standard finish. Plain, as manufactured, without treatment or covers.

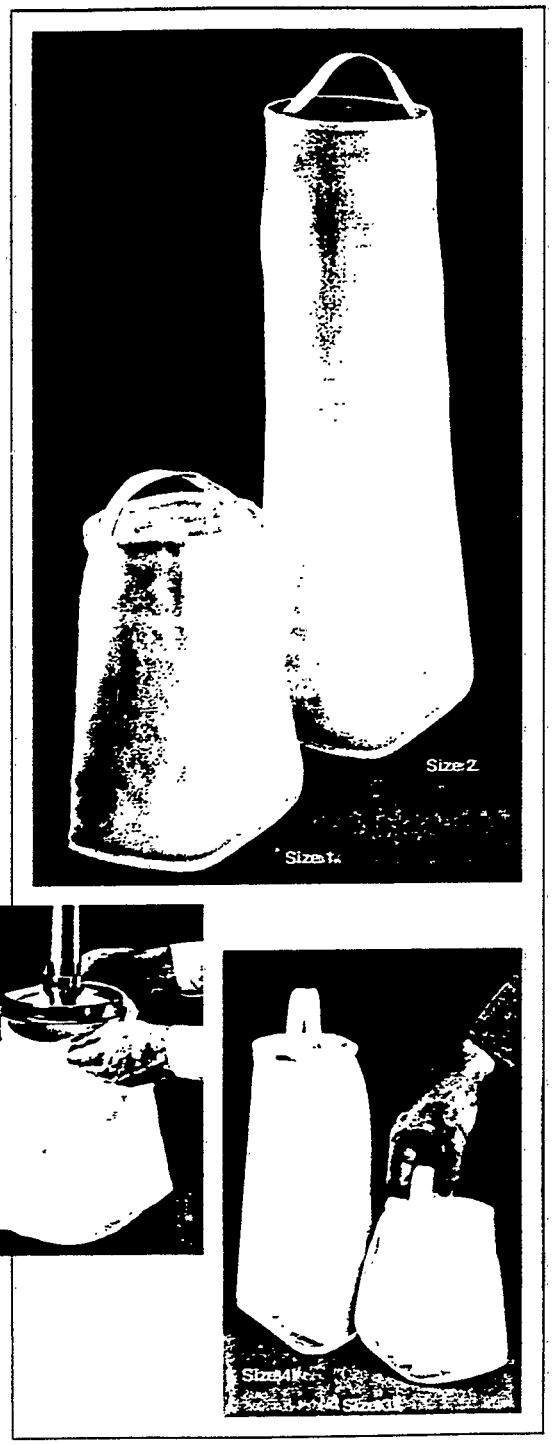
Glazed finish. The outermost surface fibers are melted by the momentary application of high heat. This bonds them to one another and effectively reduces the possibility of their breaking off. (Not available on high-temperature bags.)

Mesh covers. Covers are available that completely encase the bag. Made of woven polyester mesh, nylon mesh, spun-bonded nylon (Cerex), or spun-bonded polyester (Remay), they act to contain any fibers that may separate from the filter bag.

DESIGN DETAILS

All Rosedale filter bags have a metal retaining ring at their openings. Standard ring material is cadmium-plated carbon steel, with 316 stainless steel optional.

Heavy-duty handles, sewn to the reinforced bag lip, are a standard feature. They make bag removal faster and easier.



COMPARATIVE PARTICLE SIZE

U.S. MESH	INCHES	MICRONS
3	.265	6730
3½	.223	5660
4	.187	4760
5	.157	4000
6	.132	3360
7	.111	2830
8	.0937	2380
10	.0787	2000
12	.0661	1680
14	.0555	1410
16	.0469	1190
18	.0394	1000
20	.0331	841
25	.0280	707
30	.0232	595
35	.0197	500
40	.0165	420
45	.0138	354
50	.0117	297
60	.0098	250
70	.0083	210
80	.0070	177
100	.0059	149
120	.0049	125
140	.0041	105
170	.0035	88
200	.0029	74
230	.0024	63
270	.0021	53
325	.0017	44
400	.0015	37

STANDARD FIBERS AND MICRON RATINGS

CONSTRUCTION	FIBER	AVAILABLE MICRON RATINGS: 1	3	5	10	15	25	50	75	100	125	150	175	200	250	300	400	600	800
	Polyester	•	•	•	•	•	•	•	•	•				•					
	Oil-Adsorb (pp)						•												
Felts	Polypropylene	•	•	•	•		•	•		•									
	Nomex (Nylon)			•	•		•	•		•									
	Teflon				•														
Multifilament meshes	Polyester								•	•	•	•		•	•	•	•		•
	Nylon									•		•							•
Monofilament meshes	Polypropylene															•		•	
	Nylon			•	•		•	•	•	•	•	•	•	•	•	•	•	•	•

COMPATIBILITY AND TEMPERATURE LIMITS FOR STANDARD BAG MATERIALS *

FIBER	COMPATIBILITY WITH: ORGANIC SOLVENTS	ANIMAL VEGETABLE & PETRO OILS	MICRO-ORGANISMS	ALKALIES	ORGANIC ACIDS	OXIDIZING AGENTS	MINERAL ACIDS	TEMPERATURE LIMITATIONS (max. deg F)
Polyester	Excellent	Excellent	Excellent	Good	Good	Good	Good	325
Polypropylene	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Good	225
Nylon	Excellent	Excellent	Excellent	Good	Fair	Poor	Poor	325
Nomex Nylon	Excellent	Excellent	Excellent	Good	Fair	Poor	Poor	475
Teflon	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	500

* Chart is to be used as a guide. User should make tests with specific media to assure compatibility.

FILTER BAG SIZES

USED ON ROSEDALE MODEL NO.	BAG SIZE	LENGTH (inches)	DIAMETER (inches)	SURFACE AREA (sq. ft.)	BAG VOLUME (gallons)
4-6	3	8	4.12	0.5	0.5
4-12	4	14	4.12	1.0	1.0
6-12	7	15	5.10	1.3	1.3
6-18	8	21	5.10	2.0	1.5
6-30	9	32	5.10	3.4	2.8
8-15	1	16.5	7.06	2.0	2.1
	1 (inner)	14.5	5.75	1.6	1.7
8-30	2	32	7.06	4.4	4.6
and 16 thru 36	2 (inner)	30	5.75	3.6	3.8

PRESSURE DROP DATA

The graph shows pressure drop through clean filter bag media of various micron ratings. **The curves do not consider pressure drop through the filter housing.**

BAG SIZE CORRECTION

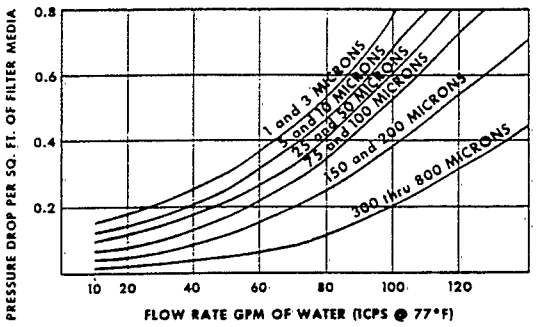
To obtain pressure drop correction for a specific bag size, divide the pressure drop obtained from the graph by the square foot area of the bag.

VISCOSITY CORRECTION

If viscosity is higher than one, multiply the corrected pressure drop as obtained above by the appropriate viscosity correction factor.

SELECTING A ROSEDALE FILTER BAG

1. Determine which type of filter bag material and which fiber best suits your needs.
2. Determine the micron rating you require.
3. Refer to the "How to order" chart below, and build an ordering code.



Bag Size	Surface Area (sq. ft.)
1	2.0
1 (inner)	1.6
2	4.4
2 (inner)	3.6
3	0.5
4	1.0
7	1.8
8	2.0
9	3.4

Viscosity (cps)	Correction Factor
50	4.5
100	8.3
200	16.6
400	27.7
800	50.0
1000	56.2
1500	77.2
2000	113.6
4000	161.0
6000	250.0
8000	325.0
10000	430.0

HOW TO ORDER FILTER BAGS

Build an ordering code as shown in this example:

Linemaster: PE 1 P 9 S

Example: PE 25 P 7 S-SS

FIBER AND MICRON RATINGS

Felt, polyester = PE
Microns: (1) 3, 5, 10, 15, 25, 50, 75, 100, 200

Felt, polypropylene = PO
Microns: 1, 3, 5, 10, 25, 50, 100

Felt, Oil-Adsorb, 25-micron = OA 25

Felt, Nomex nylon = HT
Microns: 5, 10, 25, 50, 100

Felt, Teflon, 10-micron = TE 10

Mesh, monofilament nylon = NMO
Microns: 5, 10, 25, 50, 75, 100, 125, 150, 175, 200, 250, 300, 400, 600 800

Mesh, monofilament polypropylene = PMO
Microns: 300, 600

Mesh, multifilament polyester = PEM
Microns: 75, 100, 125, 150, 200, 250, 300, 400, 800

Mesh, multifilament nylon (light) = NM
Microns: 100, 150

Mesh, multifilament nylon (heavy) = HNM
Microns: 800

Inner Bags for Model 8 or Multibag Filters

To order inner bags, use a second, separate ordering code. It should be built using the system shown above, but prefixed by the symbol "IN". Example: IN — PE 25 P 2 S-SS

ADDITIONAL OPTIONS

SS = Stainless steel ring

BAG STYLE

(S) Carbon steel plated ring

BAG DIMENSIONS

Symbol	Diam. (in.)	Length (in.)	Housing Model
1 =	7-1/16	x 16-1/2	8-15
2 =	7-1/16	x 32	8-30
3 =	4-1/8	x 8	4-6
4 =	4-1/8	x 14	4-12
7 =	5-1/8	x 15	6-12
8 =	5-1/8	x 21	6-18
(9) =	5-1/8	x 32	6-30

BAG FINISH OR COVER

(P) = None
G = Fiber-free glazed finish
PEM = Polyester multifilament mesh cover
NM = Nylon multifilament mesh cover
C = Spun-bonded nylon (Cerex) cover
R = Spun-bonded polyester (Remay) cover

ROSEDALE PRODUCTS, INC.
Box 1085, Ann Arbor, MI 48106
(313) 665-8201

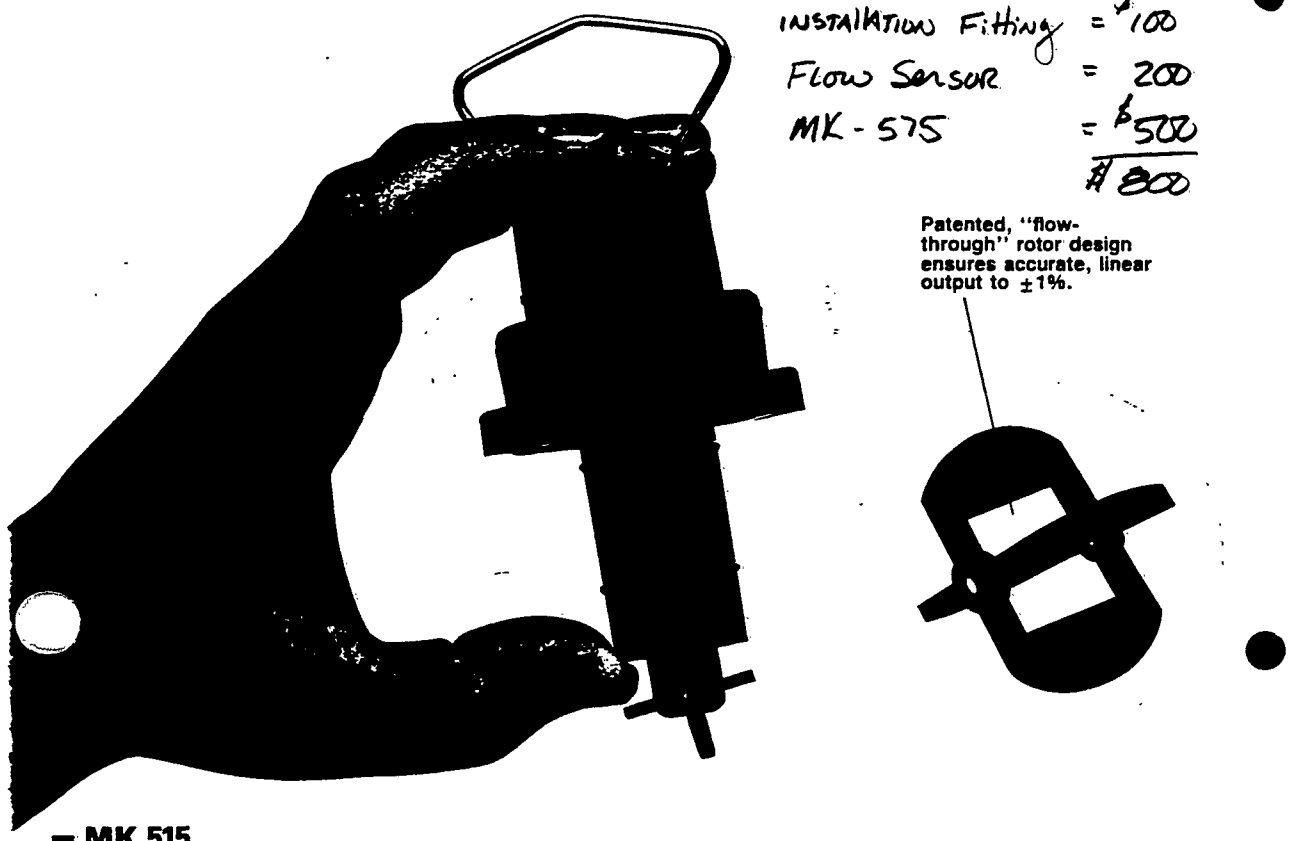
Catalog 6002-FB-2 Litho in USA

FLOW SENSOR/TOTALIZER

per Burt Process Equipment
508-649-9660

The Flow Sensor That Makes Short Work Of Your Flow Measurement

INSTALLATION Fitting = $100
Flow Sensor = 200
MK-575 = $500
$800



Patented, "flow-through" rotor design ensures accurate, linear output to ±1%.

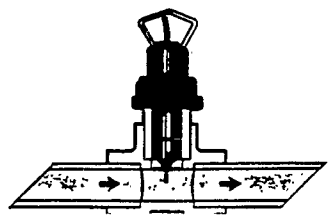
MK 515
ROTOR-X™ FLOW SENSOR

Streamline your flow measurement operation with the MK 515 ROTOR-X™ Flow Sensor. By using this compact flow sensor, a matched sensor installation fitting, a Signet flow meter or controller, and ordinary hand tools, you'll have a complete flow monitoring or controlling system—*in minutes.* Accurate to ±1% of full scale, with repeatability at ±0.5% of full scale, this insertion sensor operates on a simple electromechanical principle. And, it's proven in thousands of liquid flow applications worldwide. It all adds up to precision, dependability, and convenience—basic advantages that are quickly outdating its in-line counterparts.

A TIMESAVER YOU CAN BANK ON
Convert your maintenance hours into minutes, with the ROTOR-X™. Should a sensor, rotor, or O-ring need to be replaced, it takes only seconds. Reduce your system downtime substantially with a stand-alone MK 515 sensor. Or, simply *add an MK 319 Wet Tap Assembly and completely eliminate downtime.* Combined with the ROTOR-X™ during initial installation, the MK 319 Wet Tap allows sensor removal without system shut-down.

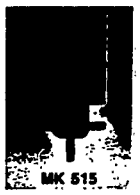
Optional local or remote capability lets you place your meter up to 200 feet away without signal amplification. And, you can install the MK 515 in **pipe sizes ranging from ½ inch to 36 inches** without a lot of additional cost, because the ROTOR-X price increases only slightly for larger pipe sizes.

RUGGED CONSTRUCTION FOR LONG WEAR
Available in a choice of chemically resistant, non-contaminating housing materials, the ROTOR-X **stands up to the harshest environments.** The glass-filled polypropylene housing version is lightweight—but strong. A feature which makes it ideal for handling a wide range of liquids, including corrosive fluids in chemical processing. For processes containing acids and solvents, the PVDF (polyvinylidene fluoride) housing version is a tough fluorocarbon that is highly resistant to more severe fluids, such as acids and solvents. (See PVDF section for more information on Signet's all PVDF flow monitoring systems.)



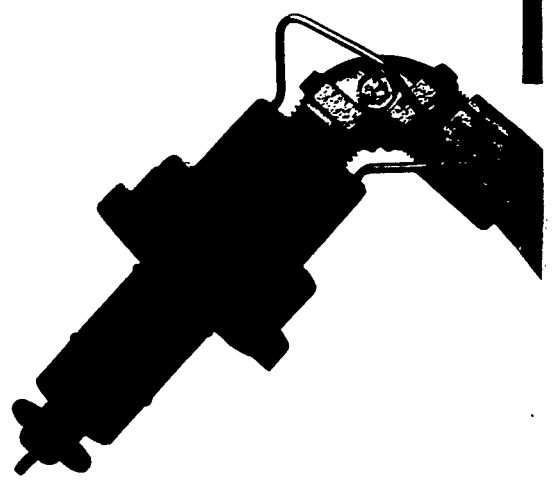
FLOW MEASUREMENT SIMPLE AND ACCURATE

The ROTOR-X works on a simple, but precise, electro-mechanical principle based on measuring the rate and volume of flow in your pipe. Four permanent magnets, imbedded in the rotor blades, spin past a coil in the sensor body. As the fluid flow causes the rotor to rotate, a sine wave signal is produced, directly proportional to the flow rate. The **patented "open cell" feature of the rotor ensures a linear, repeatable output** up to 30 fps—with accuracy of ±1% of full scale. The result—minimal head loss and no cavitation. Additionally, you can combine the ROTOR-X Flow Sensor with an intrinsic safety barrier (contact the factory for a list of suggested barriers) for use in hazardous environments.


MK 515

QUICK, EASY CONDUIT INSTALLATION

Designed to allow optional conduit installation, the MK 515 lets you easily comply with local codes requiring conduit protection. For instance, pry off the plug on top of the sensor. Underneath it you'll find a ½ inch (F) NPT thread. Now, using an optional conduit adapter fitting kit, connect your conduit. And, either an optional instrument back-cover kit, or a specially prepared NEMA box, will provide everything you need for quick conduit connection to a meter or controller. Additionally, you can **adapt to both rigid and flexible liquid-tight conduit**, protecting your system hookup from harsh elements and mechanical damage.



SPECIFICATIONS:

Output Signal:	1V p-p/fps nominal
Output Frequency:	5-6 Hz/fps nominal
Flow Rate Range:	1 to 30 fps
Linearity:	±1% of full range
Output Accuracy:	±1% of full range
Repeatability:	±0.5% of full range
Maximum % Solids:	1% of fluid volume
Standard Cable Length:	25 feet

HOW TO ORDER

ROTOR-X™ FLOW SENSORS

Part No.	Housing Material	Shaft Material	Pipe Size (in.)	Sensor O.D. (in.)	Sensor Length (in.)
P51530-P0	Polypro	Titanium	½–4	1.05	3.50
P51530-P1	Polypro	Titanium	5–8	1.05	5.00
P51530-P2	Polypro	Titanium	10–UP	1.05	7.75
P51530-V0	PVDF	Hastelloy C	½–4	1.05	3.50
P51530-V1	PVDF	Hastelloy C	5–8	1.05	5.00
P51530-V2	PVDF	Hastelloy C	10–UP	1.05	7.75

ROTOR-X with WET-TAP ASSEMBLY

For more options to the MK 319/P51530, see page 40.

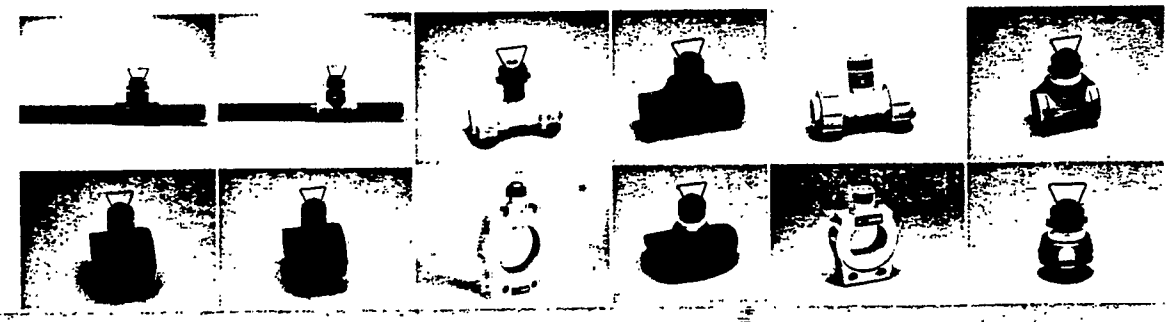
Wet-Tap (Pipe Installation Fitting not included.)

Part No.	Valve Assembly Material	Sensor Housing Material	Shaft Material	Pipe Size (in.)	Sensor O.D. (in.)	Sensor Length (in.)
MK 319/ 515-P3	PVC	Polypro	Titanium	½–4	1.05	11.75
MK 319/ 515-P4	PVC	Polypro	Titanium	5–8	1.05	13.00
MK 319/ 515-P5	PVC	Polypro	Titanium	10–UP	1.05	16.00

Sensor Installation Fittings

MK 515/565/8500

PIPE MATL	PVC 40 & 80	CPVC 80	PVDF	FIBERGLASS		POLYPROPYLENE	STAINLESS 316
PIPE SIZE	P/N	P/N	P/N	P/N	PRICE	P/N	P/N
1/2"	PV8T005	CPV8T005	SFMT005	N/A		PPMT005	CR4T005
3/4"	PV8T007	CPV8T007	SFMT007	N/A		PPMT007	CR4T007
1"	PV8T010	CPV8T010	SFMT010	N/A		PPMT010	CR4T010
1 1/4"	PV8T012	CPV8T012	SFMT012	N/A		PPMT012	CR4T012
1 1/2"	PV8T015	CPV8T015	SFMT015	FPT015	$210	PPMT015	CR4T015
2"	PV8T020 PV8S020	CPV8T020	SFMT020	FPT020	$210	PPMT020	CR4T020
2 1/2"	PV8T025 PV8S025	CPV8T025	SFMT025*	N/A		PPMT025*	CR4W025
3"	PV8T030 PV8S030	CPV8T030	SFMT030*	FPS030	$240	PPMT030*	CR4W030
4"	PV8T040 PV8S040	CPV8T040	SFMT040*	FPS040	$295	PPMT040*	CR4W040
5"	Use IR85050	N/A	SFMT050*	N/A		PPMT050*	CR4W050
6"	PV8S060	Use PV8S060 or IR8S060	SFMT060*	FPS060	$410	PPMT060*	CR4W060
8"	PV8S080	Use PV8S080 or IR8S080	SFMT080*	FPS080	$440	PPMT080*	CR4W080
10"	Use IR8S100	Use IR8S100	N/A	FPS100	$610		CR4W100
12"	Use IR8S120	Use IR8S120	N/A	FPS120	$775		CR4W120



Part Number:

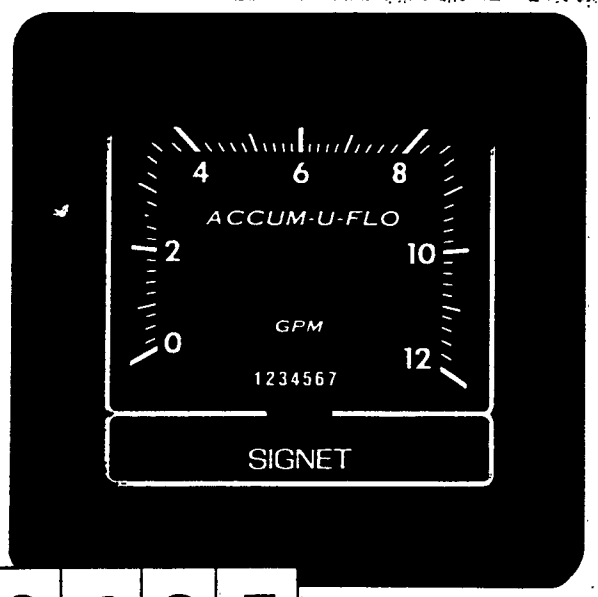
PV8T020

- Pipe/Tubing Size
- Type
- Schedule
- Material or Type

Fitting Styles:

T = "TEE"	PVC, CPVC and fiberglass have slip ends, PVDF (metric) has socket ends; copper (for copper and brass tubing) has "sweat-on" ends; iron, brass, carbon steel, and stainless steel have threaded ends.
S = Saddle	"Cement-on" for PVC & CPVC; "double strap-on" for iron; "cement-on" for fiberglass. Please specify wall thickness and O.D. for fiberglass; and pipe schedule for PVC or iron.
W = Weldolet	Weld to existing pipe; please specify pipe schedule.
B = Brazolet	Braze to existing pipe; please specify pipe schedule.

Accurate, Low-Maintenance Flow Volume Indicators



MK 575/MK 575R ACCUM-U-FLO

Just a quick glance at Signet's MK 575 Accum-u-flo gives you **accurate fluid flow rate and totalized flow volume readings.** By having both these essential flow functions combined on one convenient unit, you'll save space and eliminate additional expense. Flow rate is displayed on an easy-to-read 5½ inch analog dial. While totalized volume is presented on a low-maintenance, electro-mechanical counter. Choose from a 7-digit non-resettable counter (MK 575) for continuous totalizing or a 5-digit front resettable counter (MK 575R) for periodic totalizing. The MK 575's 245 degree, high-torque meter gives you *greater resolution in high-vibration areas.* With a resulting flow rate accuracy of ±1% of full scale—and totalized volume accuracy of ±2% of calibrated flow rate. And, you can easily interface the Accum-u-flo with other TTL compatible equipment. Includes a 117 VAC to 12 VDC power converter.

SPECIFICATIONS:

Display Accuracy (MK 575):	±1% of full scale
Display Repeatability (MK 575):	±0.5% of full scale
Volume Display Accuracy:	±2% of full scale
Pulse Output:	
TTL Compatible:	Source, 6.5 mA at 4.6 V Sink, 25 mA at 0.4 V
Counter:	
TTL Compatible:	Source, 5 mA Sink, 5 mA
Power Requirements:	Nominal 8 to 18 VDC, at 315 mA. Not damaged by voltage spikes as high as 25 VDC. (Power converter included) Includes reverse voltage protection.
Dimensions:	5½ inch square bezel (requires 5.1 inch panel cutout) 4.75 inches deep

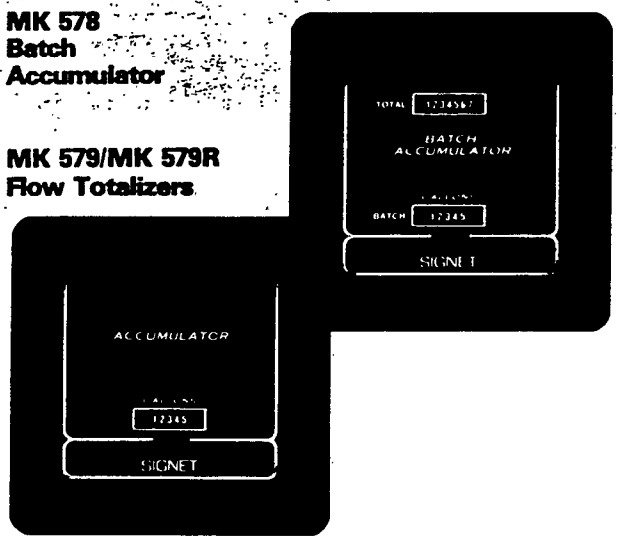
HOW TO ORDER

Part No.

P57540
P57540R Resetable
P57840
P57940
P57940R Resetable

MK 578 Batch Accumulator

MK 579/MK 579R Flow Totalizers



When monitoring **total fluid volume AND separate batch volume** is required, choose Signet's MK 578 Batch Accumulator. Its 5-digit resettable counter is perfect for periodic batch monitoring. In addition, its 7-digit non-resettable counter allows on-going measurement. For *single flow volume accumulation*, order Signet's low-cost MK 579. This totalizer gives you the option to choose either the 7-digit non-resettable counter or the 5-digit resettable (specify MK 579R). All instruments are TTL compatible for easy interfacing with external equipment. Each includes a 117 VAC to 12 VDC power converter.

EQUALIZATION TANK

Ambi INCORPORATED

December 5, 1991 Project Number #3211

** IMPORTANT QUOTATION **
Mr. David Day
Fuss and O'Neill Consulting Engineers
146 Hartford Road
Manchester, CT 06040

Reference: Linemaster Switch Company
Subject : FRP Tank
Telephone No.: 203 646-2469 FAX No.: 203 643-6313

Dear David:

Ambi, Incorporated takes great pleasure in submitting the following proposal to Fuss and O'Neill Consulting Engineers for fabricated plastic equipment:

PROPOSAL AND SPECIFICATIONS

---

1. One (1) 635 GALLON CYLINDRICAL TANK measuring 5'-0" dia. by 4'-4" deep with flat top, flat bottom, constructed from FRP (fiberglass reinforced plastic) and including:
   a. All hand lay-up construction using Hetron 197 premium grade polyester resin
   b. Interior surface with one (1) layer of "C" glass for maximum corrosion resistance
   c. Exterior surface pigmented "Ambi Blue" with surfacing agent and ultra violet inhibitor
   d. FRP threaded half couplings including:
      Eight (8) 1 1/2" dia.
      Two (2) 3" dia.
      One (1) 4" dia.
   e. Bolt-on cover to have 1/3 hinged opening

   Price: $2,030.00

2. Option: replace Eight (8) 1 1/2" and Two (2) 3" dia. FRP couplings with PVC bulk head fittings

   Price deduct: $300.00

SERVING INDUSTRY SINCE 1967
P.O. BOX Z, 1114 LONSDALE AVENUE, LINCOLN, R.I. 02865 • (401) 724-6330
• FAX: (401) 727-1170

Ambi INCORPORATED

Should we receive a purchase order, delivery to be arranged. Terms are 40% deposit, 40% at completion prior to shipment and 20% net 30 days. Prices quoted are f.o.b. plant Lincoln, RI. The CONDITIONS OF SALE on the back of the front page form an integral part of this quotation.

David, I will contact you shortly to discuss the status of this proposal and how we can further serve Fuss and O'Neill Consulting Engineers.

Very truly yours,

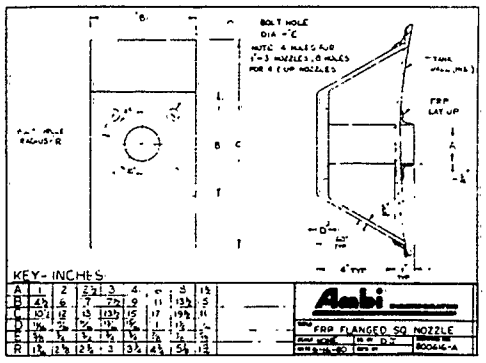
Edward B. Medeiros

Edward B. Medeiros, Sales Manager
Ambi, Incorporated

DAS:tw

This is our 24th year manufacturing corrosion resistant equipment! Thank you for considering Ambi, Incorporated.

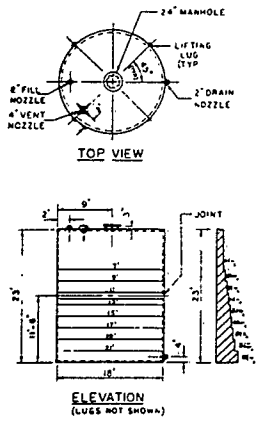
Ambi INCORPORATED



The unique Ambi square faced flange with wing gussetts.

We have determined from our long history that **the best tank armored against corrosion is hand lay/spray up.**

The process of **hand lay/spray-up affords the greatest reliability** over other methods such as filament wound. For hand lay-up, Ambi strictly adheres to quality standards including Voluntary Product Standards PS 15-69 for Custom Contact-Molded Reinforced-Polyester Chemical-Resistant Process Equipment and ASTM D 4097-82 Contact-Molded Glass-Fiber-Reinforced Thermoset Resin Chemical-Resistant Tanks. When you select Ambi for your tank supplier, you receive the highest quality hand lay/spray-up FRP tanks with inherent reliability and at modest cost.



Typical tank construction showing staggered wall

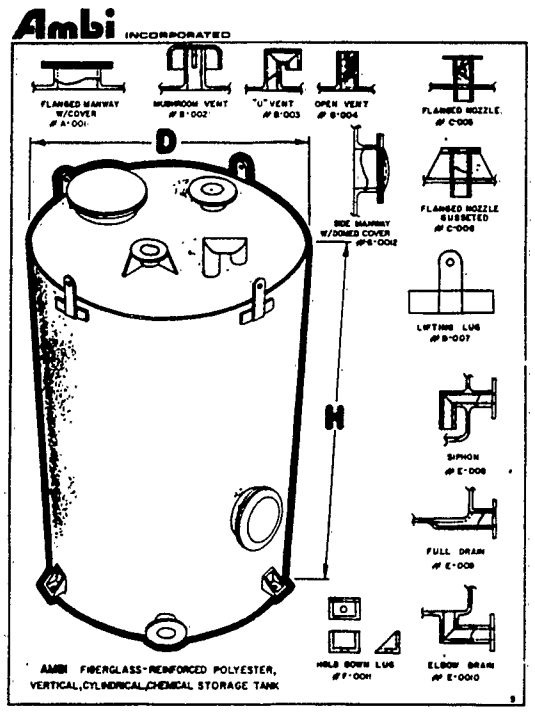
All flanged nozzles on Ambi tanks utilize the **unique Ambi square faced flanged nozzles** with wing gussetts, a great innovation over conventional flanged nozzles.

Single piece construction of the flange, nozzle and the wing gussetts insure extraordinary strength under severe mechanical loading.

You can forget leaks from flange/nozzle/tank joints due to mechanical failure with this unique Ambi flange.

In order to best select the proper resin for your application, we must have the following information:

1. All chemicals and concentrations to which the tank will be exposed 2. maximum and minimum pH values 3. Maximum and minimum temperature 4. Solution abrasiveness 5. Mixing requirements 6. Insulation requirements for thermal stability



Many accessories are available on an Ambi Tank

Consider the Ambi FRP chemical process tank for your next installation. Remember:

- **Engineered Quality and Reliability**
- **Experience and Modest Cost**
- **Configured to your Application Needs**
- **Wide Selection of Resins**
- **The Extra Ambi Touch... Of Course!**

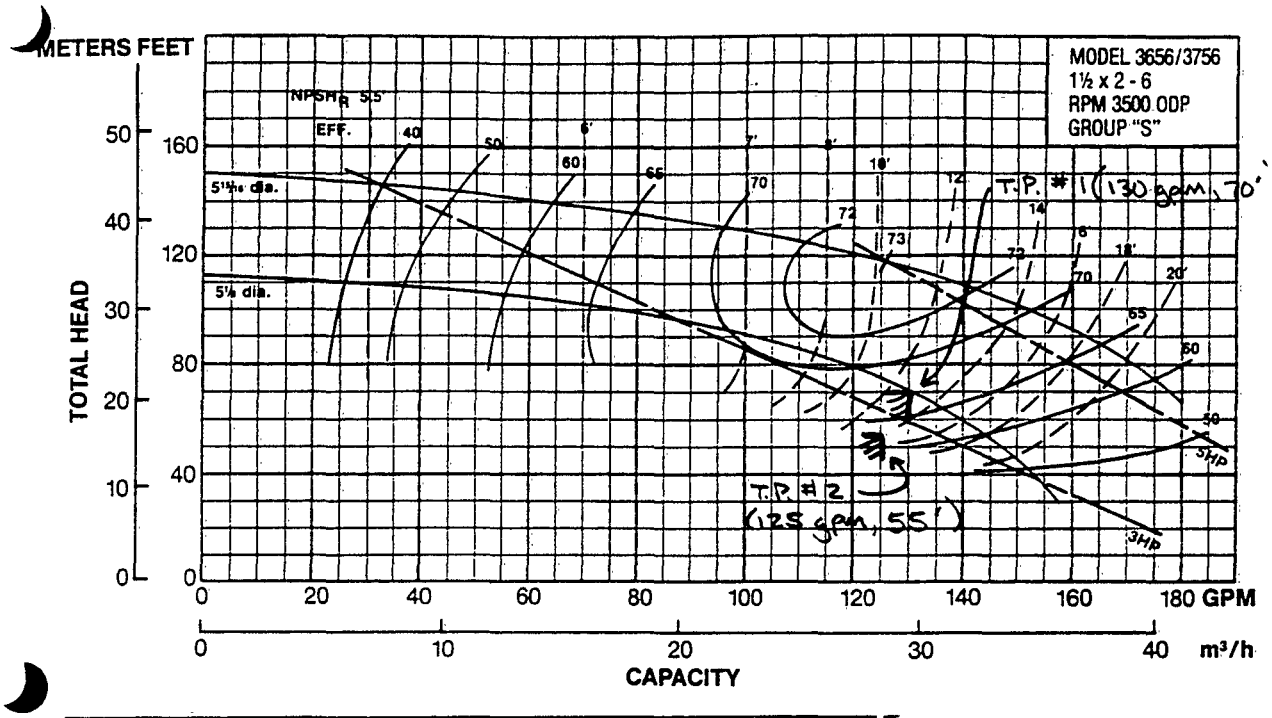
PUMPS

- TRANSFER PUMP #1
- TRANSFER PUMP #2
- DRY WELL SUMP PUMP

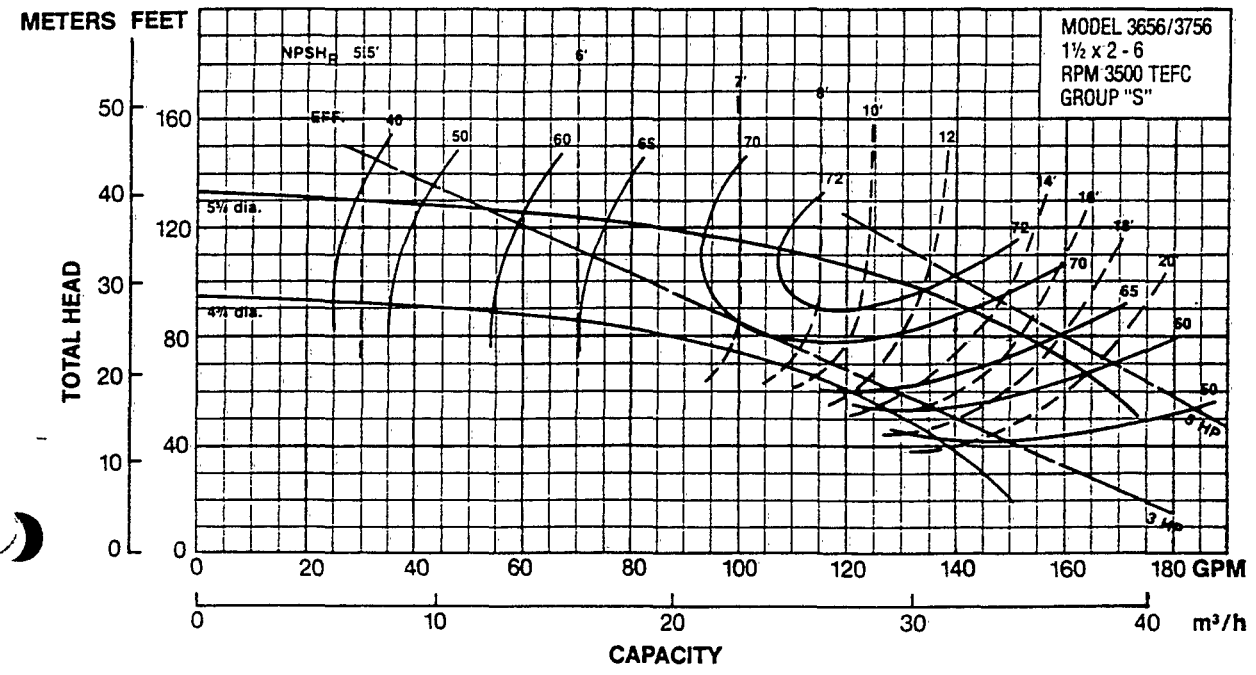
T.P. #1 : 5⅛" Impeller DiA
T.P. #2 : Special Impeller TRim @ 4¾"

Performance Curves

"S" Group Pumps



GOULDS PUMPS, INC.
SENECA FALLS, NEW YORK 13148



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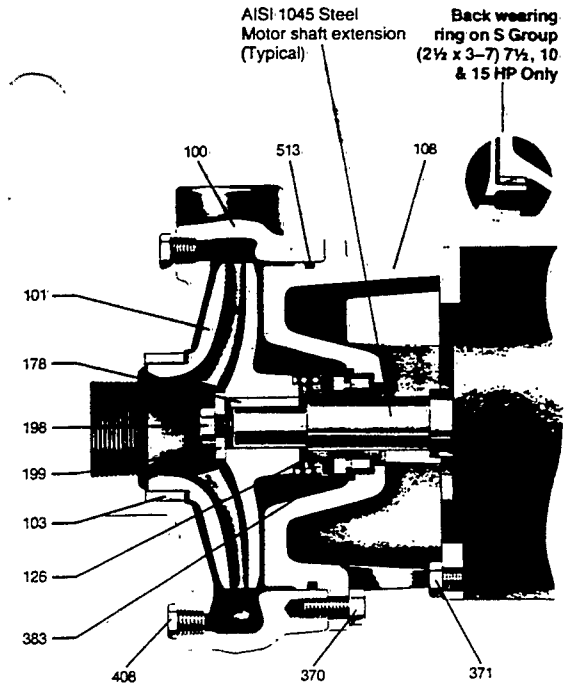


MATERIALS OF CONSTRUCTION

Item No.	Part Name	Material: All Iron	Bronze Fitted	All Bronze
100	Casing	1001	1001	1102
101	Impeller		1102	
103	Casing Wear Ring		1102	
108	Adapter		1001	1001
184	Seal Housing①	1-pc. w/adapter		1102
126	Shaft Sleeve	AISI TYPE 300 SERIES Stainless Steel		
178	Impeller Key			
198	Impeller Bolt			
199	Impeller Washer			
370	Hex HD Cap Screw Adapter to Case	SAE 1200 Series Steel Grade 5		
371	Hex HD Cap Screw Adapter to Motor			

383 Mechanical Seal	Part No.	Service	Rotary	Stationary	Elastomers	Metal Parts
STD.	10K13	General	Carbon	Ceramic	Buna	TYPE 316 S.S.
OPT.	10K19	Hi-Temp		Ni-Resist	EPR	
OPT.	10K25	Chem. Duty		Ceramic	Viton	

408	Pipe Plug ¼"	Steel	Brass
513	O-Ring	Buna-N	

Materials of Construction	Material Code	Engineering Standard
	1001	Cast Iron ASTM A48 CL20
	1102	Bronze ASTM B584

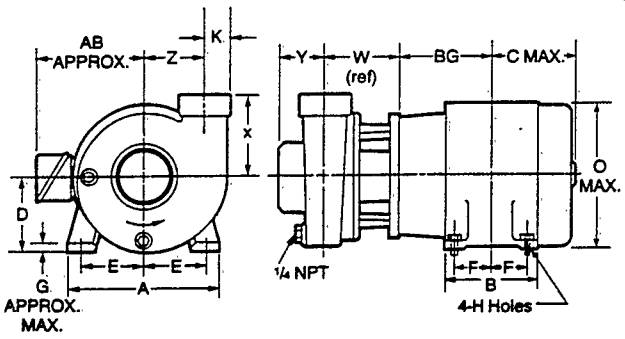
①For separate seal housing and adapter construction, All bronze material only, see repair parts page.

Pumps will be shipped with top-vertical discharge position as standard. For other orientations, remove casing bolts—rotate discharge to desired position—replace and tighten to 25 ft. lbs. Note that discharge may extend below motor mounting surface in bottom-horizontal position; adequate clearance must be provided.

PUMP DIMENSIONS AND WEIGHTS

Pump	NPT THRD. Suct.	Disch.	W	X	Y	Z	K	Wt. (lbs.)
1½ x 2-6	2	1½	4¼	4½	2⅝	3½	1¼	30
2½ x 3-7	3	2½		6		4	1 13/16	45
1½ x 2-8	2	1½		5		4¼	1¼	50
3 x 4-7	4	3	4⅜	6	2½	5	3¾	78

Note: 3 x 4-7 only has 125 lb. ANSI flat-faced flanged connections.



TRANSFER Pump # 1 AND T.P. # 2

MOTOR FRAMES/HORSEPOWER

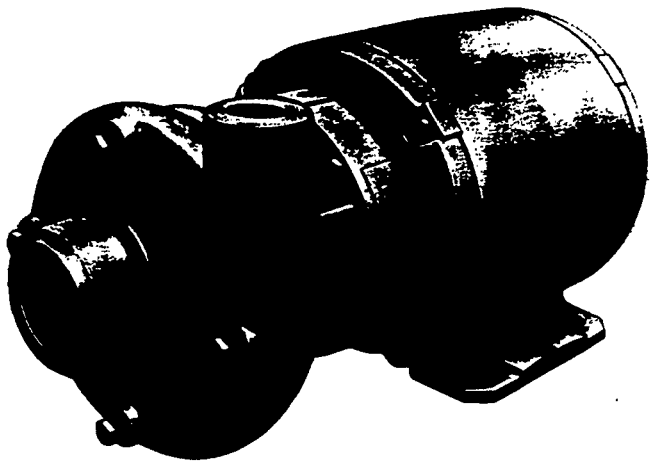
Motor Frame	MOTOR HORSEPOWER 3500 RPM 1ϕ ODP	1ϕ TEFC	3ϕ ODP	3ϕ TEFC	1750 RPM 1ϕ ODP	1ϕ TEFC	3ϕ ODP	3ϕ TEFC
143	—	—	—	—	—	1	—	1
145	3	—	3	—	1½	1½	2	2
182	3	—	5	3	2	2	3	3
184	5	3	7½	5	3	3	—	—
213	7½	5	10	7½	—	—	—	—
215	10	—	15	10/15	—	—	—	—
†254TCZ	—	—	20	—	—	—	—	—
†256TCZ	—	—	25	20	—	—	—	—

250 TCZ frames with 210 series JM shaft extension.

MOTOR DIMENSIONS AND WEIGHTS

Frame JM	A*	B*	BG	C* Max	D	E	F	G*	H	O* Max	AB*	Wt. Max. (lbs).
143	6½	6	4⅞	6	3½	2¾	2	¼	11/32	7¼	5⅞	44
145			5⅜	6⅛			2½					57
182	8⅞	6⅜	5⅞	6¼	4½	3¾	2¼	½	13/32	9¼	8⅛	75
184		7⅜	6⅜	7¼			2¾					92
213	10⅛	7⅝	7¼	8	5¼	4¼	2¾	5/8	17/32	11¼	9 1/16	144
215		9⅛	8	8¾			3½					170
254TCZ	12⅜	11½	9⅛	10	6¼	5	4⅛			13 5/32	10 11/16	253
256TCZ			10	11			5					305

*Dimensions may vary with manufacturers
(All dimensions in inches and weights in lbs. Do not use for construction purposes.)



Goulds

Close-Coupled Centrifugal Pumps

MODEL

3656

S-Group

FEATURES

CLOSE COUPLED DESIGN
Compact design saves space and simplifies maintenance.
BACK PULL-OUT
Reduces maintenance down-time.
MECHANICAL SEAL
Standard John Crane Type 21.
MATERIALS OF CONSTRUCTION
Available in All Iron, Bronze Fitted or All Bronze material for maximum application flexibility.
REPLACEABLE WEARING COMPONENTS
- AISI TYPE 303 Stainless Steel shaft sleeve.
- Iron or Bronze casing wear ring.

DESIGNED FOR MAXIMUM EFFICIENCY
Enclosed impeller design, dynamic balancing and renewable wear rings reduce losses affecting performance and pump life.
MOTOR ADAPTER
Rigid cast iron motor adapter provides support and registered fits maintain positive unit alignment.
SUCTION & DISCHARGE PIPE CONNECTIONS
Threaded NPT connections EXCEPT 3 x 4-7 Model only with 125 Lb. ANSI flat faced flanges.
MOTORS
Standard NEMA Frame, JM shaft extension, C-Face mounting.
1- or 3-Phase, 3500 or 1750 RPM.
Open Drip-proof and Totally Enclosed Fan Cooled.

SPECIFICATIONS

CAPACITIES TO...
550 GPM (125 m³/hr) at 3500 RPM
200 GPM (45 m³/hr) at 1750 RPM
HEADS TO...
280 ft. TDH (85m) at 3500 RPM
67 ft. TDH (20m) at 1750 RPM
WORKING PRESSURE...
175 PSIG (12 bars)
MAXIMUM SUCTION PRESSURE TO...
100 PSIG (7 bars)
MAXIMUM TEMPERATURES TO...
212°F (100°C) with standard seal
OR
250°F (121°C) with optional high temperature seal for water applications.
DIRECTION OF ROTATION...
Clockwise when viewed from motor end.
MOTORS...
NEMA Frame, JM shaft extension, C-Face.
Open Drip-proof or Totally Enclosed Fan Cooled, High Efficiency 60 Hz., with 1.15 Service Factor.

1-Phase, 115/230 volt
3500 RPM 3 to 10 HP
1750 RPM to 3 HP

3-Phase, 208-230/460 volt through 215JM Frames

230/460 volt 250JM and Larger Frames

3500 RPM 3-20 HP
1750 RPM to 3 HP

Optional Explosion Proof or Premium High Efficiency motors available in 3-Phase only.

MECHANICAL SEALS...
Standard ceramic/carbon faces, 316 S/S metal components and Buna-N elastomers. Optional High Temperature and severe duty seal materials are available.

APPLICATIONS

Specifically designed for:
- Water circulation
- Booster service
- Liquid transfer
- Spraying systems
- Irrigation
- General purpose pumping

125 Lb. Flanged Connections
3 x 4 – 7 Model Only

Close-Coupled Centrifugal Pumps
All Iron, Bronze Fitted or
All Bronze Construction

Pump Price List
SECTION 5
MODEL
3656
S-Group
Effective January 7, 1991

T.P. #2 (same as #1) special impeller trim ∴ cost = additional #40
TOTAL = 40+765 = $805.00

3500 RPM 3 Phase Units

Pump Size	Motor Enclosure	Impeller Diameter (in.)	HP @ 3500 RPM	1.15 SF, 3 Phase, 208-230/460 Volt						Wt. lbs.
				All Iron		Bronze Fitted		All Bronze		
				Order No.	Price	Order No.	Price	Order No.	Price	
T.P. #1	ODP	5 1/8	3	3AI13035	$765.00	3BF13035	$765.00	3AB13035	$885.00	80
	TEFC	4 3/4		3AI23035	885.00	3BF23035	885.00	3AB23035	1,005.00	95
1 1/2 x 2-6	ODP	5 15/16	3 "H"	3AI13035H	765.00	3BF13035H	765.00	3AB13035H	885.00	80
	TEFC	5 5/8		3AI23035H	885.00	3BF23035H	885.00	3AB23035H	1,005.00	95
	ODP	5 15/16	5	3AI15035	865.00	3BF15035	865.00	3AB15035	985.00	110
	TEFC	5 5/8		3AI25035	965.00	3BF25035	965.00	3AB25035	1,085.00	
2 1/2 x 3-7	ODP	4 1/8	3	4AI13035	800.00	4BF13035	800.00	4AB13035	1,005.00	100
	TEFC	3 7/8		4AI23035	920.00	4BF23035	920.00	4AB23035	1,125.00	125
	ODP	4 5/8	5	4AI15035	905.00	4BF15035	905.00	4AB15035	1,110.00	120
	TEFC	4 7/16		4AI25035	1,005.00	4BF25035	1,005.00	4AB25035	1,205.00	140
	ODP	5 3/8	7 1/2	4AI17535	1,045.00	4BF17535	1,045.00	4AB17535	1,240.00	135
	TEFC	5 1/16		4AI27535	1,210.00	4BF27535	1,210.00	4AB27535	1,410.00	165
	ODP	5 7/8	10	4AI11135	1,190.00	4BF11135	1,190.00	4AB11135	1,390.00	165
	TEFC	5 1/2		4AI21135	1,350.00	4BF21135	1,350.00	4AB21135	1,550.00	205
	ODP	6 3/4	15	4AI11635	1,340.00	4BF11635	1,340.00	4AB11635	1,540.00	190
	TEFC	6 3/8		4AI21635	1,445.00	4BF21635	1,445.00	4AB21635	1,645.00	225
1 1/2 x 2-8	ODP	6 1/4	7 1/2	5AI17535	1,030.00	5BF17535	1,030.00	5AB17535	1,195.00	130
	TEFC	5 3/4		5AI27535	1,200.00	5BF27535	1,200.00	5AB27535	1,370.00	160
	ODP	6 3/4	10	5AI11135	1,180.00	5BF11135	1,180.00	5AB11135	1,340.00	160
	TEFC	6 1/4		5AI21135	1,340.00	5BF21135	1,340.00	5AB21135	1,510.00	200
	ODP	7 5/8	15	5AI11635	1,330.00	5BF11635	1,330.00	5AB11635	1,500.00	185
	TEFC	7		5AI21635	1,435.00	5BF21635	1,435.00	5AB21635	1,600.00	220
	ODP	8 1/16	20*	5AI12135	1,510.00	5BF12135	1,510.00	5AB12135	1,670.00	255
	TEFC	7 3/4		5AI22135	1,610.00	5BF22135	1,610.00	5AB22135	1,775.00	310
3 x 4-7	ODP	5 1/8	7 1/2	6AI17535	1,170.00	6BF17535	1,170.00	Not Available		155
	TEFC	4 11/16		6AI27535	1,335.00	6BF27535	1,335.00			185
	ODP	5 1/2	10	6AI11135	1,315.00	6BF11135	1,315.00			185
	TEFC	5 1/8		6AI21135	1,450.00	6BF21135	1,450.00			225
	ODP	6 3/8	15	6AI11635	1,460.00	6BF11635	1,460.00			210

* 215JM Shaft Extension Motor

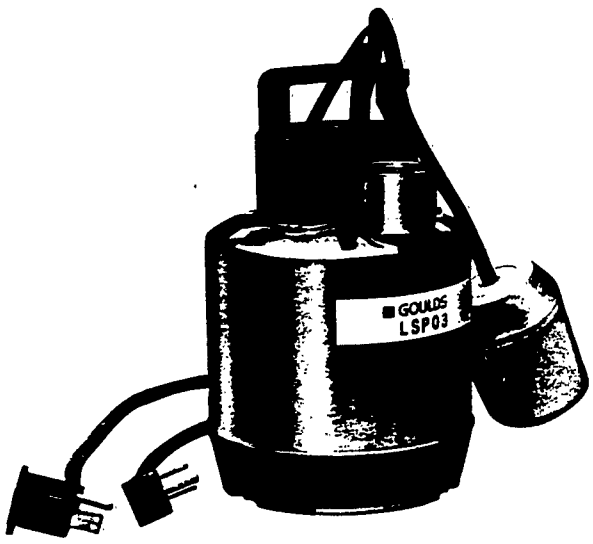
OPTIONAL MECHANICAL SEALS

Materials				Part No.	Seal Type	Service	List Price Adder	Casing O-Ring
Rotary	Stationary	Elastomer	Metal Parts					
Carbon	Ni-Resist	EPR	316 S.S.	10K19	21	Hi-Temperature	$21.00	Buna
	Ceramic	Viton		10K25		Chemical	52.00	Viton
	Tungsten Carbide			10K27		Hi-Temperature Mild Abrasive	202.00	

NOTE: Optional high temperature mechanical seal for temperatures up to 250°F.
Casing O-Ring, item 513, up-grade to Viton material provided as standard with purchase of 10K25 seal option.

Price covers pump with standard diameter impeller, as shown, for a particular motor size. If other than standard diameter is required add $40.00 list.

Dry Well Sump Pump



Goulds

Submersible Sump Pump

MODEL

LSP03

APPLICATIONS

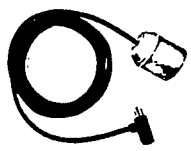
Specially designed for the following uses:
- Basement Draining
- Water Transfer
- Dewatering

SPECIFICATIONS

Pump:
- Discharge size: 1 ½" NPT.
- Capacities: to 40 GPM.
- Maximum head: 21 feet TDH.

Power cord:
- Heavy duty 3-wire 16/3 SJT with NEMA 5-15 P 3-prong grounding plug, 115 volts.
- Power cord length: 10 feet.
- Temperature: 104°F (40°C) maximum liquid temperature.

Motor:
- ⅓ HP, 115 volt, 60 Hz, Single phase, 3400 RPM.
- Built-in thermal overload protection with automatic reset.
- Permanent-Split-Capacitor type.
- Amps: 2.6 maximum.
- Class F insulation.
- Stainless steel shaft.

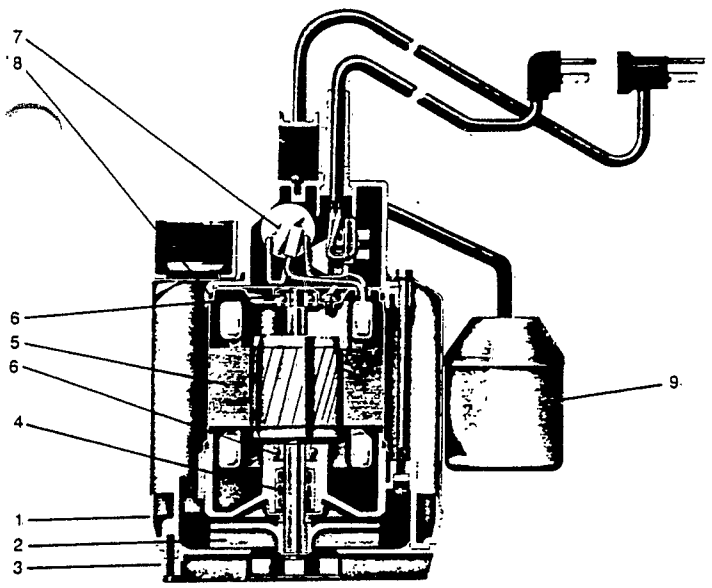


- **Separate Float Switch is supplied with pump.**
- **Heavy duty 3-wire 16/3 SJT electrical cord with NEMA 5-15P 3-prong grounding plug Series-connected ("Piggy-back" type).**
- **Switch cord length: 10 feet.**

FEATURES

Corrosion-resistant construction.
304 Stainless Steel motor casing and fastners.
Glass-filled thermoplastic impeller and volute.
Ball bearing construction. Both upper and lower bearings are greased for life.
Motor is permanently lubricated for extended service life and is powered for continuous operation. All ratings are within the working limits of the motor.
303 Stainless Steel shaft.
Separate float switch is attached to the pump at the factory. Float switch is adjustable for various liquid levels. Easily removed for direct pump operation or switch replacement.
Complete unit is lightweight, portable and easy to service.

BLSP03
Effective March, 1991



Goulds

Submersible Sump Pump

MODEL

LSP03

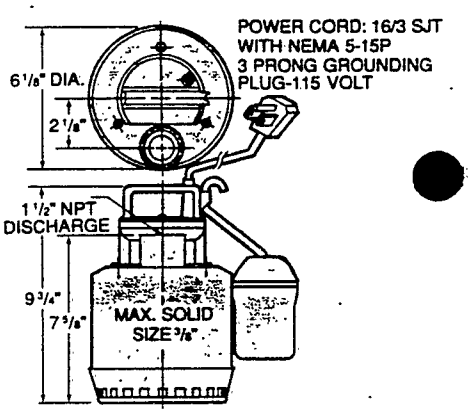
PARTS

Item No.	Part Description
1	Casing
2	Impeller
3	Suction Strainer
4	Shaft Seal with Cover
5	Motor
6	Bearing
7	Capacitor
8	O-Ring
9	Float Switch

DIMENSIONS AND WEIGHTS

Horsepower	1/3
Voltage	115
Amps	2.6 Max.
Phase	1
RPM	3400
Weight (lbs.)	9

(All dimensions in inches and weights in lbs. Do not use for construction purposes. Drawing is not to scale.)

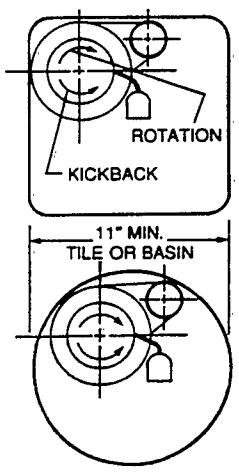


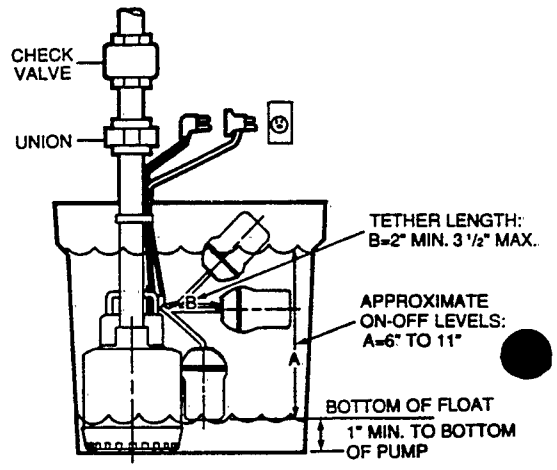
PERFORMANCE RATINGS

Total Head-Ft.*	20	15	10	5
Gallons Per Hour	300	1200	1740	2220

(In gallons per hour)
*Vertical distance from water level to highest point in discharge—plus pipe friction.
Maximum pump submergence is 10 ft.

INSTALLATION





SENECA FALLS, NEW YORK 13148

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

PRINTED IN U.S.A.

Goulds Models DVP, LSP03 and LSP12V

Price List

SECTION 4

SUMP PUMPS

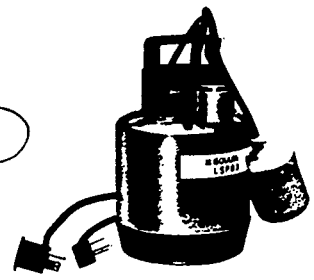
Effective January 7, 1991

Discount "D" Applies

GOULDS Sump Pumps

SPECIAL NOTE: Outside equipment not of our manufacture is subject to the same percentage of price increase as may be made by our supplier to us.

Model LSP03

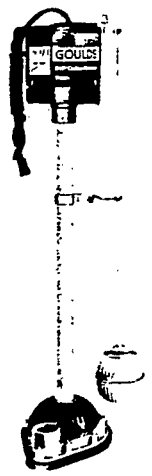


Also Available: 12 Volt Model LSP12V

HP	Order No.	List Price	Weight
1/3	LSP03	$152.00	9
12 Volt D.C.	LSP12V	368.00	14

LSP03 is assembled with one A2-9 Mercury Float Switch which is included in price.
*A2-9 1/2 HP, 115 V, 13 Amps Max., Mercury Float Switch, **$27.00** List, if ordered separately.

Model DVP
(with 8' cord)



HP	Order No.	List Price	Weight
1/3	DVP	$190.00	19

All prices are F.O.B. shipping point.
All prices are subject to change without notice and are subject to any increase which may be in effect on date of shipment.
GENERAL INFORMATION: The company reserves the right to substitute other materials than those specified in its catalog and price sheets whenever necessary under prevailing conditions. Every effort will always be made to insure the usual high quality of Goulds Pumps and Water Systems.

GOULDS PUMPS, INC.
SENECA FALLS, NEW YORK 13148

SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE.

PRINTED IN U.S.A.
PSUMP

- AIR STRIPPING TOWER
- BLOWER

DMD1216A91\86088
Corres.

N A T I O N A L
ENVIRONMENTAL
S Y S T E M S

36 Maple Avenue • Seekonk, Massachusetts 02771
(508) 761-6611 FAX (508) 761-6898

October 16, 1991

Mr. David Day
Fuss & O'Neil
146 Hartford Road
Manchester, CT 06040

SUBJECT: National Environmental Systems Proposal
No. 01-071191.07.01, Revision I
Woodstock, N.Y.

Dear Mr. Day:

Thank you for your interest in National Environmental's equipment for subsurface hydrocarbon contamination abatement. Per your request for quotation/design information, I am pleased to recommend the following equipment for this remediation project.

1 - National Environmental Air Stripping System to meet the following conditions:

Flow Rate	125 gpm
Water Temperature	48° F
Influent Water Concentrations:	
TCE	40000 ppb
Effluent Water Concentrations:	
TCE	5 ppb
Tower Diameter	48 inches 50"
Overall Height	42 feet including 3'6" Dia. ~~5'~~ OVH Clearwell 3'6"
Blower Motor	1½ H.P., 230 VAC, 1Ø, TEFC
Packing Media	3.5 inch Lanpac

This tower includes two visual cleanout port/inspection port, influent piping, influent spray assembly, top flange, flanged siphon drain, temperature gauge, pressure gauge, blower including stand, transition, and field installation kit, packing, mist eliminator, clearwell, drawings and installation manual.

$25,990.00

October 16, 1991

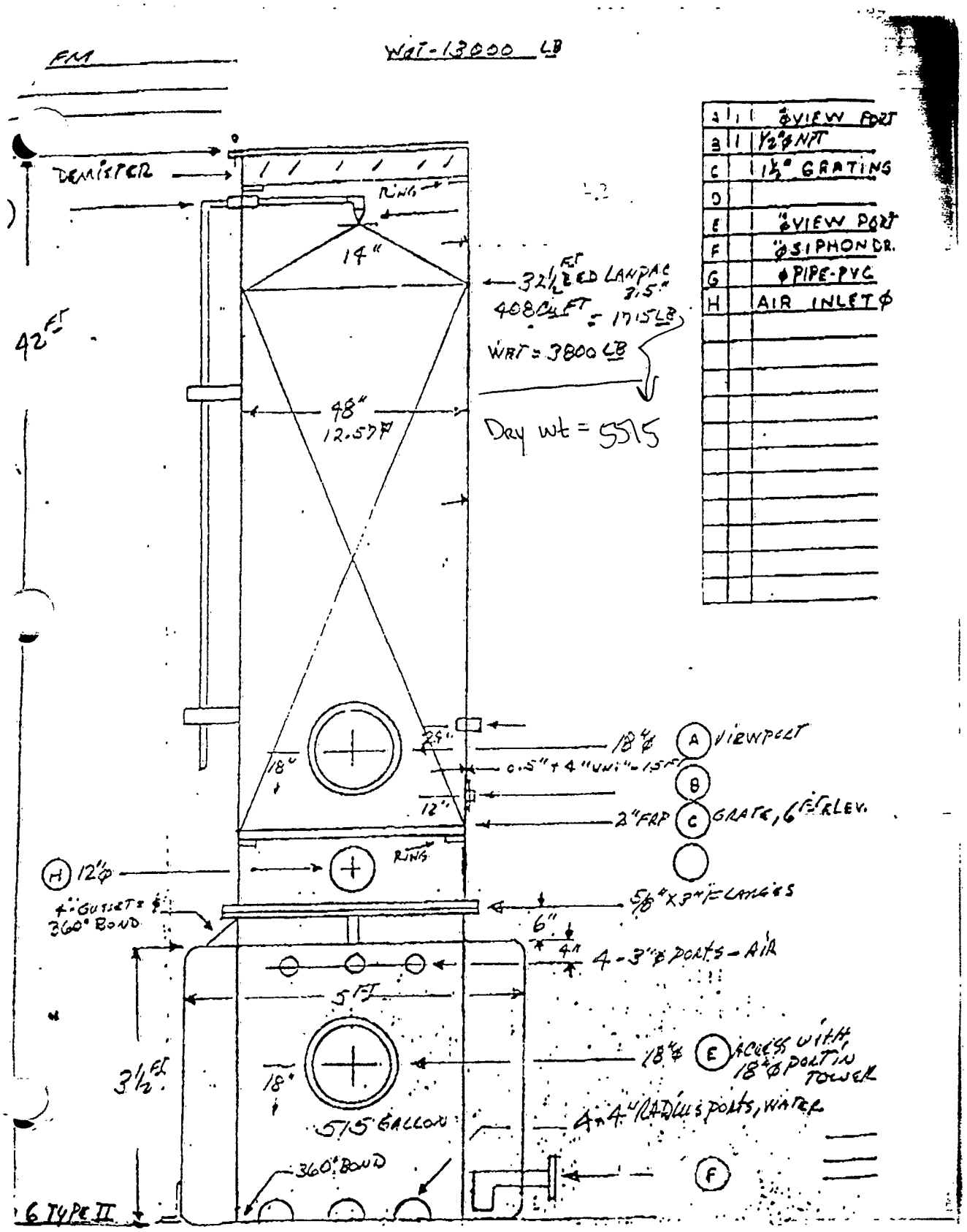
We appreciate the opportunity to assist you with this project. If you have any questions or if you need more information, please do not hesitate to contact me.

Very truly yours,

Pixie Terreault

Pixie Terreault

PT:es
QUOTE VALID FOR 60 DAYS
TERMS: NET 30, FOB: OUR PLANT



N A T I O N A L
ENVIRONMENTAL
S Y S T E M S INC

36 Maple Avenue • Seekonk, Massachusetts 02771
(508) 761-6611 FAX (508) 761-6898

EFFECTIVE 5/15/90

WARRANTY CONDITIONS

per Price list - performance and Structural warranty

This Warranty is a LIMITED warranty; anything in the warranty notwithstanding. Implied warranties for particular purpose and merchantability shall be limited to the duration of the express warranty. National Environmental Systems, Inc. expressly disclaims and excludes any liability of consequential or incidental damages for breach of any express or implied warranty.

National Environmental Systems, Inc. equipment is warranted as to workmanship, material, and performance when properly installed, used, and cared for provided that the original design parameters represent actual field parameters at the time of operation, subject to verification by an EPA certified laboratory. All electrical connections should be installed by an electrician licensed within the State of installation. Should any part prove defective within twelve (12) months from date of shipment, it will be replaced F.O.B. destination without charge, provided the part is returned to National Environmental Systems, Inc. transportation charges prepaid. Exception to this warranty will be pump hoses and pump seals; these items will be subject to the same warranty except for a period of six (6) months from date of shipment. Due to the wide variety of possible applications and conditions of use, no express or implied warranty is made for carbon adsorption systems for performance, safety, or suitability for particular purpose.

No allowance will be made for labor, transportation, or other charges incurred in the replacement or repair of defective parts by the customer. This warranty does not apply when damage is caused by sand or abrasive materials pumped with the fluids, lightning, improper voltage supply, careless handling, improper installation, improper well design, or corrosion due to substances that were unknown to National Environmental Systems, Inc. at the time of shipment.

Any alteration or disassembly of equipment without proper authorization from National Environmental Systems, Inc. voids all warranties stated herein.

Prices and Specifications are effective only in the continental USA and are subject to change without notice.
F.O.B. Point and Title: All material is sold F.O.B. factory. Title to all material sold shall pass to buyer upon delivery by Seller to carrier at shipping point.
Special data and Drawing charges are subject to Factory determination.

NATIONAL ENVIRONMENTAL SYSTEMS INC. AIR STRIPPING

PROJECT INFORMATION	
PROJECT NUMBER	01-771191-01
PROJECT NAME	Linemaster
FIRM NAME	Fuss & O'Neill
CONTACT NAME #1	Dave Day
CONTACT NAME #2	
TEL. NO.	203-646-2469

SITE PARAMETERS	
CONTAMINANT NUMBER #1	13
CONTAMINANT NAME	TCE
DATA AVAILABLE	YES
INFLUENT CONC. (ppb)	40000
EFFLUENT CONC. (ppb)	5
PERCENT REMOVAL	99.98750%
CONTAMINANT NUMBER #2	
CONTAMINANT NAME	
DATA AVAILABLE	
INFLUENT CONC. (ppb)	
EFFLUENT CONC. (ppb)	
PERCENT REMOVAL	
CONTAMINANT NUMBER #3	
CONTAMINANT NAME	
DATA AVAILABLE	
INFLUENT CONC. (ppb)	
EFFLUENT CONC. (ppb)	
PERCENT REMOVAL	
CONTAMINANT NUMBER #4	
CONTAMINANT NAME	
DATA AVAILABLE	
INFLUENT CONC. (ppb)	
EFFLUENT CONC. (ppb)	
PERCENT REMOVAL	
CONTAMINANT NUMBER #5	
CONTAMINANT NAME	
DATA AVAILABLE	
INFLUENT CONC. (ppb)	
EFFLUENT CONC. (ppb)	
PERCENT REMOVAL	
CONTAMINANT NUMBER #6	
CONTAMINANT NAME	
DATA AVAILABLE	
INFLUENT CONC. (ppb)	
EFFLUENT CONC. (ppb)	
PERCENT REMOVAL	
WATER FLOWRATE (GPM)	125
WATER TEMP. (DEG. F)	48
WATER TEMP. (DEG. C)	8.9

NATIONAL ENVIRONMENTAL SYSTEMS INC. AIR STRIPPING PROGRAM

PROJECT INFORMATION	
PROJECT NUMBER	01-071191-01
PROJECT NAME	Linemaster
FIRM NAME	Fuss & O'Neil
CONTACT NAME #1	Dave Day
CONTACT NAME #2	
TEL. NO.	203-646-2469

CONTAMINANT NUMBER	CONTAMINANT NAME	VC	A	ML
CONTAMINANT NUMBER #1	TCE	256	0.006	3.45
CONTAMINANT NUMBER #2				??
CONTAMINANT NUMBER #3				??
CONTAMINANT NUMBER #4				??
CONTAMINANT NUMBER #5				??
CONTAMINANT NUMBER #6				??

CONTAMINANT NUMBER	CONTAMINANT NAME	L	PL	HENRY LAW
CONTAMINANT NUMBER #1	TCE	4978	62.4	0.23568
CONTAMINANT NUMBER #2		??	??	
CONTAMINANT NUMBER #3		??	??	
CONTAMINANT NUMBER #4		??	??	
CONTAMINANT NUMBER #5		??	??	
CONTAMINANT NUMBER #6		??	??	

CONTAMINANT NUMBER	CONTAMINANT NAME	DL	A/W	R
CONTAMINANT NUMBER #1	TCE	2.52e-05	30/60	18.85
CONTAMINANT NUMBER #2				
CONTAMINANT NUMBER #3				
CONTAMINANT NUMBER #4				
CONTAMINANT NUMBER #5				
CONTAMINANT NUMBER #6				

NATIONAL ENVIRONMENTAL SYSTEMS INC. AIR STRIPPING PROGRAM

PROJECT INFORMATION	
PROJECT NUMBER	01-071191-01
PROJECT NAME	Linemaster
FIRM NAME	Fuss & O'Neil
CONTACT NAME #1	Dave Day
CONTACT NAME #2	
TEL. NO.	203-646-2469

TOWER INFORMATION	PACK SAFETY FACTOR	TOWER DIA.	CFM	AIR/WATE
	1.05	48.0000	1337	80

CONTAMINANT NUMBER	CONTAMINANT NAME	PH W/SF (FT)	PH NO/SF (FT)	AIR/WATE MIN/MAX
CONTAMINANT NUMBER #1	TCE	32.5749	31.0237	30/60
CONTAMINANT NUMBER #2				
CONTAMINANT NUMBER #3				
CONTAMINANT NUMBER #4				
CONTAMINANT NUMBER #5				
CONTAMINANT NUMBER #6				

CONTAMINANT NUMBER	CONTAMINANT NAME	% REMOVAL	HENRY LAW
CONTAMINANT NUMBER #1	TCE	99.9875%	0.23568
CONTAMINANT NUMBER #2			
CONTAMINANT NUMBER #3			
CONTAMINANT NUMBER #4			
CONTAMINANT NUMBER #5			
CONTAMINANT NUMBER #6			

NATIONAL ENVIRONMENTAL SYSTEMS INC. AIR STRIPPING PROGRAM

PROJECT INFORMATION	
PROJECT NUMBER	01-071191-01
PROJECT NAME	Linemaster
FIRM NAME	Fuss & O'Neil
CONTACT NAME #1	Dave Day
CONTACT NAME #2	
TEL. NO.	203-646-2469

CONTAMINANT NUMBER	CONTAMINANT NAME	HENRY LAW	HTU	NTU
CONTAMINANT NUMBER #1	TCE	0.236	3.29	9.43
CONTAMINANT NUMBER #2				
CONTAMINANT NUMBER #3				
CONTAMINANT NUMBER #4				
CONTAMINANT NUMBER #5				
CONTAMINANT NUMBER #6				

CONTAMINANT NUMBER	CONTAMINANT NAME	PH	PH/SF
CONTAMINANT NUMBER #1	TCE	31.02	32.57
CONTAMINANT NUMBER #2			
CONTAMINANT NUMBER #3			
CONTAMINANT NUMBER #4			
CONTAMINANT NUMBER #5			
CONTAMINANT NUMBER #6			

SITE PARAMETER	
WATER FLOWRATE (GPM)	125
WATER TEMP. (DEG. F)	48
WATER TEMP. (DEG. C)	8.9

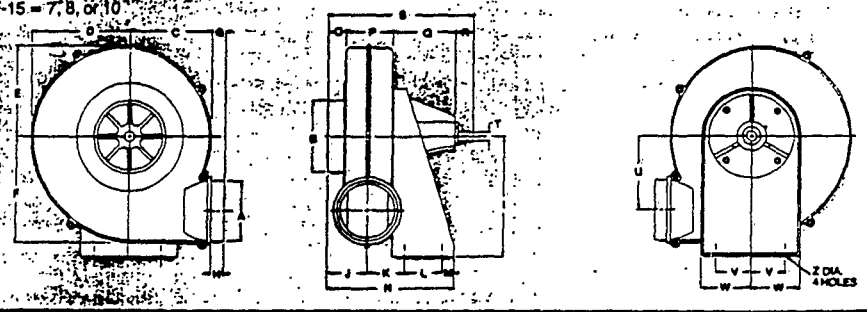
TOWER PARAMETER	
DRIVING CONTAMINANT	TCE
TOWER DIAMETER (IN)	48
PACK HIGHT CALC. (FT)	32.57
AIR FLOW CALC. (CFM)	1337
AIR TO WATER RATIO	80

DIMENSIONAL DATA

AF SIZE	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	Z
8	4	4	4 15/16	5 13/16	5 11/32	6 7/16	1 3/8	1	10	2 3/8	2 1/8	3 1/4	3/4	9 3/4	1 1/8	3 1/2	3 11/16	3	11 5/16	3/4	4 9/16	2 7/8	4	7/16
9	4	5	6	7 1/4	6 17/32	7 3/4	1 1/16	1	10	3 1/16	2 27/32	3 1/4	3/4	10 11/32	1 1/16	3 3/4	3 11/16	3	11 3/8	3/4	5 3/8	2 7/8	4	7/16
10	5	6	6 11/16	8 5/16	7 25/32	9	1 1/8	1	10	3 3/8	2 31/32	3 1/4	3/4	10 11/32	1 1/2	3 3/4	3 11/16	3	11 5/16	3/4	6 3/8	2 7/8	4	7/16
12	6	7	7 3/4	9 1/4	8 1/2	10 7/16	1 1/8	1	11 1/2	3 3/8	3 13/32	4 1/2	1 1/4	12 25/32	1 1/2	4 1/4	5 1/16	4	15 5/16	1	7 5/16	3 1/8	4 1/2	3/4
15	8	*	9 3/8	11	10	12	1 9/16	1	15	4 7/16	4 3/8	4 1/2	1 1/4	14 9/16	1 1/2	5 1/8	5 1/16	4	16 13/16	1 7/16	7 7/8	3 1/4	5	3/4

* "B" Dimension on AF-15 = 7, 8, or 10

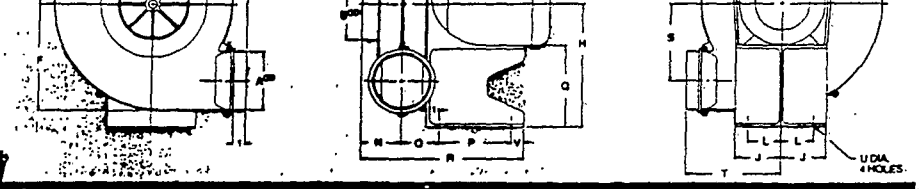
ARRANGEMENT 2 CAST ALUMINUM BASE



AF SIZE	A	B	C	D	E	F	G	N	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	FRAME SIZE
10	5	6	6 11/16	8 5/16	7 25/32	9	1 1/8	11 1/2	5	1 1/2	4	3 3/4	3 3/8	3 1/4	7	8	14 7/16	6 3/8	7 13/16	7/16	1 1/16	13/16	
12	6	7	7 3/4	9 1/4	8 1/2	10 7/16	1 1/8	11 1/2	5	1 1/2	4	4 1/4	3 3/8	3 9/16	7	8	15	7 5/16	8 7/8	7/16	1 1/16	13/16	
12	6	7	7 3/4	9 1/4	8 1/2	10 7/16	1 1/8	11 1/2	5	1 1/2	4	4 1/4	3 3/8	3 9/16	8	7	16 1/8	7 5/16	8 7/8	7/16	1 1/16	13/16	
15	8	*	9 3/8	11	10	12	1 9/16	15	6 5/16	1 1/2	4 7/8	5 7/8	4 7/16	5 1/8	8 3/4	11 1/2	20 1/2	7 7/8	10 15/16	9/16	1 7/8	2 5/16	
15	8	*	9 3/8	11	10	12	1 9/16	15	6 5/16	1 1/2	4 7/8	5 7/8	4 7/16	5 1/8	8 3/4	10 1/2	20 1/2	7 7/8	10 15/16	9/16	1 7/8	2 5/16	
15	8	*	9 3/8	11	10	12	1 9/16	15	6 5/16	1 1/2	4 7/8	5 7/8	4 7/16	5 1/8	8 3/4	9 3/4	20 1/2	7 7/8	10 15/16	9/16	1 7/8	2 5/16	

2 30V 60Hz Single Phase TEFC

ARRANGEMENT 4 CAST ALUMINUM BASE

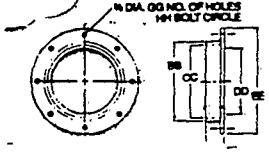


* "B" Dimension on AF-15 = 7, 8, OR 10

ARRANGEMENT 4 STEEL BASE

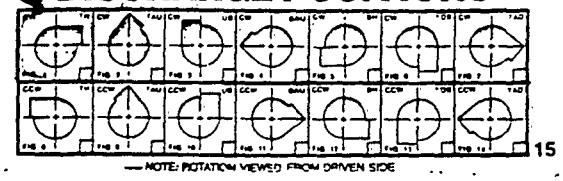
CHANGE Blower No. 2

FLANGES



COLLAR O.D.	PART NO.	BB	CC	DD	EE	FF	GG	HH
4	414	4 7/16	4 1/32	3 5/16	7 3/4	1 1/4	4	6 1/8
5	415	5 5/16	5 1/32	4 5/16	7 7/8	1 1/4	4	6 3/4
6	416	6 7/16	6 1/32	5 1/2	9	1 5/16	4	8
7	417	7 1/2	7 1/32	6 1/4	9 7/8	1 5/16	8	8 7/8
8	418	9	8 1/32	7 1/2	13 1/2	1 1/2	8	11 3/4
10	419	10 3/4	10 1/32	—	16	1 1/8	8	14 1/4

DISCHARGE POSITIONS

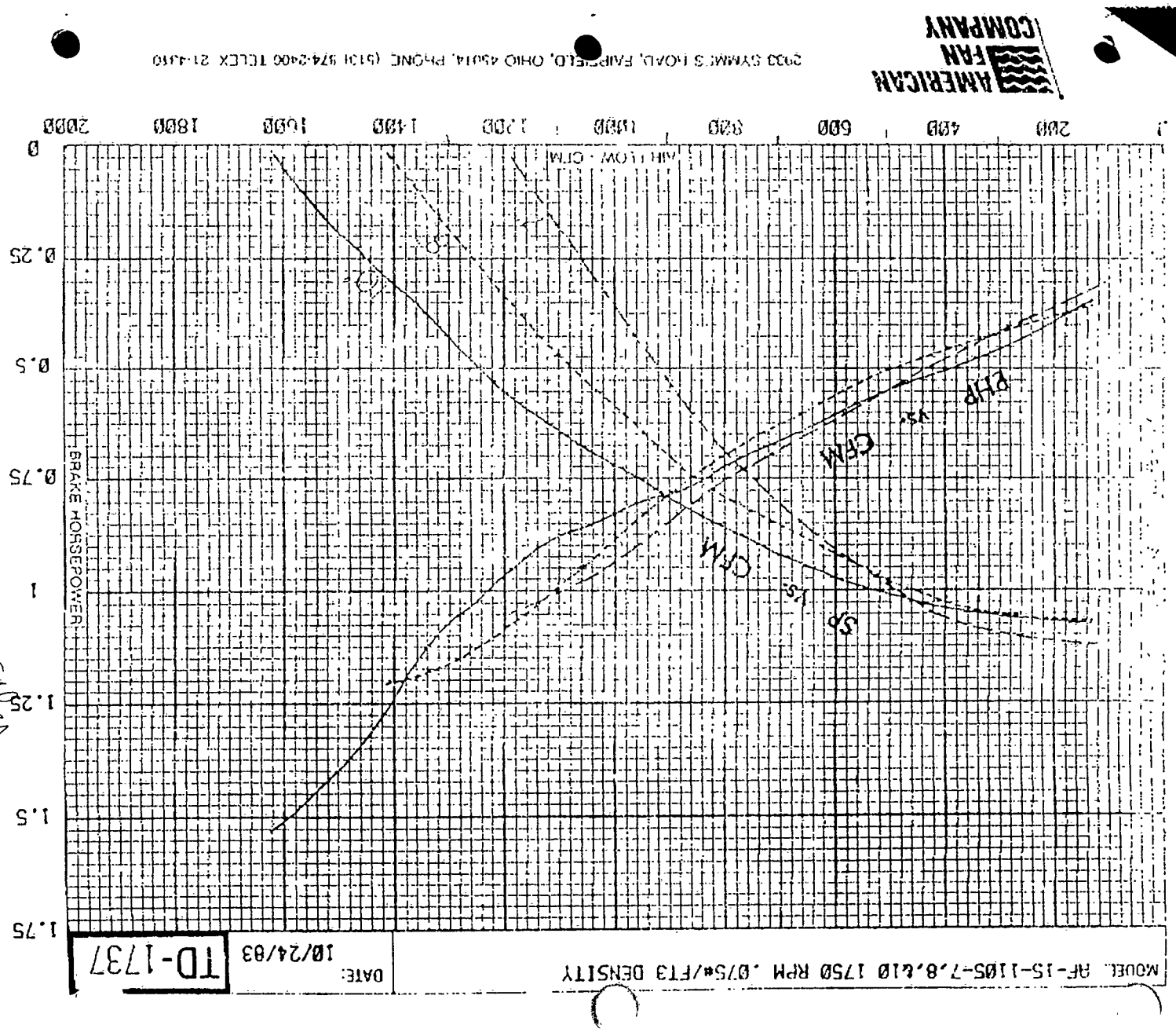


NOTE: ROTATION VIEWED FROM DRIVEN SIDE

NOTICE
If the filmed image is less clear than this Notice it is due to the quality of the document being filmed.

LINEMASTER SWITCH
ADMINISTRATIVE RECORD

LIN003 670



513 & 670 SSSD → SALES

- SOLENOID VALVE
- TEMPERATURE SWITCH
  & BULB SENSOR

DMD1216A91\86088
Corres.

O'Keefe Controls Co.

Mailing Address
P.O. Box Q
Trumbull, CT 06611

Phone 203 261-6711
Fax 203 261-8331

Main Office
4 Maple Drive
Monroe, CT 06468

Specialists in Valves, Controls, Pneumatics & Fluid Measurement

FAX TRANSMISSION DATA SHEET

Date: 11/14/91 Fax No: 1-643-6313

Please deliver the following page(s) to:

Attention: DAVE DAY

Company name: Fax to O'Neill

City, State:

From:

Name: Bob O'Keefe

Total number of pages sent: 4 (Including this sheet)

Reference: Valve & Temp Switch

Message: For Draining H2O. 11/15/91

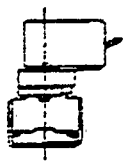
- Solenoid Valve Volts ? Hz
  Model 9210B56 120/60
  (0 differential for drain) } $292

- Temp Switch Bulb Sensor
  ↓ SB110 / QB10A1 } $200
  $100 $100
  Adjustable −30 to +60 °F

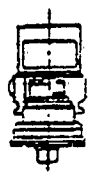
$500 for Valve & Temp Switch

O'Keefe Controls Co.

Solenoid Valve, Temp Switch & Bulb Sensor = $500.00



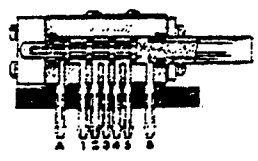
ASCO
Solenoid Valves



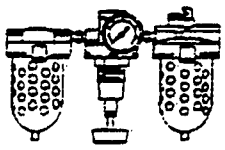
ASCO
Pressure
Switches

Fairchild
Precision
Regulators

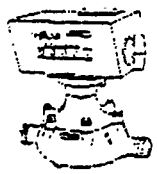
Dwyer
Pressure
Instruments



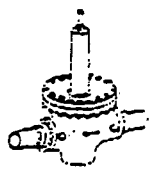
Dynamco
Air Logic



Wilkerson
Filters
Regulators



Neptune
Liquid
Meters



Kaye & MacDonald
Pressure
Reducing Valves

S-SERIES Temperature Switches

How to Select and Order

ASCO S-Series switches consist of two components, the switch unit and the transducer unit.

How to Select

1. Select the adjustable operating range based on desired actuation temperature.
2. Check that rated overrange temperature is sufficient.
3. Read across and select the desired S-Series switch unit with the proper enclosure.
4. Continue across and select a matching transducer unit compatible with the fluid.

How to Order

Factory assembled — Simply order the switch and transducer unit by catalog number joined by a slash (/),e.g., SA10D/QA10A1.

Field assembled — Simply order the switch and transducer unit separately by individual catalog number e.g., one SA10D and one QA10A1.

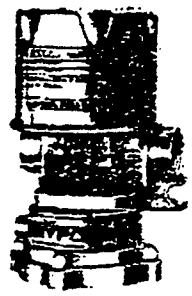
Options — Add appropriate suffix for desired option (see pages 34-35).

Important Note: The third digit of each of the catalog numbers must be identical, e.g., SA1[1]0D and QA[1]0A1.

Select S-Series temperature switch

SA, Switch Unit

Single-Stage Adjustable Deadband units allow independent adjustment of the set and reset points over the full operating range of the switch. The minimum difference between set and reset points is the deadband listed below; the maximum difference is the full range of the switch.



General Purpose

SB, SD or SE Switch Unit

SB Switch Unit: Single-Stage Fixed Deadband units have an adjustable set point and a non-adjustable automatic reset point.

SD Switch Unit: Manual reset on decreasing temperature units operate automatically on increasing temperature and must be reset manually on decreasing temperature.
(To order, change second digit to letter "D", e.g., S[E]40D becomes S[D]40D).

SE Switch Unit: Manual reset on increasing temperature units operate automatically on decreasing temperature and must be reset on increasing temperature.
(To order, change second digit to letter "E", e.g., S[B]40D becomes S[E]40D.

Specifications

Adjustable Operating Range (°F)	Rated Overrange Temperature (°F)			Adjustable Deadband Minimum At Mid-Range (°F) ①	Adjustable Deadband Maximum Full Scale		
	Direct Mount	Capillary			General Purpose	Watertight Enclosure	Explosion-Proof
		Copper	SS		Catalog No.	Catalog No.	Catalog No.
−50-20	200	200	200	8	SA10D	SA11D	SA12D
−30-60	250	250	250	8	SA10D	SA11D	SA12D
0-90	260	300	300	8	SA10D	SA11D	SA12D
50-160	260	350	350	8	SA10D	SA11D	SA12D
100-220	260	450	450	8	SA10D	SA11D	SA12D
160-260	260	500	500	9	SA10D	SA11D	SA12D
225-340	--	550	600	12	SA10D	SA11D	SA12D
300-450	--	550	700	12	SA10D	SA11D	SA12D
350-510	--	550	800	18	SA10D	SA11D	SA12D
425-640	--	550	890	32	SA10D	SA11D	SA12D

°C = (°F -32) x 5/9

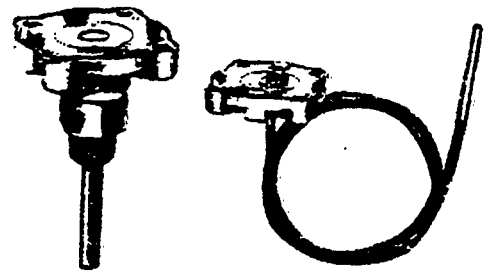
Fixed Deadband At Mid-Range (°F) ①	Fixed Deadband or Manual Reset: General Purpose Catalog No.	Watertight Enclosure Catalog No.	Explosion-Proof Catalog No.
3	SB10D	SB11D	SB12D
3	SB10D	SB11D	SB12D
3	SB10D	SB11D	SB12D
3	SB10D	SB11D	SB12D
3	SB10D	SB11D	SB12D
3	SB10D	SB11D	SB12D
6	SB10D	SB11D	SB12D
6	SB10D	SB11D	SB12D
7	SB10D	SB11D	SB12D
20	SB10D	SB11D	SB12D

All switch units above are in stock for immediate delivery.

① Values shown are nominal.

ASCO TRI-POINT

Select transducer unit below

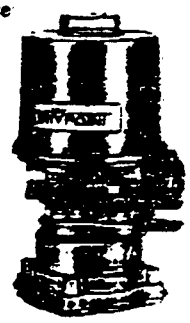


Direct Mount 1/2" NPT — Capillary and Bulb

SA, SB, SC, SD, or SE unit below

SC Switch Unit

Two-Stage Fixed Deadband units consist of two separate snap-action switches, each with an independently adjustable set point and non-adjustable reset point. The difference between the set and reset points of each switch is the deadband listed below; the minimum difference between the set points of the two switches is the separation.



not marked — Explosion Proof

Transducer Unit

The temperature transducer works on the vapor principle where the internal pressure within the system is generated by the vapor pressure of a chemical within a sealed system. The temperature sensed by the bulb is related uniquely to an internal pressure within the system. The pressure acts on a diaphragm/piston to create the force output from the transducer into the switch unit.
Temperature transducers are available in two constructions. The direct mount (local) unit includes a 1/2" NPT connection for direct application to the process. The capillary and bulb-type construction allows for remote mounting from the process.

Two-Stage Fixed Deadband / Transducer Units

Fixed Deadband At Mid-Range (°F) ①	Separation: Maximum Full Scale / Minimum At Mid-Range (°F) ①	General Purpose Catalog No.	Watertight Enclosure Catalog No.	Explosion-Proof Catalog No.	Direct Mount: Copper Catalog No.	Direct Mount: 316 SS Catalog No.	6' Capillary and Bulb: Copper (Armored Capillary) Catalog No.	6' Capillary and Bulb: 316 SS (Plain Capillary) Catalog No.	12' Capillary and Bulb: Copper (Armored Capillary) Catalog No.	12' Capillary and Bulb: 316 SS (Plain Capillary) Catalog No.
4	8	SC10D	SC11D	SC12D	QA10A1	QA10A4	QA11A1	QA11A4	QA11A1D	QA11A4D
4	8	SC10D	SC11D	SC12D	QB10A1	QB10A4	QB11A1	QB11A4	QB11A1D	QB11A4D
4	8	SC10D	SC11D	SC12D	QD10A1	QD10A4	QD11A1	QD11A4	QD11A1D	QD11A4D
4	8	SC10D	SC11D	SC12D	QF10A1	QF10A4	QF11A1	QF11A4	QF11A1D	QF11A4D
4	8	SC10D	SC11D	SC12D	QJ10A1	QJ10A4	QJ11A1	QJ11A4	QJ11A1D	QJ11A4D
4	9	SC10D	SC11D	SC12D	QL10A1	QL10A4	QL11A1	QL11A4	QL11A1D	QL11A4D
8	12	SC10D	SC11D	SC12D	—	—	QN11A1	QN11A4	QN11A1D	QN11A4D
8	12	SC10D	SC11D	SC12D	—	—	QT11A1	QT11A4	QT11A1D	QT11A4D
10	18	SC10D	SC11D	SC12D	—	—	QU11A1	QU11A4	QU11A1D	QU11A4D
27	32	SC10D	SC11D	SC12D	—	—	—	QW11A4	—	QW11A4D

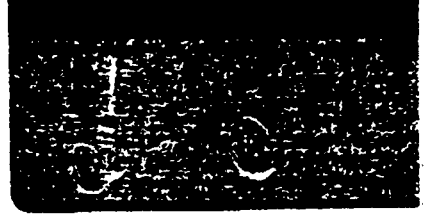
All switch units and transducer units above are in stock for immediate delivery.

2 WAY PILOT OPERATED General Service Solenoid Valves

Asco Red-Hat / Red-Hat II

8210 SERIES

Brass or Stainless Steel Bodies • ⅛" to 2½" N.P.T.



Specifications

Solenoid Enclosures: Valves listed in this series have either Red-Hat metal solenoid enclosures or Red-Hat II molded epoxy solenoids. Red-Hat II valves are identified by the change letter "G" in their catalog numbers, e.g., 8210G1, and are shown in red.

Standard Enclosures:
Red-Hat — Type 1 General Purpose
Red-Hat II — Types 1, 2, 3, 3S, 4 and 4X Combination General Purpose and Watertight.

Optional Enclosures:
Red-Hat — Types 3, 7 and 9 Combination Explosionproof and Raintight. To order, add prefix "EF" to catalog number. (Except Catalog Numbers 8210B57, 8210B58 and 8210B59.)④
Red-Hat II — Types 3, 3S, 4, 4X, 6, 6P, 7 and 9 Combination Explosionproof and Watertight. To order, add prefix "EF" to catalog number.
Additional constructions are available. The Optional Electrical Features Section, page 11, contains descriptions and ordering information for: Open Frame Solenoids • Junction Box Enclosures • Panel Mount Constructions.

Electrical: standard Voltages:
24, 120, 240, 480 volts, AC, 60 Hz
(or 110, 220 volts, AC, 50 Hz)
6, 12, 24, 120, 240 volts, DC
Other voltages are available when required.

Coil: Continuous duty molded Class F or H, as listed.

Nominal Ambient Temperature Ranges: Red-Hat and Red Hat II Valves/AC Construction: 32°F to 125°F
Red-Hat Valves/DC Construction: 32°F to 77°F (104°F occasionally).
Red-Hat II Valves/DC Construction: 32°F to 104°F.
Refer to Engineering Section for details

Valve Parts in Contact with Fluids:
Body — Brass or Stainless steel, as listed
Seals and Discs — Buna "N" or Teflon®, as listed
Disc Holder — Nylon, as listed
Core Tube — 305 s.s.
Core and Plugnut — 430F s.s.
Springs — 302 s.s.
Shading Coil — Copper (brass body); Silver (stainless steel body)

Approvals: CSA certified
UL listed as indicated. Refer to Engineering Section for details.

Ordering Information:
Important: We must have catalog number, voltage and Hertz, operating pressure and fluid handled. Use strainers with solenoid valves.

®Dupont Co. trademark

SPECIFICATIONS

Pipe Size (ins.)	Orifice Size (ins.)	Cv Flow Factor	Operating Pressure Differential (psi) Min.	Max. AC Air-Inert Gas	Max. AC Water	Max. AC Light Oil @ 300 SSU	Max. DC Air-Inert Gas	Max. DC Water	Max. DC Light Oil @ 300 SSU	Max. Fluid Temp. °F AC	Max. Fluid Temp. °F DC	Standard Solenoid Enclosures Red-Hat–Type 1 Red-Hat II–Types 1,2,3,3S,4 and 4X. Brass Body Catalog Number	Brass Body Constr. Ref. No. ⑤	Brass Body UL Listing	S.S. Body Catalog Number	S.S. Body Constr. Ref. No. ⑤	S.S. Body UL Listing	Watt Ratings/ Class of Coil Insulation ⑫ AC	Watt Ratings/ Class of Coil Insulation ⑫ DC
NORMALLY CLOSED (Closed when de-energized), Buna "N" or Teflon® Seating																			
⅛	⅛	1.5	⑬	150	125	—	40	40	—	190	150	8210C73⑭	1P	•	8210G36⑮	1P	•	6.1/F	11.6/F
¼	5/32	3	0	150	150	—	40	40	—	180	150	8210G93	5D	o	—	—	—	10.1/F	11.6/F
¼	¼	3	5	200	150	125	125	100	100	180	150	8210G1	6D	o	—	—	—	6.1/F	11.6/F
⅜	⅜	3	5	300	300	300	—	—	—	175	—	8210G6	5D	o	—	—	—	17.1/F	—
¼	7/32	2.2	⑬	150	125	—	40	40	—	180	150	8210G15⑭	2P	•	8210G37⑮	2P	•	6.1/F	11.6/F
¼	5/16	4	0	150	150	—	40	40	—	150	150	8210G94	5D	o	—	—	—	10.1/F	11.6/F
¼	¼	4	0	150	150	125	40	40	—	175	150	—	—	—	8210G87	7D	•	17.1/F	11.6/F
½	⅜	4	5	200	150	125	125	100	100	180	150	8210G2	6D	o	—	—	—	6.1/F	11.6/F
½	⅜	4	5	300	300	300	—	—	—	175	—	8210G7	5D	o	—	—	—	17.1/F	—
⅜	⅜	5	0	150	150	125	40	40	—	175	150	—	—	—	8210G88	7D	•	17.1/F	11.6/F
⅜	¼	5	5	125	125	125	100	90	75	180	150	8210G9	9D	o	—	—	—	6.1/F	11.6/F
⅜	⅜	5	0	150	150	—	40	40	—	180	150	8210G95	8D	o	—	—	—	10.1/F	11.6/F
½	½	6.5	5	250	150	100	125	125	125	180	150	8210G3	11D	o	—	—	—	6.1/F	11.6/F
½	½	6	0	350	300	200	200	180	160	200	77	8210B26⑯	10P	⑰	—	—	—	15.4/F	30.6/H
¾	¾	13	0	150	125	125	100	100	80	180	77	8210B54	31D	⑱	8210D89	15D	⑱	15.4/F	30.6/H
1	1	13	5	150	150	100	125	125	125	180	150	8210G4	12D	o	—	—	—	6.1/F	11.6/F
1	1	13.5	0	300	225	115	—	—	—	200	—	8210B27	14P	•	—	—	—	20/F	—
1¼	1¼	15	0	150	125	125	100	100	80	180	77	8210B55	32D	⑱	—	—	—	15.4/F	30.6/H
1¼	1¼	15	5	150	150	100	125	125	125	180	150	8210G8	15D	o	—	—	—	6.1/F	11.6/F
1½	1¼	22.5	0	150	125	125	100	100	80	180	77	8210B56	33D	⑱	—	—	—	15.4/F	30.6/H
1½	1¼	22.5	5	150	150	100	125	125	125	180	150	8210G22	18D	•	—	—	—	6.1/F	11.6/F
2	1¾	43	5	150	125	90	50	50	50	180	150	8210G100	20P	•	—	—	—	6.1/F	11.6/F
2½	1¾	45	5	150	125	90	50	50	50	180	150	8210G101	21P	•	—	—	—	6.1/F	11.6/F

CARBON FILTERS

Culligan® HI-FLO CULLAR® automatic water filters

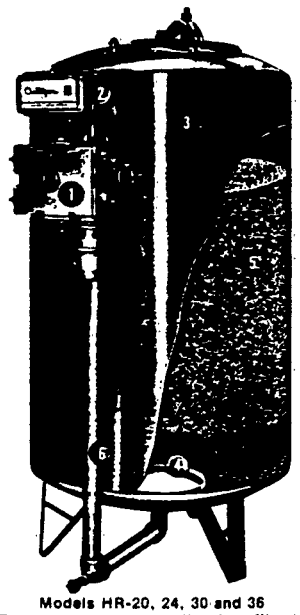
Activated Carbon Filters Absorb and Adsorb to Solve a Variety of Water Problems

1. AUTOMATIC CONTROL
Models HR-20 through 36 are equipped with the Culligan self-contained automatic control valve using exclusive design cartridge for instant servicing. A raw water bypass is incorporated to handle water demands during the backwash operation. Larger models HR-42 through 60 have a nest of hydraulically activated diaphragm valves to accomplish the cycles of backwash, rinse and service. There is no raw water bypass during backwash operations on these larger models.

2. WEATHERPROOF TIMER
Timer controls filter reconditioning process on a regular schedule at any time of any day. Push-button feature permits extra clean-up cycle without disrupting pre-set schedule. Standard features include an extra SPDT electrical contact for operating solenoid valves or pump starters during reconditioning cycle, and a gasketed case to make the timer weatherproof. Locking hasp helps make the unit tamperproof.

3. 5-YEAR TANK WARRANTY
Heavy duty tanks are designed for 100 psi working pressure and tested at 150% of design pressure. All tanks have a 4-6 mil (0.08-0.16 mm) baked-on phenolic epoxy interior and carry a 5-year extended warranty policy. Tank exteriors are painted with a grey rust-inhibiting primer.

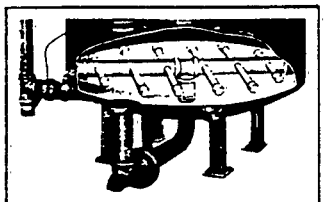
4. DISTRIBUTOR SYSTEM
Graded gravel lower distribution assures uniform distribution of backwash, rinse, and service flows in smaller models HR-20 through 36. Header lateral design with fine slot non-corrosive plastic distributors disperse water laterally for even distribution in larger models HR-42 through 60.



Models HR-20, 24, 30 and 36

For potable water application, filters with Cullar® Activated Carbon should be used only where the influent bacterial quality is known to be acceptable. If bacterial contamination is present an acceptable method of water disinfection is indicated.

OPERATING DATA		
Pressure	1.5 bar — 7 bar 20 psi — 100 psi	
Temperature	5°C — 50°C 40°F — 120°F	Standard
	up to 80°C up to 180°F	Available as option
Electrical Requirements	120 V 60 Hertz 220 V 50 Hertz	



Models HR-42, 48 and 60

5. FINEST MEDIA
Highly adsorptive Cullar D has a broad range of pore openings to handle the job of chlorine removal, plus taste and odor removal. Cullar G media is also available for maximum efficiency on detergent and oil removal. Other specialty grades of activated carbon can be used for specific applications. Consult Culligan for proper carbon media selection. See Specification Sheet for details.

6. COMPLETELY PACKAGED
All filters are furnished complete from inlet to outlet and factory pre-tested for tightness and proper operation. Installation requires only plumbing to filter and drain, loading the tanks and wiring to the timer. Smaller models are mounted on wood skids for easy handling during shipment. Models larger than 36 inches in diameter have valve nest removed at bolt-on flanges, and packaged separately for safer transit and easier job site handling.

SPACE REQUIREMENTS			
MODEL	WIDTH	DEPTH	HEIGHT
HR-20	53 cm 21 in.	89 cm 35 in.	170 cm 67 in.
HR-24	64 cm 25 in.	102 cm 40 in.	170 cm 67 in.
HR-30	79 cm 31 in.	114 cm 45 in.	195 cm 77 in.
HR-36	94 cm 37 in.	137 cm 54 in.	203 cm 80 in.
HR-42	109 cm 43 in.	147 cm 58 in.	211 cm 83 in.
HR-48	125 cm 49 in.	163 cm 64 in.	214 cm 84 in.
HR-60	155 cm 61 in.	198 cm 78 in.	234 cm 92 in.

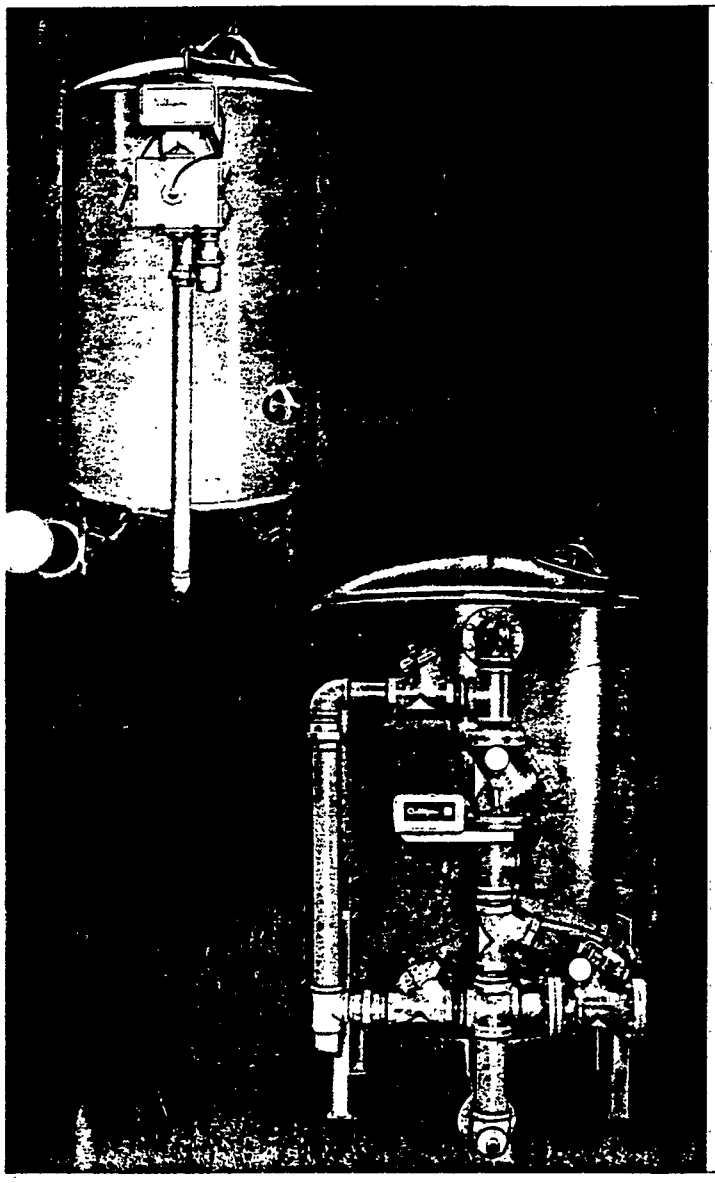
WARRANTED against failure due to faulty workmanship, materials and corrosion for a period of 1 year.

Culligan®

Worldwide Service Capability

For the right answer to your water treatment problems, turn to the people who offer the efficient, economical systems approach. Our products and services, marketed by Culligan dealers, licensees and subsidiaries, are available through 1,350 offices in more than 90 countries. Just call and say, "Hey Culligan Man!"®

Culligan®



HI-FLO™ CULLAR®

automatic water filters

an activated carbon filter
for effective removal of
chlorine by adsorption

Also for removal of:

- other tastes and odors
- color
- tannins
- phenols
- pesticides
- detergents
- trace oil

Culligan WATER TREATMENT WORLDWIDE T.M.

Design Data

CULLAR. FILTERS

	MODEL	FLOW RATES: TASTE. ODOR. & ORGANIC REMOVAL FLOW GPM	TASTE. ODOR. & ORGANIC REMOVAL DROP PSI	DECHLORINATION[2] FLOW GPM	DECHLORINATION[2] DROP PSI	BACK WASH GPM	TANK[3] SIZE (IN)	PIPE SIZE: SERVICE (IN)	PIPE SIZE: DRAIN (IN)	MEDIA VOL. STD. FT³	DIMENSIONS[6]: WIDTH IN.	DIMENSIONS[6]: DEPTH IN.	DIMENSIONS[6]: HEIGHT IN.	WEIGHT: SHIP LB.	WEIGHT: OPERAT. LB.	MODEL
HI-FLO 2	PV-12R	5	1.0	8	7	8	12x37	1½	¾	1.4	14	12	53	141	285	PV-12R
	PV-16R	7	1.0	14	4	15	16x48	1½	1	2.8	17	20	65	305	520	PV-16R
HI-FLO 5	HR-20	12	2.0	22	5	20	20x54	1½	1	6.0	21	36	69	670	1,275	HR-20
	HR-24	15	2.0	31	8	30	24x54	1½	1	8.0	25	40	69	835	1,625	HR-24
	HR-30	25	3.0	49	10	50	30x60	2	2½	14.0	31	46	77	1,330	2,525	HR-30
	HR-36	35	4.0	71	10	70	36x60	2	2½	20.0	37	54	84	1,810	3,575	HR-36
HI-FLO 50	HR-42	50	4.0	100	14	90	42x60	2½	2½	24.0	43	51	86	3,200	5,120	HR-42
	HR-48	65	4.0	125	16	130	48x60	2½	3	30.0	49	60	92	4,520	7,120	HR-48
	HR-54	80	6.0	150	18	160	54x60	2½	3	40.0	55	71	94	5,640	9,025	HR-54
	HR-60	100	4.0	200	13	210	60x60	3	3	48.0	61	98	98	6,900	11,160	HR-60

DEPTH FILTERS

	MODEL	FLOW RATES: CONTINUOUS[4] FLOW GPM	CONTINUOUS[4] DROP PSI	PEAK[5] FLOW GPM	PEAK[5] DROP PSI	BACKWASH STD. GPM	BACKWASH QUAD. GPM	TANK[3] SIZE (IN)	PIPE SIZE (IN): INLET & OUTLET	PIPE SIZE (IN): DRAIN	MEDIA VOL. STD. FT³	DIMENSIONS: WIDTH IN.	DIMENSIONS: DEPTH IN.	DIMENSIONS: HEIGHT IN.	WEIGHT: SHIP LB.	WEIGHT: OPERAT. LB.	MODEL
HI-FLO 2	PV-12D	8	2	12	4	10	—	12x37	1½	¾	1.5	14	18	53	222	365	PV-12D
	PV-16D	14	3	21	7	20	—	16x37	1½	1	2.8	17	20	53	410	615	PV-16D
HI-FLO 5	HD-20	22	3	45	10	30	50	20x54	1½	1	6.0	21	36	69	975	1,600	HD-20
	HD-24	31	3	65	16	50	80	24x54	1½	2½	8.0	25	40	69	1,315	2,150	HD-24
	HD-30	49	5	100	16	70	120	30x60	2	2½	13.0	31	46	77	2,015	3,275	HD-30
	HD-36	71	5	140	16	90	160	36x60	2½	2½	19.0	37	54	84	2,970	4,750	HD-36
HI-FLO 50	HD-42	95-142	5-10	190	17	136	226	42x60	3	3	25.0	43	51	86	4,980	6,850	HD-42
	HD-48	125-187	6-10	250	16	188	324	48x60	3	3	34.0	49	62	92	6,300	8,850	HD-48
	HD-54	160-240	5-8	320	13	210	398	54x60	4	3	42.0	55	72	94	8,000	11,290	HD-54
	HD-60	200-300	4-9	400	14	270	430	60x60	4	3	52.0	61	77	98	9,770	13,990	HD-60
	HD-72	290-425	4-9	560	14	400	—	72x60	6	4	75.0	73	88	94	14,150	20,100	HD-72
	HD-84	390-575	4-9	770	14	540	—	84x60	6	4	106.0	85	94	97	19,240	27,300	

(1) Taste, odor, and organic removal based on 5 gpm per square foot of filter area.
(2) Dechlorination flow rate can be set up to 10 gpm per square foot of filter area.
(3) Dimensions are diameter by straight side sheet.
(4) Normal Service Range based on 10 gpm per square foot of filter bed area.
(5) Peak Flow based on 20 gpm per square foot of filter bed area, not recommended for extended periods of time.
(6) Does not include operating and maintenance spaces, ASME code tanks are slightly taller.

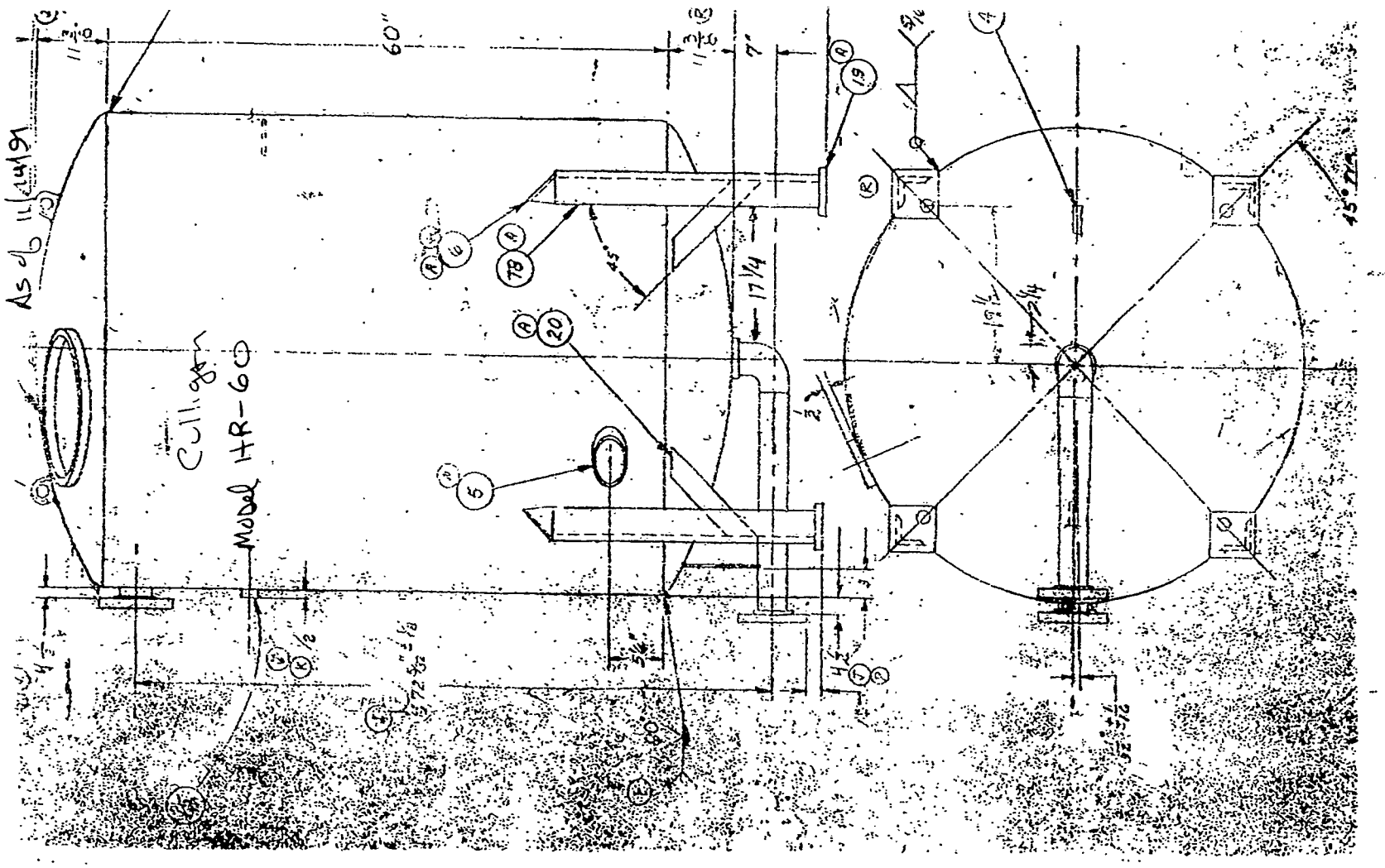
NOTE: CONSULT FACTORY FOR WATER RECLAMATION APPLICATIONS.

Multi-Tech™ Systems

Design Data

MODEL	DAILY CAPACITY[1]	SERVICE FLOW RATE PER TANK[2]: NORMAL	SERVICE FLOW RATE PER TANK[2]: MAXIMUM	BACKWASH FLOW RATE[3]	TANK DIAMETER	PIPE SIZE[4]	MODEL
MT-20	0.065 MGD	15 gpm	22 gpm	30 gpm	20 in.	1½ in.	MT-20
MT-24	0.095 MGD	22 gpm	30 gpm	50 gpm	24 in.	1½ in.	MT-24
MT-30	0.150 MGD	35 gpm	50 gpm	70 gpm	30 in.	2 in.	MT-30
MT-36	0.215 MGD	50 gpm	70 gpm	100 gpm	36 in.	2 in.	MT-36
MT-42	0.280 MGD	65 gpm	95 gpm	130 gpm	42 in.	2½ in.	MT-42
MT-48	0.367 MGD	85 gpm	125 gpm	170 gpm	48 in.	3 in.	MT-48
MT-54	0.475 MGD	110 gpm	160 gpm	220 gpm	54 in.	3 in.	MT-54
MT-60	0.580 MGD	135 gpm	190 gpm	270 gpm	60 in.	4 in.	MT-60
MT-72	0.842 MGD	195 gpm	280 gpm	400 gpm	72 in.	4 in.	MT-72
MT-84	1.15 MGD	265 gpm	380 gpm	530 gpm	84 in.	6 in.	MT-84
MT-96	1.52 MGD	350 gpm	500 gpm	700 gpm	96 in.	6 in.	MT-96
MT-120	2.37 MGD	550 gpm	780 gpm	1100 gpm	120 in.	6 in. (8 in.)	MT-120

(1) Daily Capacity based on 24 hour operation of 3 train system operating at normal service flow rate of 7 gpm/ft² per train.
(2) Service flow rates based on 7 gpm/ft² per train. When one train of the 3 train system is in backwash, the remaining 2 trains will operate at 10.5 gpm-ft².
(3) The backwash flow rate of both the clarifier and filter are approximately 14 gpm/ft². The clarifier eductor draws 2-3 cfm/ft² air during the scour cycle for additional mineral bed expansion.
(4) Pipe size selection is based on a maximum velocity of 5 fps at the Normal Service flow rate.
(5) Total water usage per train is 225 gallons per sq ft of filter tank area. This includes 140 gallons of influent water for clarifier backwash and system rinse plus 85 gallons of filtered water for depth filter backwash



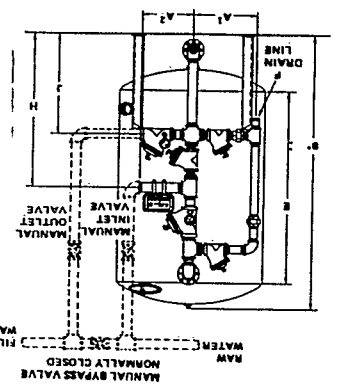
LINEMASTER SWITCH
ADMINISTRATIVE RECORD

Printed in USA Rev. 10/82 No. 8162-03

Culligan

42 - 64 INCH
HI-FLO® FILTERS
DEPTH AND CULLAN®
TECHNICAL DATA SHEET

FRONT VIEW

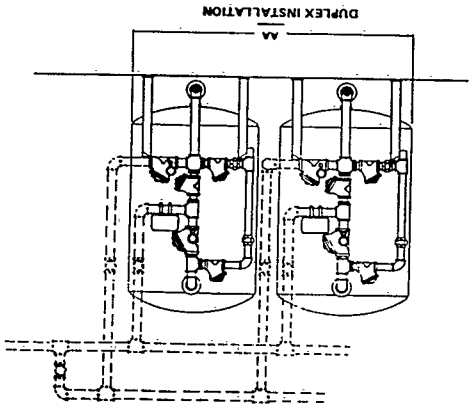


MODEL	DIMENSIONS													DRAIN FLOW		
	A1	A1	AA	B*	C	D_{Dia}	E	F	G	H	J	K	STANDARD	MIN QUADRA-KLEEN™	OPERATING WEIGHT
HD-42	17in. 43 cm	16 in. 41 cm	90 in. 229 cm	86 in. 218 cm	51 in. 130 cm	42 in. 107 cm	80 in. 152 cm	3 in.	3 in. 90 cm	38 in. 97 cm	22 in. 56 cm	47 in. 119 cm	136 gpm 515 lpm	226 gpm 855 lpm	6,850 lb. 3 100 kg
HD-48	18 in. 41cm	16 in. 41 cm	102 in. 259 cm	92 in. 234 cm	62 in. 157 cm	48 in. 122 cm	80 in. 152 cm	3 in.	3 in. 114 cm	45 in. 76 cm	30 in. 147 cm	58 in. 147 cm	188 gpm 712 lpm	324 gpm 1 226 lpm	8,850 lb. 4 020 kg
HD-60	20 in. 51 cm	22 in. 56 cm	126 in. 320 cm	98 in. 241 cm	77 in. 196 cm	60 in. 152 cm	80 in. 152 cm	3 in.	4 in. 112 cm	44 in. 56 cm	23 in. 160 cm	71 in. 1 022 lpm	270 gpm 1 022 lpm	480 gpm 1 817 lpm	13,390 lb. 6 350 kg
HD-72	43 in. 109 cm	41 in. 104 cm	175 in. 445 cm	94 in. 239 cm	88 in. 224 cm	72 in. 183 cm	60 in. 152 cm	4 in.	6 in. 193 cm	78 in. 66 cm	26 in. 206 cm	82 in. 208 cm	400 gpm 1 510 lpm		20,000 lb. 9 130 kg
HD-84	49 in. 124 cm	41 in. 104 cm	200 in. 508 cm	97 in. 246 cm	94 in. 239 cm	84 in. 214 cm	60 in. 152 cm	6 in.	8 in. 197 cm	75 in. 89 cm	27 in. 221 cm	87 in. 221 cm	540 gpm 2 050 lpm		27,300 lb. 12 400 kg
HR-42	15 in. 36 cm	17 in. 43 cm	90 in. 229 cm	86 in. 218 cm	51 in. 130 cm	42 in. 107 cm	60in. 152 cm	2⅞ in.	2⅞ in. 104 cm	41 in. 64 cm	25 in. 119 cm	47 in. 119 cm	90 gpm 341 lpm		5,120 lb. 2 325 kg
HR-48	15 in. 38 cm	18 in. 46 cm	102 in. 259 cm	92 in. 234 cm	60 in. 152 cm	48 in. 122 cm	60 in. 152 cm	3 in.	2⅝ in. 119 cm	47 in. 79 cm	31 in. 142 cm	56 in. 142 cm	130 gpm 492 lpm		7,120 lb. 3,230 kg
HR-60	18 in. 46 cm	20 in. 51 cm	126 in. 320 cm	98 in. 241 cm	77 in. 196 cm	60 in. 152 cm	80 in. 152 cm	3 in.	3 in. 127 cm	50 in. 60 cm	27 in. 178 cm	70 in. 178 cm	210 gpm 795 lpm		11,160 lb. 5 070 kg

CULLAR®

DEPTH

DUPLEX INSTALLATION

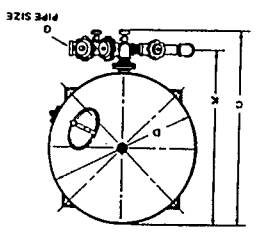


NOTES:
(1) PIPE AND FITTINGS SHOWN DOTTED TO BE FURNISHED BY OTHERS.
(2) AN ELECTRICAL OUTLET SHOULD BE PROVIDED WITHIN FIVE FEET OF THE EQUIPMENT LOCATION
(3) INSIDE DIAMETER - ALLOW A MINIMUM OF 3 INCH FOR OUTSIDE CLEARANCE.

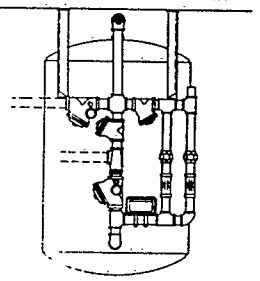
OVERALL HEIGHT BASED ON STANDARD NON CODE CONSTRUCTION. SPECIALLY CONSTRUCTED TANKS DESIGNED FOR HIGHER WORKING PRESSURES AND A.S.M.E. CODE CONSTRUCTED TANKS ARE SLIGHTLY TALLER. CONSULT FACTORY IF HEIGHT IS CRITICAL. ALLOW 24-INCHES ABOVE FILTER FOR FILLING

ALL DIMENSIONS ARE ± 1 INCH AND ARE SUBJECT TO CHANGE WITHOUT NOTICE.

TOP VIEW



HI-FLO™ DEPTH FILTER SHOWING
QUADRA-KLEEN™ BACKWASH SYSTEM
Consult factory for details



- LIGHTING
- HEATING

Hose down blower heater

2 to 40 kW

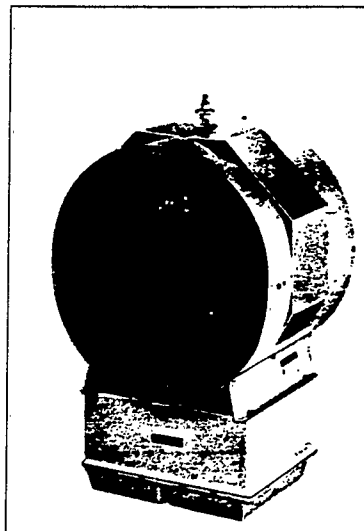
120 to 575V

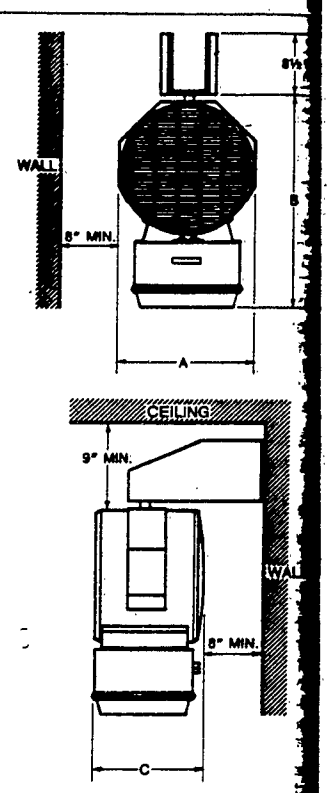
U.L. Listed

Built-in Controls
Corrosion Resistant
Washable, Watertight

Factory Pre-wired
Swivel Mounting Bracket

Type HDH





kW	Volts	Phase	Dimensions (inches) A	B	C
2.5-5.0	120-277	1	13¾	22½	12
5.0	480	1	13¾	24½	14
7.5	208-480	1			
5.0-7.5	208-575	3			
10.0-20.0	All	1.3	17	27	14
25.0-39.0	480,575	3	21⅛	30¼	16

Applications

☐ Ideal for comfort heating or freeze protection in "clean areas" or non-hazardous dusty/dirty environments which periodically require cleaning — can be hosed down. Locations include:
☐ Coal handling areas (non-hazardous)
☐ Food processing plants
☐ Foundries
☐ Car washes
☐ Cement plants
☐ Steel mills
☐ Canneries or dairies
☐ Waste water treatment plants.

Features

Monel Fintube® elements — attached to junction box with leak-proof threaded fittings for maximum corrosion resistance.

Anodized Aluminum case — Stainless or epoxy painted steel available on special order.

NEMA 4X molded fiberglass junction box — houses built in controls which include two power contactors (primary & backup), motor contactor and fused transformer for 120V control circuit. Branch circuit protection and temperature control must be provided separately and remotely mounted.

Stainless steel swivel wall mounting bracket — included with heater.

Built-in overtemperature protection — provided by epoxy sealed automatic and manual (back up) reset thermal cutouts.

Epoxy sealed thermal fan delay — allows fan motor to continue to operate after heating thermostat has been satisfied to maximize transfer of generated heat to space being heated and extend operating life of heating elements.

Totally enclosed fan motor — Permanently lubricated ball bearings for long life. Resistant to moisture and corrosion (⅓ hp, 460V, 3 phase).

All hardware stainless steel.

Aluminum fan. Finished same as outlet grille.

Adjustable louvered outlet grille — to direct air flow up or down. Painted with one coat zinc chromate primer and two coats of corrosion resistant paint for added moisture and corrosion protection.

Heavy gauge rear wire grille — protects against accidental contact with the rapidly rotating fan. Finished same as outlet grille.

Recommended temperature control — Chromalox WCRT-100 thermostat. (See Controls section).

Options

Case
Heavy gauge anodized aluminum or epoxy painted steel.

Pilot light
Indicates when power is on.

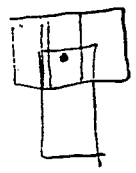
Three-position switch
Internal heat-cool switch (heater on, heater off, fan only) permits air flow with or without energizing the heating elements. The switch is accessible from outside the NEMA 4X enclosure.

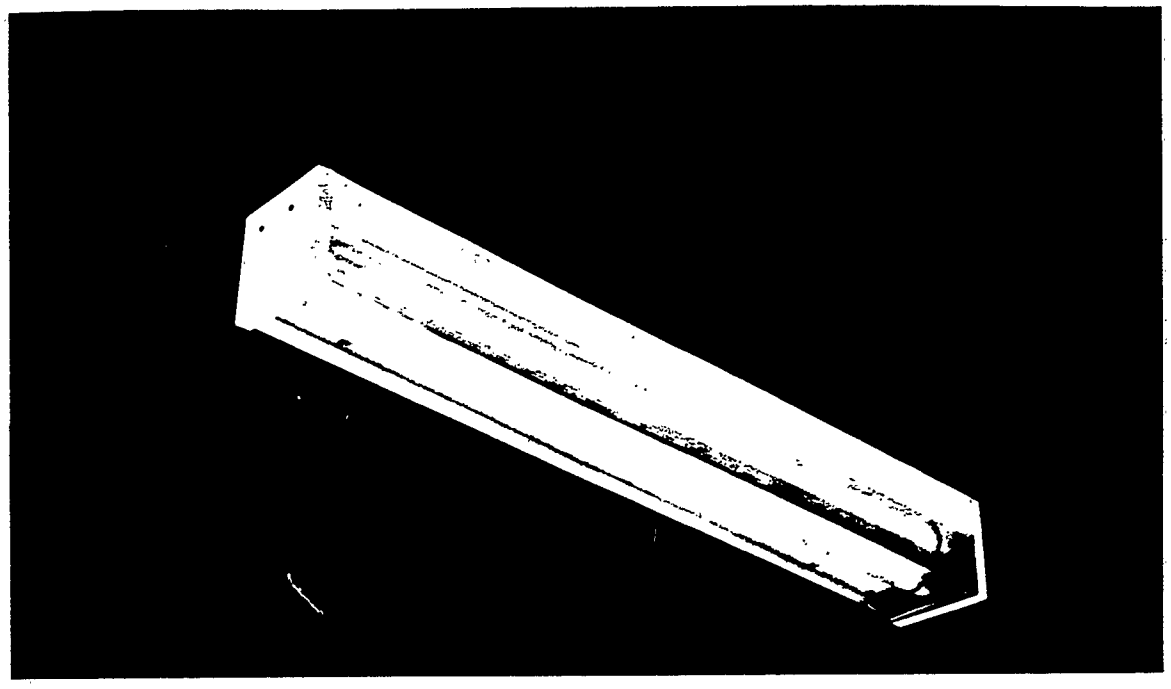
Thermostat
Internal thermostat with a temperature range of 40°-100°F has an adjustable control knob outside the NEMA 4X enclosure.

Additional ratings available — contact your local Chromalox representative.

Hose down blower heater

Heater kW	Volts	Phase	Amps	Motor Volts	Phase	Output BTU/Hr.	Air Temp. Rise °F	Air Velocity Ft./Min.	Air Volume CFM	Horizontal Air Throw Ft.	Catalog Number	Stock States	PCN	Wt. Lbs.
2.0	120	1	16.7	115	1	6824	21	430	405	12.5	HDH-200	NS	211123	56
2.0	208	1	9.6	208	1	6824	21	430	405	12.5	HDH-200	$	211131	56
2.0	240	1	8.3	240	1	6824	21	430	405	12.5	HDH-200	NS	211140	56
2.0	277	1	7.2	277	1	6824	21	430	405	12.5	HDH-200	NS	211158	56
3.0	120	1	25.0	115	1	10,236	31	430	405	12.5	HDH-300	NS	211166	56
3.0	208	1	14.4	208	1	10,236	31	430	405	12.5	HDH-300	NS	211174	56
3.0	240	1	12.5	240	1	10,236	31	430	405	12.5	HDH-300	$	211182	56
3.0	277	1	10.8	277	1	10,236	31	430	405	12.5	HDH-300	NS	211190	56
5.0	208	1	24.0	208	1	17,060	40	430	405	12.5	HDH-500	NS	211203	68
5.0	240	1	20.8	240	1	17,060	40	430	405	12.5	HDH-500	$	211211	68
5.0	277	1	18.1	277	1	17,060	40	430	405	12.5	HDH-500	NS	211220	68
5.0	480	1	10.4	480	1	17,060	40	430	405	12.5	HDH-500	NS	211238	68
5.0	208	3	13.9	208	1	17,060	40	430	405	12.5	HDH-500	NS	211246	68
5.0	240	3	12.0	240	1	17,060	40	430	405	12.5	HDH-500	NS	211254	68
5.0	480	3	6.0	480	1	17,060	40	430	405	12.5	HDH-500	$	211262	68
5.0	575	3	5.0	115	1	17,060	40	430	405	12.5	HDH-500	NS	211270	68
7.5	208	1	36.1	208	1	25,590	37	640	590	13	HDH-750	NS	211289	68
7.5	240	1	31.3	240	1	25,590	37	640	590	13	HDH-750	NS	211297	68
7.5	277	1	27.1	277	1	25,590	37	640	590	13	HDH-750	NS	211300	68
7.5	480	1	15.6	480	1	25,590	37	640	590	13	HDH-750	NS	211318	68
7.5	208	3	20.8	208	1	25,590	37	640	590	13	HDH-750	$	211326	68
7.5	240	3	18.1	240	1	25,590	37	640	590	13	HDH-750	NS	211334	68
7.5	480	3	9.0	480	1	25,590	37	640	590	13	HDH-750	$	211342	68
7.5	575	3	7.5	115	1	25,590	37	640	590	13	HDH-750	NS	211350	68
10.0	240	1	41.7	240	1	34,120	28	800	1180	40	HDH-1000	NS	211369	78
10.0	277	1	36.1	277	1	34,120	28	800	1180	40	HDH-1000	NS	211377	78
10.0	480	1	20.8	480	1	34,120	28	800	1180	40	HDH-1000	NS	211385	78
10.0	208	3	27.8	208	1	34,120	28	800	1180	40	HDH-1000	NS	211393	78
10.0	240	3	24.1	240	1	34,120	28	800	1180	40	HDH-1000	$	211406	78
10.0	480	3	12.0	480	1	34,120	28	800	1180	40	HDH-1000	$	211414	78
10.0	575	3	10.1	115	1	34,120	28	800	1180	40	HDH-1000	NS	211422	78
12.5	277	1	45.1	277	1	42,650	36	800	1180	40	HDH-1250	NS	211430	78
12.5	480	1	26.0	480	1	42,650	36	800	1180	40	HDH-1250	NS	211449	78
12.5	208	3	34.7	208	1	42,650	36	800	1180	40	HDH-1250	NS	211457	78
12.5	240	3	30.1	240	1	42,650	36	800	1180	40	HDH-1250	NS	211465	78
12.5	480	3	15.1	480	1	42,650	36	800	1180	40	HDH-1250	NS	211473	78
12.5	575	3	12.6	115	1	42,650	36	800	1180	40	HDH-1250	NS	211481	78
15.0	480	1	31.3	480	1	51,180	32	900	1330	45	HDH-1500	NS	211496	78
15.0	208	3	41.7	208	1	51,180	32	900	1330	45	HDH-1500	$	211502	78
15.0	240	3	36.1	240	1	51,180	32	900	1330	45	HDH-1500	NS	211510	78
15.0	480	3	18.1	480	1	51,180	32	900	1330	45	HDH-1500	$	211529	78
15.0	575	3	15.1	115	1	51,180	32	900	1330	45	HDH-1500	NS	211537	78
19.5	240	3	47.0	240	1	66,534	42	900	1330	45	HDH-2000	NS	211545	78
20.0	480	1	41.7	480	1	68,240	42	900	1330	45	HDH-2000	NS	211553	78
20.0	480	3	24.1	480	1	68,240	42	900	1330	45	HDH-2000	$	211561	78
20.0	575	3	20.1	115	1	68,240	42	900	1330	45	HDH-2000	NS	211570	78
25.0	480	3	30.1	480	3	85,300	42	740	1800	48	HDH-2500	$	211019	90
25.0	575	3	25.1	575	3	85,300	42	740	1800	48	HDH-2500	NS	211588	90
30.0	480	3	36.1	480	3	102,360	50	740	1800	48	HDH-3000	$	211027	90
30.0	575	3	30.2	575	3	102,360	50	740	1800	48	HDH-3000	NS	211596	90
35.0	480	3	42.1	480	3	119,420	57	740	1800	48	HDH-3500	NS	211609	90
35.0	575	3	35.2	575	3	119,420	57	740	1800	48	HDH-3500	NS	211617	90
39.0	480	3	47.0	480	3	133,068	65	740	1800	48	HDH-4000	$	211035	90
39.0	575	3	39.2	575	3	133,068	65	740	1800	48	HDH-4000	NS	211625	90





Specifications

DESCRIPTION:

The M5000 series is an all-aluminum weather resistant fluorescent luminaire designed primarily for outdoor use under protected areas. This fixture is completely enclosed by a clear DR-acrylic diffuser and fully gasketed to withstand moisture and dirt. Most sizes and combinations use a low temperature ballast for reliable service under cold conditions. Suggested applications include; the illumination of parking garages, and use under canopies, soffits, and facades. Indoor use is possible in cold storage areas or high humidity areas.

CONSTRUCTION:

Housing, end plates, and reflectors are completely die formed of .040" thick quality aluminum. All other components and hardware are aluminum or stainless steel which will not rust. Available nominal sizes include, but are not limited to, 4ft., and 8ft. The end plates which close off the fixture are gasketed with urethane. Along both sides of the housing lies continuous urethane gasketing to create a tight seal against the plastic diffuser. A gasketed joiner band is provided for the middle of all 8ft. units for added support of the diffuser. The same joiner band is available for end-to-end mounting in continuous rows.

ELECTRICAL:

Units are available wired for one or two lamps either in a rapid start, slimline, or high output circuit. Tandem wiring of two units to operate from a single ballast is available. All electrical components are U.L. approved. One lamp rapid start ballasts are class "P", L.P.F., unless specified H.P.F. Two lamp rapid start, all slimline, and all high output ballasts are class "P", H.P.F., CBM-ETL where available. Units are wired for 110-125 volt, 60 HZ. AC, or as specified. All rapid start and two lamp slimline ballasts are rated for +50°F operation, unless units are specified with optional available 0°F low temperature ballasts. One lamp slimline ballasts are rated for 0°F operation. High output ballasts are rated for −20°F operation, unless specified differently. Sufficient knockouts are provided on the back for electrical feeds. Although no knockout is provided in the end plate, surface conduit entry can be made into the end of the fixture by going through the end plate and using a chase nipple into the 7/8" hole in the socket plate. Fixtures bear I.B.E.W.-A.F.L. and U.L. labels.

DIFFUSER:

The clear, one-piece plastic diffuser provided is extruded from a .110" thick DR-acrylic mixture for maximum strength and long-lasting coloration. The outside is smooth for dirt resistance and ease of cleaning. Large linear prisms line the total inside surfaces for maximum light dispersal, freedom from glare, and lamp obscurity. The diffuser has a snug fit against the continuous gasketing. It is held in place by the end plates and on 8ft. units by an additional center joiner band.

MOUNTING:

Units are designed for surface mounting either individually or in continuous rows. Individual units are supplied with two end plates. Tandems are supplied with two end plates and one gasketed joiner band. For longer continuous rows, the proper number of ends and joiners will be supplied if specified.

FINISH:

Aluminum parts are put through a multi-cleansing process afterwhich a high quality white enamel is sprayed on and baked at 350°F. Will provide a reflectivity of 88%.

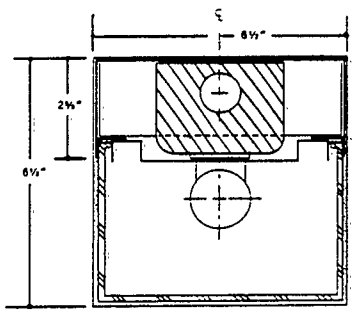
MERCURY

25 BRIGHTON AVENUE, PASSAIC, NEW JERSEY 07055 □ 201-779-5400 □ 212-695-6100

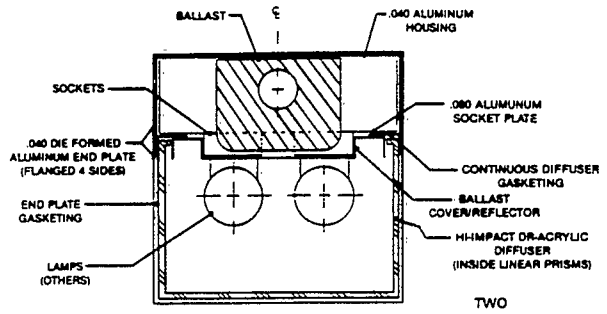
M5000 Series

Dimensional Data

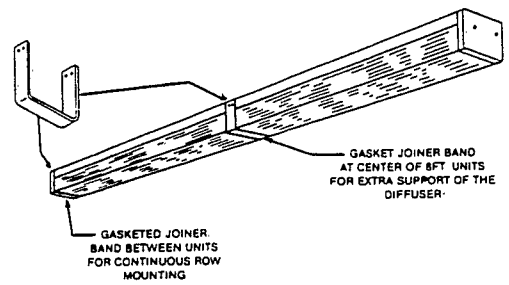
CROSS SECTION



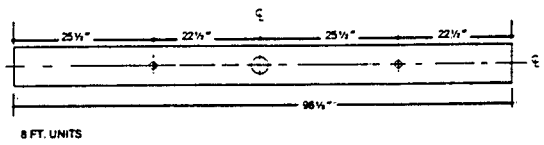
ONE LAMP



TWO LAMP



BACK PLANS



8 FT. UNITS

⊖ = 2⅛" K.O.
⊖ = ½" K.O.

NOTE: CONSULT SALES DEPARTMENT FOR 4FT. INFORMATION

Ordering Data

TYPE	NOMINAL SIZE (FT.)	CATALOG NO.	DESCRIPTION	STARTING TEMP.	LENGTH (IN.)
RAPID START (430 MA.)	4	M5000-140-RS	1-40W F40 LPF	+50°F	48⅛"
		M5000-240-RS	2-40W F40 HPF	+50°F	
		M5000-140-RS-0°DEG	1-40W F40 HPF	0°F	
		M5000-240-RS-0°DEG	2-40W F40 HPF	0°F	
SLIMLINE (430 MA.)	4	M5000-148	1-39W F48 HPF	0°F	48⅛"
		M5000-248	2-39W F48 HPF	+50°F	
	8	M5000-196	1-75W F96 HPF	0°F	96⅛"
		M5000-296	2-75W F96 HPF	+50°F	
		M5000-296-0°DEG	2-75W F96 HPF	0°F	
	16	M5000-196/16T	2-75W F96 HPF	+50°F	192⅛"[1]
HIGH OUTPUT (800 MA.)	4	M5000-148-HO	1-60W F48/HO HPF	−20°F	48⅛"
		M5000-248-HO	2-60W F48/HO HPF	−20°F	
	8	M5000-196-HO	1-110W F96/HO HPF	−20°F	96⅛"
		M5000-296-HO	2-110W F96/HO HPF	−20°F	
	16	M5000-196/16T-HO	2-110W F96/HO HPF	−20°F	192⅛"[1]

TYPE	CATALOG NO.	DESCRIPTION
ACCESSORIES AND ADDERS	-HPF	HIGH POWER FACTOR
	-277V	277V HPF
	-ESB	ENERGY SAVING BALLAST[2]
	-EM. PK.	EMERGENCY PACK
	-JB-5000	GASKETED JOINER BAND[3]

NOTES:

1 - Two 8ft. housings, one two lamp ballast, one joiner band.
2 - ESB, where available.
3 - For continuous row mounting, specify row information to obtain proper number of joiner bands and end plates.

DIMENSIONS SUBJECT TO CHANGE. CONSULT FACTORY FOR VERIFICATION.

DISCHARGE PERMIT APPLICATION
(SEPARATE DOCUMENT)

DLB1219A91\86088

APPENDIX F
EMERGENCY DISCHARGE AUTHORIZATION

FEASIBILITY STUDY REPORT
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
AUGUST 1992

86088\DLB0717A.WP

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

February 10, 1992

EMERGENCY DISCHARGE AUTHORIZATION

Mr. John Maloney
Linemaster Switch Corporation
29 Plaine Hill Road
P.O. Box 238
Woodstock, CT 06281-0238

Re: DEP/WPC 169-004
Location: 29 Plaine Hill Road
Woodstock, CT

Dear Mr. Maloney:

In accordance with Section 22a-449 of Chapter 446k, Connecticut General Statutes, as amended, an emergency authorization for the temporary discharge of pretreated groundwater from a recovery system to the waters of the State is hereby granted to Linemaster Switch Corporation for the site located at 29 Plaine Hill Road, Woodstock. Linemaster Switch Corporation shall ensure that the following terms and conditions are met.

1. All treatment facilities as described in the report entitled Design Report Interim Removal Treatment System for Linemaster Switch Corporation, Woodstock, Connecticut dated December 1991 and letter dated February 4, 1992 which were submitted by Fuss & O'Neill, Inc. for Linemaster Switch Corporation shall be installed with the following conditions, and a letter verifying such installation shall be filed with the Commissioner prior to initiation of the discharge.

   A) All gravity piping from the treatment system to pond 1 and from pond 1 to pond 3 shall be tested for infiltration and exfiltration. The maximum infiltration shall be 25 gallons/inch diameter/mile of sewer.

   B) At least two impervious trench dams shall be installed on the 6" gravity effluent line between the treatment system and the pond.

   C) A circular chart recorder shall be included to record flow measurements from the flow meter on the treatment system effluent.

   D) Carbon filters may not be backwashed on-site.

2. The groundwater shall be collected, pretreated and discharged to Mill Brook via a direct discharge to on-site Pond 3 then through a gravity fed pipe to on-site Pond 1, into a swale and then into Mill Brook, in accordance with the above referenced report and letter.

3. The discharge from the treatment system shall not exceed and shall otherwise conform to the following limitations and shall be monitored in accordance with the schedule below. Monitoring results shall be submitted to Naomi Davidson of the Bureau of Water Management within 30 days of sampling.

   A) Maximum Daily Flow - 130,320 gallons per day

   B) Maximum Allowable Concentration (discharge from secondary GAC Unit to Pond 3)

Parameter	Code	Maximum Concentration	Sample Type
1,2 Dichloroethane	442-028	<1 ug/l	Grab
1,1 Dichloroethylene	443-028	<7 ug/l	Grab
Tetrachloroethylene (PCE)	458-028	<5 ug/l	Grab
Trichloroethylene (TCE)	462-028	<5 ug/l	Grab
Vinyl Chloride	463-028	<2 ug/l	Grab
Total Volatile Hydrocarbons by EPA Method 8010 and 8020*	892-028	10 ug/l	Grab

*Sum of the concentrations of all compounds listed as being detectable by EPA Methods 8010 and 8020 (excluding MTBE), which are present at levels greater than non-detectable (ND).

   C) Sampling Frequency - Monitor discharge from secondary GAC filter every other day for the first two weeks following initiation of the discharge, weekly for the next month, and then monthly for the duration of this authorization.

   D) The monitoring report shall include the concentration of all EPA Method 8010 and 8020 parameters (including those that are not detected), the total flow (Code 626-007) and the number of hours of discharge (Code 626-079) for each day of sample collection and the instantaneous flow (Code 627-078) at the time of grab sample collection.

4. If any of the above limitations are exceeded, the operator shall immediately cease discharging and notify Naomi Davidson of the Engineering and Enforcement Division of the Bureau of Water Management.

5. Effective upon initiation of the discharge, Linemaster Switch Corporation shall begin quarterly monitoring for aquatic toxicity. Monitoring shall be conducted according to the protocol established for determining compliance with acute or chronic toxicity limits set forth below. If any monitoring result indicates that the maximum daily acute toxicity limit has been exceeded, additional testing as required by paragraph 5.B shall be performed.

ACUTE AND CHRONIC TOXICITY

A) Effective upon issuance of this authorization, a daily composite or grab sample of the effluent shall not exhibit acute or chronic toxicity in the receiving body (discharge pipe outlet).

(1) Dilution equivalent to 0 gallons per hour (gph) is allocated to a zone of influence for assimilation of toxicity.

(2) Compliance with this authorization condition shall be achieved when there is no significant mortality in an undiluted daily composite or a grab sample of the effluent as determined by the pass/fail methodology in Section 22a-430-3(j)(7)(A) of the Regulations of Connecticut State Agencies.

(3) Monitoring to determine compliance with this limit shall be performed following the toxicity testing protocol for static acute toxicity tests in "Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms" (EPA 600/4-85/013) with the following specifications:

(i) Neonatal Daphnia pulex (less than 24 hours old) and juvenile Pimephales promelas (30 +/- 5 days old) shall be used as test organisms.

(ii) Synthetic freshwater prepared as described in EPA 600/4-85/013 and adjusted to a hardness of 50 mg/l as $CaCO_3$ shall be used as dilution water in the tests.

(iii) Test duration shall be 48 hours for Daphnia pulex and 96 hours for Pimephales promelas.

(4) Each effluent sample shall be analyzed for the following parameters: copper, lead, nickel, zinc, total oil and grease, total dissolved solids, pH, surfactants, ammonia and volatile organic compounds including MTBE following EPA Methods 8010 and 8020.

B) (1) If any test result indicates that the maximum daily toxicity limit for the effluent has been exceeded, a second sample of the effluent shall be collected and an LC_{50} value shall be determined as described above and the results shall be reported to Rose Gatter-Evarts of the Water Management Bureau within 30 days of the receipt of the first set of test results.

(2) In determining LC_{50} values, five (5) test concentrations, in duplicate, shall be utilized.

(3) The LC_{50} value shall be determined by the computational method (Binomial Distribution, Probit Analysis, Moving Average Angle, Spearman-Karber) which yields the smallest 95% confidence interval and LC_{50} value which is consistent with the dose-response data.

(4) Any test in which the survival of test organisms is less than ninety (90) percent in any replicate control test chamber or failure to achieve test conditions as specified in Section 22a-430-3(j)(7)(A) of the Regulations of Connecticut State Agencies, such as maintenance of appropriate environmental controls, shall constitute an invalid test and will require immediate retesting. Failure to submit valid test results constitutes an authorization violation.

(5) Results of the toxicity tests required as part of this authorization condition, including all supporting chemical/physical measurements performed in association with the toxicity tests, as well as dose/response data shall be entered on the Aquatic Toxicity Monitoring Report form (ATMR). The ATMR shall be sent to:

Ms. Rose Gatter-Evarts
Aquatic Toxicity
Connecticut DEP
122 Washington Street
Hartford, CT 06106

(6) If any two consecutive tests results or any three test results in a single year indicate that the maximum daily toxicity limit has been exceeded, Linemaster Switch Corporation shall immediately take all reasonable steps to eliminate toxicity wherever possible and shall submit a report for the review and approval of the Commissioner in accordance with Section 22a-430-3(j)(10)(c) of the Regulations of Connecticut State Agencies describing proposed steps to eliminate the toxic impact of the discharge on the receiving waterbody. Such a report shall include a time schedule to accomplish toxicity reduction.

6. In addition to monitoring the discharge from the treatment system, the following internal points shall be monitored in accordance with the schedule outlined below and the results shall be submitted to Naomi Davidson of the Bureau of Water Management within 30 days of sampling. The monitoring report shall include the concentration of all EPA Method 8010 and 8020 parameters (including those that are not detected), and the total flow for that monitoring period.

Sampling Point	Sampling Frequency	Parameters
Influent from well MW-1db, MW-6db MW-14db, MW-15db, MW-17db, GW-10db, GW-12db	Monthly	EPA Method 8010 and 8020
Influent to air stripper	Monthly	EPA Method 8010 and 8020
Effluent from air stipper	Monthly	EPA Method 8010 and 8020
Effluent from primary GAC filter	Monthly	EPA Method 8010 and 8020

7. This authorization is subject to the same requirements of Sections 22a-430-3 and 22a-430-4 of the Regulations of Connecticut State Agencies that otherwise apply to discharge permit holders except as superseded by the conditions included herein.

8. This authorization shall expire upon coverage of this discharge by a general permit or 90 days following commencement of the discharge unless a complete discharge permit application has been submitted to the Commissioner. If a complete discharge permit application has been submitted, this authorization shall expire upon issuance of a discharge permit in accordance with Section 22a-430 of the Connecticut General Statutes; or immediately upon notification of a tentative determination to deny a permit, whichever is sooner. Should the Commissioner fail to act upon a complete application, this authorization shall remain in effect until such time as a permit is issued or upon notification of a tentative determination to deny a permit.

9. This authorization may be revoked by the Commissioner at any time.

10. Linemaster Switch Corporation shall notify Naomi Davidson of the Water Management Bureau of the date of commencement and discontinuance of the discharge.

11. All sample analyses which are required by this Authorization, and all reporting of such analyses, shall be done by a laboratory certified by the Connecticut Department of Health Services.

12. This authorization does not relieve the discharger of the obligation to obtain any other authorizations as may be required by Federal, State or Local laws or regulations.

Sincerely,

Adrian P. Freund
Chief
Water Management Bureau

APF:ND

cc: David Bramley
Gary Kennett
Michael Nalipinski
Alfred Smith
Leslie White

APPENDIX G
AIR PERMIT

FEASIBILITY STUDY REPORT
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
AUGUST 1992

86088\DLB0717A.WP

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

December 23, 1991

Mr. John W. Maloney
Linemaster Switch Corporation
29 Plaine Hill Road
Woodstock, Connecticut 06281

Dear Mr. Maloney:

Enclosed are certified copies of your original permit to operate a packed tower aeration ground water treatment system (air stripper) at the above location.

This letter does not relieve you of the responsibility to comply with the requirements of other appropriate Federal, State, and municipal agencies. The permit is not transferable from one permittee to another (without prior written notification), from one location to another (unless the subject equipment is a portable rock crusher), or from one piece of equipment to another. The permits must be posted for easy access at the site of operation.

Permit renewal applications must be filed at least one hundred twenty (120) days prior to the permit expiration date, if applicable. Any physical change, change in the method of operation, or addition to this source which constitutes a "modification" pursuant to Section 22a-174-1 may subject this permit to revision under Section 22a-174-3. Any such changes should first be discussed with Mr. Thomas F. Bythrow of the Bureau of Air Management, by calling (203)566-8230.

Sincerely,

Steven E. Peplau

Steven E. Peplau
Director
Engineering & Enforcement

SEP:emw

12/26/91

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

PAGES 2 THROUGH 5 ARE HEREBY INCORPORATED BY REFERENCE INTO THIS PERMIT

TOWN NO.	PREMISE NO.	PERMIT NO.	STACK NO.
217	2	0001	01

EQUIPMENT CLASSIFICATION
☐ FUEL BURNING ☐ INCINERATOR ☒ PROCESS MFG. OTHER _____

DATE ISSUED: 12/23/91

EXPIRATION DATE (NONE UNLESS NOTED):

PERMIT TO : ☐ CONSTRUCT ☒ OPERATE OTHER _____

PREMISE TYPE :
- ☐ PREMISE W/ POTENTIAL EMISSIONS ≥ 100 TPY WITHOUT PERMIT (i.e., EPA—"MAJOR SOURCE")
- ☐ PREMISE W/ POTENTIAL EMISSIONS ≥ 100 TPY WITH PERMIT (i.e., EPA—"MAJOR SOURCE")
- ☒ PREMISE W/ POTENTIAL EMISSIONS < 100 TPY (i.e., EPA—"MINOR SOURCE")

TYPE OF POLLUTANT FOR WHICH A PREMISE IS A "MAJOR SOURCE" :

☐ SO_2	☐ SO_2
☐ NO_x	☐ NO_x
☐ CO	☐ CO
☐ TSP	☐ TSP
☐ VOC	☐ VOC
☐ PM—10	☐ PM—10
OTHER _____	OTHER _____

TYPE OF MODIFICATION : ☐ MAJOR MODIFICATION ☐ MINOR MODIFICATION ☒ NEW SITING

TYPE OF SOURCE :
- ☐ A1 SOURCE (ACTUAL EMISSIONS ≥ 100 TPY OR FOR A PREMISE WITH CONTROLS, POTENTIAL EMISSIONS ≥ 100 TPY)
- ☐ A2 SOURCE (ACTUAL EMISSIONS < 100 TPY, AND:
  1) FOR A PREMISE WITHOUT CONTROLS, POTENTIAL EMISSIONS ≥ 100 TPY, OR
  2) FOR A PREMISE WITH CONTROLS, MAXIMUM UNCONTROLLED EMISSIONS ≥ 100 TPY)
- ☒ B SOURCE ☐ NSPS SOURCE ☐ NESHAPS SOURCE

LOCATION OF EQUIPMENT (No. & Street, Town, Zip)
29 PLAINE HILL ROAD, P.O. BOX 238, WOODSTOCK, CONNECTICUT 06281

FIRM NAME
LINEMASTER SWITCH CORPORATION

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

TOWN NO.	PREMISE NO.	PERMIT NO.	STACK NO.
217	2	0001	01

EQUIPMENT CLASSIFICATION
☐ FUEL BURNING ☐ INCINERATOR ☒ PROCESS MFG. OTHER _____

DATE ISSUED: 12/23/91

EXPIRATION DATE (NONE UNLESS NOTED):

THE FOLLOWING SHALL BE CONSTRUCTED/OPERATED IN ACCORDANCE WITH THE SPECIFICATIONS LISTED IN THE PERMIT APPLICATION, WITH THE TERMS OF THE PERMIT LETTER, AND WITH ALL APPLICABLE SECTIONS OF THE CONNECTICUT "ADMINISTRATIVE REGULATIONS" FOR THE ABATEMENT OF AIR POLLUTION."

EQUIPMENT DESCRIPTION (I.D.): PACKED TOWER AERATION GROUND WATER TREATMENT SYSTEM (AIR STRIPPER)

CONDITIONS:

WELL	MAXIMUM FLOW RATE (gal/min)
MW-1db	20
MW-6db	4
MW-10db	10
MW-12db	5
MW-14db	10
MW-15db	50
MW-17db	1.5

MAXIMUM FLOWRATE, ALL WELLS COMBINED: 100.5 gal/min

MINIMUM STACK HEIGHT: 40 feet above grade

MINIMUM DISTANCE FROM STACK TO NEAREST PROPERTY LINE: 150 feet

EXHAUST GAS FLOW RATE: 535 acfm (minimum flow at maximum rated capacity)

PERMIT CONDITIONS:

Flow monitors shall be installed to gauge water flow rate for well MW-10db and for the total water flow rate of all wells combined.

Only those seven wells for which information has been provided to the Bureau of Air Management and which are conditioned under this permit are to be connected to the air stripper.

This air stripper shall be equipped with a mist eliminator with a manufacturer's guarantee of a minimum control efficiency of 99%.

All wells shall be labled accordingly (i.e. MW-1db, MW-6db, etc.)

RECORDS INDICATING CONTINUAL COMPLIANCE WITH ALL ABOVE CONDITIONS MUST BE KEPT ON SITE AT ALL TIMES AND MADE AVAILABLE UPON DEPARTMENTAL REQUEST FOR THE DURATION OF THIS PERMIT.

FIRM NAME: LINEMASTER SWITCH CORPORATION

LOCATION OF EQUIPMENT (No. & Street, Town, Zip): 29 PLAINE HILL ROAD, P.O. BOX 238, WOODSTOCK, CONNECTICUT 06281

APPLICANT'S SIGNATURE: John W. Maloney Exec. Vice Pres.

COMMISSIONER OR HIS REPRESENTATIVE:

PERMIT IS INVALID UNLESS SIGNED BY APPLICANT, SUCH SIGNATURE CONSTITUTING AGREEMENT TO THE CONDITIONS IN THIS PERMIT.

BUREAU OF AIR MANAGEMENT - PERMITS

-ACU-4 NEW 8/88

STATE OF CONNECTICUT
DEPARTMENT OF ENVIRONMENTAL PROTECTION

TOWN NO.	PREMISE NO.	PERMIT NO.	STACK NO.
217	2	0001	01

EQUIPMENT CLASSIFICATION: ☐ FUEL BURNING ☐ INCINERATOR ☒ PROCESS MFG. OTHER _____

DATE ISSUED: 12/23/91

EXPIRATION DATE (NONE UNLESS NOTED):

THE FOLLOWING SHALL BE CONSTRUCTED/OPERATED IN ACCORDANCE WITH THE SPECIFICATIONS LISTED IN THE PERMIT APPLICATION, WITH THE TERMS OF THE PERMIT LETTER, AND WITH ALL APPLICABLE SECTIONS OF THE CONNECTICUT "ADMINISTRATIVE REGULATIONS" FOR THE ABATEMENT OF AIR POLLUTION."

EQUIPMENT DESCRIPTION (I.D.): PACKED TOWER AERATION GROUND WATER TREATMENT SYSTEM (AIR STRIPPER)

CONDITIONS:

RECORDKEEPING:

Records and calculations shall be kept on site at all times indicating the following:

- Pollutant concentration in water (i.e. water test data);
- Maximum Allowable Stack Concentration (MASC) compliance for all hazardous air pollutants specified in Table II of this permit;
- Calculated VOC emission rates in #/hr and TPY.

RECORDS INDICATING CONTINUAL COMPLIANCE WITH ALL ABOVE CONDITIONS MUST BE KEPT ON SITE AT ALL TIMES AND MADE AVAILABLE UPON DEPARTMENTAL REQUEST FOR THE DURATION OF THIS PERMIT.

FIRM NAME: LINEMASTER SWITCH CORPORATION

LOCATION OF EQUIPMENT (No. & Street, Town, Zip): 29 PLAINE HILL ROAD, P.O. BOX 238, WOODSTOCK, CONNECTICUT 06281

TABLE 1 . ALLOWABLE EMISSIONS PAGE 4 OF 5

OPERATING MODE ID: AIR STRIPPER

TOWN NO.	PREMISE NO.	PERMIT NO.	STACK NO.
217	2	0001	01

CRITERIA POLLUTANTS	LB/HOUR				TPY
TSP	2.54E-5				1.11E-4
SO_x expressed as SO_2					
NO_x expressed as NO_2					
HC	0.2				0.876
CO					
Pb					
PM-10					
NON-CRITERIA POLLUTANTS					
H_2SO_4					

COMMENTS : Note: The Bureau of Water Management has issued an order requiring site remediation of the ground water at this facility.

FIRM NAME
LINEMASTER SWITCH CORPORATION

LOCATION OF EQUIPMENT (No. & Street, Town, Zip)
29 PLAINE HILL ROAD, P.O. BOX 238, WOODSTOCK, CONNECTICUT 06281

TABLE 11 , ALLOWABLE EMISSIONS, CONTINUED

OPERATING MODE ID : AIR STRIPPER

TOWN NO.	PREMISE NO.	PERMIT NO.	STACK NO.
217	2	0001	01

NON-CRITERIA POLLUTANTS	LB/HOUR		ASC* (ug/m^3)		TPY
Arsenic			0.20		
Barium			8.69		
Benzene			59.8		
Chromium			2.05		
1,2 Dichloroethylene			2991.0		
Ethylbenzene			206.9		
Lead			0.39		
Nickel			1.34		
Toluene			4471.0		
Trichloroethylene			90720.0		
Xylene			772.6		

COMMENTS : *Allowable Stack Concentration

FIRM NAME
LINEMASTER SWITCH CORPORATION

LOCATION OF EQUIPMENT (No. & Street, Town, Zip)
29 PLAINE HILL ROAD, P.O. BOX 238, WOODSTOCK, CONNECTICUT 06281

APPENDIX H
COST BACK UP

FEASIBILITY STUDY REPORT
LINEMASTER SWITCH CORPORATION
WOODSTOCK, CONNECTICUT
DECEMBER 1992

86088\DLB0717A.WP

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7-15-92	DLB	7/17/92	86-88/2

SHEET NO. 1 of

Linemaster - Cost Estimates

SC-1: NO ACTION

Site security fence - Linemaster would use architecturally appropriate fence.

Approximately $50/L.F.

50/LF x 600 LF = $30,000 (installed, including gates)

Weekly Security Checks

1 hour/week x 52 weeks/year x $25/hr = 1300

approximately $1500

* (Cost estimates from DLB)

FO-#110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
MJD	7-15-92	DLB	7/17/92	86-88

Linemaster - Cost estimates

SHEET NO 2 of

SC-1 to NO ACTION

Well	Sampling Frequency	Analysis
GW-10db, MW-1db, MW-6db, MW-8db, MW-11db, MW-15db, MW-17db, MW-19sb, POND3of 9	Monthly first 6 months, then quarterly.	8240 or 524.2 and Arsenic
All deep bedrock wells (14 wells), intermittent stream at Route 171 17	Quarterly	8240 or 524.2 and Arsenic
MW-1sb, MW-6sb, MW-7sb, MW-8sb, MW-9sb, MW-10t, MW-10sb, MW-11sb, MW-16sb, MW-16t, MW-17sb, MW-17ts, MW-17td, MW-20sb, MW-EPA-Ats, MW-EPA-Atd, MW-EPA-Ash 17	Semiannually	8240 or 524.2 and Arsenic
All other Monitoring Wells 20	Annually	8240 or 524.2 and Arsenic

Lab Costs:

9 wells x $200/sample x 1 samples/well x 4 quarters/year = $ 7,200

17 wells x $200/sample x 3 samples/well x 4 quarters/year = 40,800

17 wells x $200/sample x 1 samples/well x 2 (twice)/year = 6,800

20 wells x $200/sample x 1 sample/well x 1 event/year = 4,000

Labor (sampling): 58,800

say 60,000

9 wells	$40/hr	x 16 hrs/quarter x 4 quarters	= $	2,560
17 wells	$40/hr	x 40 hrs/quarter x 4 quarters	=	6,400
17 wells	40/hr	x 16 hrs/quarter x 2 (twice)/yr	=	1,280
20 wells	40/hr	x 40 hrs/quarter x 1 event/yr	=	1,600
				11,840

say 12000

72000

Total Cost of Sampling and Analysis $ 75,000/yr.

(- Cost estimates from DLB)

FO-#110

FUSS&O'NEILL INC
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
DLB	7/13/92	MJD	7/15/92	86088/2

SHEET NO 3 of

SC-1 : No Action

5-Year Review Cost

Data Analysis & Report

Technician	40 h x $40/hr	=	1600
Hydro/geo	40h x $55/hr	=	2200
Eng	40h x 55/hr	=	2200
PM	40 h x $75/hr	=	3000
Assoc Review	20 h x $90/hr	=	1800
			10,800

Use $15,000 for typing, printing etc

Public Meetings

Preparation	Geo/Eng	40 h x $55/hr	=	$2200
	PM/Assoc	24 h x 85/hr	=	2040
	Drafting	16 h x 40	=	640
	Printing			500
Meeting	$85/h x $90/h x 8h		=	1400
				6780
		say	$	6,000

Present Worth

5y	0.8219	=	17,259
10y	0.6756		14,187
15y	0.5553		11,661
20y	0.4564		9,584
25y	0.3751		7,877
30y	0.3083		6,474
			67,044
		say $	67,000

FO-#110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
MJD	7-15-92	DLB	7/17/92	86-88/2

Linemaster - Costestimates — SHEET NO 4 of

5C-2 & CONTAINMENT

Zone I security fence — same as 5C-1 fence

RCRA CAP *

Excavate & dispose of existing material
2000 c.y. x $20/cy = $40,000

Topsoil (515 cy.) $10/cy = 5150 say $6,000
x 1.5 installed
9,000

Filter Fabric (1500 yd²) $5/yd² = 7500 x 2 for installation = 15,000

Fine sand (500 cy) $10/cy. = 5000 x 2 for installation = 10,000

Synthetic liner (1450 yd²) $5/yd² = 7250 ~ 7500 x 2 install = 15,000

Clay layer (930 cy) $20/cy = 18600 ~ 19000 x 2 install = 38,000

Seed, Fertilize, and Mulch (ind. labor) ≅ 1,000

* Cost estimates From Terry Hinchey / Dean Audet, previous projects

Weekly Security Checks — same as 5C-1

Sampling and Analysis — same as 5C-1

Data Analysis and Report Preparation — same as 5C-1

Public meetings — same as 5C-1

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
MJD	7-8-92	DLB	7/17/92	86-88/2

Linemaster - cost estimates

SHEET NO 5 of

5C-3 : Vacuum Extraction

Zone 1 Security Fence - Same as 5C-1		
Vacuum Extraction System		
Control buildings $7,500/ea x 2 bldgs. =		15,000
Vacuum pumps		30,000
5 HP pump 14000		
15 HP pump 17000		
(= Carbtrol Corp. Estimates)		
Carbon Filters - 2 - 2000 lb. systems		16,000
$8000/ea installed		
Air piping system - assume all 4" ϕ		
650 feet x $25/ft = 16250		20,000
say 20,000 including sawcutting concrete floor		
Water piping system - assume all 4" ϕ		
400 feet x $25/ft = 10,000		12,000
say 12,000 including sawcutting floor		
Extraction wells		
35 wells x $3500/well (includes valves, etc.)		125,000
Protective boxes 35 x $300/ea = 12,250		15,000
		140,000
Site cleanup (restoration)		
12,000 SF x $2/SF		24,000

(Cost estimates from DLB)

FO - # 110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	5-26-92	DLB	7/17/92	86-88 ft

Linemaster — SC-3: Vacuum Extraction — SHEET NO. 6 of

Pumps (Dewatering)

QED Groundwater Specialists

Pneumatic Pumps – Draw-Down Pumping
Gradient Control Total Fluids pumping
low flow pumping

Pulse Pumps:
Alpha – basic pump for TTL Fluids
Need a controller – Pulselink Modular Controllers – Pulse Senders
one per well or two pumps close together
Well Master – level controller one per well needed
Remote well operator – controls up to six wells

Solo pump – no controls needed; simpler to specify, install
total Fluids pump that runs itself – one needed for each well.

Description	unit price	Quantity	Total
Pulse Pump	$495.00	40	19800
Inlet screen for pump	$60.00	40	2400
Pulse sender	$1295.00	7	9065
Remote well operator	$145.00	40	5800
Weather proof enclosure for pulselink modules	245.00	120	4900
4" well cap for 2" pumps (pump depth adjustable)	185.00	140	3400
Controller exhaust valve (when using remote well operator)	98.00	40	3920
In-well Pump Exhaust valve	98.00	40	3920
Total			53205
		Say	55,000

* Costs taken from QED letter to Jim Olson dated April 23, 1992.

FO-#110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7-15-92	DLB	7/17/92	86-88 /2

Linemaster - Cost estimates

SHEET NO. 7 of

SC-3 : Vacuum Extraction

O & M costs

Assume 3 yr. operation spaced over ten years.

Power 20HP * 0.75 * 24hr/day * 365 days * $0.08 = 10,500/yr
10500 x 3/10 = 3150/yr say 3200/yr

Maintenance 8 hr/week x $25/hr x 52 week/yr = 10,400/yr
10,400 x 3/10 = 3000

Sampling and Analysis (gas)

Year 1 12 samples x $200/sample + $100/event collection = $3600
Year 2-10 4 samples x 200/sample + 100/event = 1200/yr

Plus monitoring well sampling same as before (SC-1) 75,000

Present worth of O&M (10 yrs) 4% Discount Rate

Power $3200 x 8.111 = 25,955 say $26,000

Maintenance 3000/yr x 8.111 = 24333 say $24,300

Sampling and Analysis (gas)

1200 x 8.111 = 9733 say 10,000 + 3600 (1st year) = 13600

Operation of system (10 yrs.) - Present worth 63,900
plus carbon 2,000
65,900

say $66,000

(Cost estimates from DLB)

FO-#110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
MJD	7-15-92	DLB	7/17/92	86-88[illegible]

Linemaster - Cost Estimates

SHEET NO 8 of

SC-3 Vacuum Extraction

Replacement Costs

Carbon 1 vessel/yr 2000 lbs. x $1.50/lb = 3000 x 3 yrs. = 9000

over ten years, $1,000/yr.

Disposal consideration - $2/lb. x 2200 lbs/yr x 3 yrs. = 12,000

over ten years, 1200/yr.

Use $2000 ttl/yr.

Equipment replacement - use 25% of cost - in Year 5

25% x (30,000 + 55,000) = 21,250 x 0.8219 = 17,465

say 20,000

(vacuum pumps and dewatering pumps)

Five Year Reviews

Data Analysis and Report Preparation - same as SC-1

Public Meetings - same as SC-1

(Cost estimates from DLB)

FO - # 110

FUSS&O'NEILL
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7-15-92	DLB	7/17/92	86-88/2

Linemaster- Cost Estimate

SHEET NO. 9 of

SC-4 & Air Sparging

Zone 1 Security fence — same as SC-1

Control buildings — same as SC-3
Vacuum pumps — same as SC-3
Carbon Filters — same as SC-3
Piping system - Air — same as SC-3
Water — same as SC-3

Injection blowers
2 blowers x $25,000/ea = 50,000

Injection Wells
34 wells x 3500 = 119,000
Control boxes 34 x 300/ea = 10,200
129,000

Site Restoration — same as SC-3

O&M Costs

Assume 3 yr. operation over ten years

Power
Injection blowers 2 at 25HP → 65HP
Extraction blowers 2 at 75HP

65 x 0.75 x 24hr/day x 365 days x $0.08 = $34000/yr.
34000 x 3/10 = 10,200/yr.

Maintenance — same as SC-3

Sampling and Analysis — same as SC-1

(Costs from DLB)

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
MJD	7-15-92	DLB	7/17/92	86-88/2

Linemaster - Cost estimates

SHEET NO 10 of

SC-4 : Air Sparging

Present worth of O&M

Power $10,200/yr × 8.111 = 82,700
Maintenance 3,000/yr × 8.111 ≅ 24,300

Sampling and Analysis (gas) — Same as SC-3

1200 × 8.111 = 9733 say 10,000 + 1st year (3600) = 13600

82,700
24,300
13,600
120,600 say
+ 2000 carbon → $125,000 Present Worth O&M
Operation of system (10 yrs.)

Data Analysis and Report Preparation — Same as SC-1
Public Meetings — Same as SC-1

Replacement costs
Fence — Same as SC-1
25% of Equipment
Blowers (20,000 + 50,000) × 0.8219 = 14,380
say 15,000

(Cost estimates from DLB)

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7-15-92	DLB	7/17/92	86-88/2

Linemaster- Cost Estimates

SHEET NO. 11 of

SC-5: Incineration

Zone 1 Security Fence — Same as SC-1

Staging area preparation

clear and grub staging area (120' x 200') = 24000 sf

$2,000

Granular fill 12" deep x 24000 SF = 24000 ft³

24000 x 1/27 = 889 cy x $15/cy = 13333 s.y. $13,000

Erosion Control barriers 300' x $2/ft $ 600

Fence 300 ft x $15/ft + gates $4500

~ 20,000

(- DLB) s.y. 25,000

Soil Excavation

20,000 cy ≈ 30,000 tons

Deep excavation - 40'

Clam shell in sheeting of cofferdam 7-18 cy

$15/cy x 20,000 cy = $300,000

(- Means '92)

Sheeting/Shoring 40' Deep Exc. 100s/ton

25' Deep Exc. $20/SF $

110' length x 4 walls x 40' Deep = 18000 SF x 20 = 360,000

(- Means '92)

Screening

vibrating screen $6.50/cy x 5,000 cy = $35,000

(- Means '92)

Backfill Excavation $3/cy x 20,000 cy = $60,000 (- Means '92)

Soil/Ash Sampling 1 sample/100 cy x 20,000 cy = 200 samples

200 samples x $500/sample = $100,000 (assumed)

FO-#110

FUSS&O'NEILL Inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7-15-92	DLB	7/17/92	86-88/2

Linemaster - Cost Estimates

SHEET NO. 12 of

SC-5: Incineration

Mobilization \ Demobilization of Incinerator — $ 25,000

(- DLB)

Incineration (25 tons/hour max; use 100 tpd)

$300/ton x 30,000 tons = $9 million say $ 10 million

(- O.H. Materials Corp.)

Site Restoration

Topsoil (12000 SF + 24,000 SF) x 0.5' deep / 27 ft³/cy = 667 cy

$15/cy x 667 cy = $10,000

Loam, Seed, and Mulch $100/1000 SF x 36000 = $3600

Plantings, etc. allow 10,000

Repave Drive area $10/sy x 1100 sy 11,000

34,600

(- DLB) say $ 35,000

Weekly Security Checks — same as SC-1

MW Sampling and Analysis — same as SC-1

Data Analysis and Report Preparation — same as SC-1

Public Meetings — same as SC-1

FO-#110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
MJD	7/15/92	DLB	7/17/92	86-88/2

Linemaster - Cost Estimates

SHEET NO. 13 of

SC-6: BIODEGRADATION

Zone I Security fence	- same as SC-1	
Control building (1)	- same as SC-3	
Biodegradation system		
Water injection wells	19 wells x $3500	$66,500
Water extraction wells	30 wells x $2500	75,000
Air injection blower		25,000
Liquid injection pump		10,000
Microorganism purchase and culturing equipment	allow	25,000
Piping		
Air -	500' x $25/ft	12,500
injection points	12 x 1000	12,000
Water - (Injection piping)	500' x $25/ft	12,500
Water - (extraction piping)	1000' x $15/ft	15,000

System operation - Assume 10 years

Power - Blower assume 25HP, Pump 10HP
35 HP x 0.75 x 24hr/day x 365 days x $0.08 = $18,400

Operation
10hr/wk x 52 wk/yr x $25/hr = 13,000/yr

Cultusing microorganisms say 5,000/yr

Hydrogen peroxide addition allow 5,000/yr
Volume depends on effective flow rate

$41,000/yr

(Cost estimates from D.L.B.)

FO-#110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
MJD	7/15/92	DLB	7/17/92	86-88/U

Linemaster - Cost Estimates

SHEET NO. 14 of

SC-6 & BIODEGRADATION

Monitor Well Sampling

Assume will have to sample 10 wells/month for 1st year

For D.O., VOCs, metals, etc.

Year 1 10 wells x 12 samples/yr x $300/sample = $36,000

For years 2-10 assume quarterly sampling

10 wells x 4 samples/yr x $300/sample = $12,000/yr.

Also "normal" sampling and Analysis — Same as SC-1

DATA analysis and Report Preparation — Same as SC-1

Public Meetings — Same as SC-1

(Cost estimates from DLB)

FO-#110

FUSS&O'NEILL Inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
MJD	7/15/92	DUB	1/17/92	86-88/2

Linemaster - Cost Estimates

SHEET NO 15 of

MM-1: NO ACTION

Capital Costs — NONE

O&M Costs

Sampling and Analysis — same as SC-1

Quarterly	60,000
Semi Annually	8,000
Annually	7,000
	75,000

Five Year Reviews

Data Analysis and Report Preparation — same as SC-1

Public Meetings — same as SC-1

FO - # 110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7/15/92	DLB	7/17/92	86-88/u

SHEET NO. 16 of

Linemaster - Cost estimates

MM-4: Air Stripping & Carbon Adsorption

Capital Costs - None - Equipment already installed

O&M Costs

Operation

2 hr/wk x 52 week/yr x $25/hr = $2600 say $3,000

Power - assume effective 12 h/day operation

Blower 1.5 HP
TP#1 5 HP
TP#2 3 HP
Well pumps 10.5 HP
} 20 HP x 0.75 x 12 h/d x 365 days x $0.08 = $ 5256/yr

5256
1152
6408

Heat 10 kw x 8 h/d x 160 days/yr x 0.08 = 1152

Total 6500

Maintenance $5,000
Carbon $2,500

Analyses

Monthly 8010/8020 = 12 x 200 = $2400/yr

Toxicity $1000/qtr. $4000/yr

say $6500

Equipment Replacement

Carbon replacement - assume 1 filter/2 years 80 cf x 29 pcf x $2/lb =
$4640

Total = $20,040 say $25,000

(every 5 yrs.) Transfer pumps. $\frac{1500}{5000}$ x 15963 = 4789 say $5,000

(one/5 yrs.) Well pumps 500/ea 2000 PW

(years 15 & 30) Blower 500/ea 500 PW

Packing (every 5 yrs.)	5000/ea x .8219	4110	
	.6756	3378	
	.5553	2776	
	.4564	2282	
	.3751	1876	
	.3083	1541	
		15953	say $16,000

(Cost estimates from DLB)

FO - # 110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO.
MJD	7/15/92	DLB	7/17/92	86-88/2

Linemaster - Cost estimates — SHEET NO. 17 of

MM-5: UV/Oxidation & Carbon Adsorption

Liquid-phase UV system — $122,500
(- Table 2 Document RES0718891\86088 FSO)

Freight — $14,000

Installation — 12,000
(10% of Equipment because most already in place)

O&M COSTS

Power - same pumps as w/air strippers plus 60-150 kW depending on system - 100 kW for estimate

18.5 HP x 0.75 ≅ 14 KW → 114 x 12 h/d x 365 d x $0.06 ≅ 30,000
UV Lamps 100 kW (better rate more usage)
Heat @ $0.06 ≅ 1,000
Total $31,000

Operator 4 hr/wk x 52 wk/yr x 25/hr = $5200

Carbon - same as air stripper

Maintenance - 5,000 same as air stripper
Analyses - 6500 same as air stripper

MW Sampling and Analysis - Same as SC-1

Equipment Replacements

UV lamps $1000/yr
Transfer pumps (one/5 yr) $150/ea
well pumps (one/5 yr) 500/ea

Data Analysis and Report Preparation - Same as SC-1

Public Meetings - Same as SC-1

(cost estimates from DLB)

FO-#1110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
DLB	7/14/92	MJD	7/17/92	92088/2

SHEET NO. 1 of

SENSITIVITY ANALYSIS

Sensitivity Analysis:

1. Change Remediation Time to 3yrs; 30 yrs

Alternate SA-3

3 yr Remediation

O&M

Power (SC-3) 20 HP x 0.75 x 24 h/day x 365 d/y x 0.08 = $10,500/yr

Maint (SC-3) eh/w x 25 h x 52 w/y = $10,400/yr

Power $10,500 x 2.7751 = 29,100

Maint 10,400 x 2.7751 = 28,800

Sampling & Analysis

Year 1 3600

Year 2 & 3 1200/y x 1.8861 x 0.9615 = 2200

$65,700

Doesn't differ from 10 year life because 10 year costs were developed by spreading the 3 year life over 10 years

FO-#110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT NO
DLB	7/14/92	MJD	7/17/92	86088/26

SENSITIVITY ANALYSIS — SHEET NO. 2 of

30 YR REMEDIATION

Alternative 5A-3

O&M

Power $10,500/yr \times 17.292 = 181,560$

Maint $10,400/yr \times 17.292 = 179,840$

384,600

S&A

year 1 $3600 \quad 3,600$

year 2-30 $1200 \times 16.984 \times 0.9615 = 19,600$

Carbon 1 vessel/yr = $3,000/yr \times 17.292 \quad 51,900$

436,500

Alternative 5A-4

Power $34,000/yr \times 17.292 = 587,900$

Maint $10,400/yr \times 17.292 = 179,800$

S&A

year 1 3600 — 3,600

year 2-30 — 19,600

Carbon — 51,900

842,800

FO-#110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
DLB	7/14/92	MJD	7/17/92	86088/2

SENSITIVITY ANALYSIS — SHEET NO 3 of

2. SUBSTITUTE UV/OXIDATION FOR AIR STRIPPING

Change in total SA cost

SA-3

Capital - Same

Replacement

- fence (year 16)
- all vacuum equipment 385,000 (year 16) x0.5553 = 47,200
- GW system - no change — 20,000

27,200

O&M costs

436,500 vs 66,000 = 370,500

Base cost $

2,152,800
27,200
370,500
2,550,500

SA-4

Capital - same

Replacement 70,000 in year 16 = 38,900 - 15,000 = 23,900

O&M

842,800 - 125,000 = 717,800

Base cost 2,380,800
23,900
717,800

$3,122,500

FO-#110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
DLB	7/14/92	MJD	7/17/92	86088/a

SENSITIVITY ANALYSIS

SHEET NO 4 of

3. Add Vapor Phase Carbon Treatment to Air Stripper
   From Air Permit Application - updated
   Gas Phase Equipment say $25,000
   Building Modifications say 10,000
   Duct work 5,000
   Freight 4,000
   Installation 10,000
   $56,000

O&M Cost
   Additional blower
   assume 3HP / 12 h/day = 788 /yr x 17.29¢ = $13,600
   Labor 1 h/wk = $1300/yr x 17.29¢ 22,500
   Maintenance say $500/yr 8600
   Carbon use
   - from air permit approximate discharge is 5 lbs of VOCs/day (TCE ~ 95% lbs)
   - use from Calgon isotherms @ 77° 2.2 lbs/lb TCE
   use 3 lb/lb because air often will be cold in
   = HEK & OHD calculated 5780 lbs TCE to deep bedrock
   assume all removed 3 x 5780 = 17,340 lbs carbon
   at $2/lb = $34,680 + transportation & regeneration
   costs include another $2/lb
   Assume removal occurs uniformly over 30 years @ 200 lbs/yr
   carbon use 600 lbs/yr x $4/lb = 2400/yr
   Air Heater 5 KW x 12 h/day x 365 day/y x $0.08 = $1800/yr

EQ - #110

FUSS&O'NEILL inc
consulting engineers

PREPARED BY	DATE	CHECKED BY	DATE	PROJECT N
DLB	7/14/92	MJD	7/17/92	86088/2

SENSITIVITY ANALYSIS — SHEET NO 5 of

Total O & M Costs - Vapor Phase Carbon Treatment

Present Worth

Blower		13,600
Heat	1800 x 17.292	31,100
Labor		22,500
Maint		2,600
Carbon	2400 x 17.292	41,500
S&A		23,200
		140,500

REPLACEMENT

because it is chlorinated hydrocarbons, assume complete replacement in year 16

25,000 x 0.5553 = 13,900 say $15,000

HH-4

Capital Cost	$56,000
Contingencies (25%)	14,000
	70,000
O&M increase	140,500
Replacement increase	15,000
	$225,500 increase in air shipping cost for 30 years

Air Sampling

Assume monthly for 1st year then quarterly thereafter - same cost as for SC-3 & SC-4

3600	year 1	3,600
1200	thereafter	19,600
		23,200

3.6.11

Fuss & O'Neill Inc.

T E C H N I C A L M E M O R A N D U M

TO: Michael Nalipinski, RPM

FROM: David Bramley, PM

DATE: February 23, 1993

RE: Linemaster Switch Corp.
Feasibility Study (FS) Response

CC: Lynne Jennings - EPA
Gary Kennett - Linemaster
Naomi Davidson - DEP
Leslie White - DEP
Al Smith - Murtha, Cullina, Richter & Pinney

On February 18, 1993 a meeting was held at Linemaster to discuss the comments of the Agency on the FS. Among the items discussed was the need for emissions control on the existing air stripper and on the proposed soil vapor extraction (SVE) system. The Agency advised that an OSWER Directive dated June 15, 1989, specifies air discharge limits for ozone precursors (chlorinated hydrocarbons among other) in ozone nonattainment areas to 3 lb/hr or 15 lb/day or 10 tpy. In addition, 40 CFR 264 Subpart AA limits emissions to 10 parts per million (ppm) by weight in air without treatment.

The FS proposed that no off-gas treatment be included on the existing Interim Removal Treatment System (IRTS) air stripper. Controls were included for the proposed SVE system. The Agency requested that Fuss & O'Neill determine the actual and proposed rates of emissions from the air stripper and the SVE system, calculate the cost of controls, and evaluate the need for controls. The Agency also requested clarification of the cost for emission controls (carbon filtration) developed in the Sensitivity Analysis shown in Table 15-3 of the FS.

Rather than modify the text of the FS, and to maintain the schedule established by the Agency, the information generated was to be