STATIONARY SOURCE: Interplastic
LOCATION: Mpls

EMISSIONS SUMMARY

PERMIT NO. 1176
DATE: 07-22-91

PAGE 1 OF 1
ENG GMB

PROCESS DESCRIPTION	AIR PROG.	OP SCH	EMIS POINT	REF.	CRITERIA POLLUTANTS, TPY TSP P	TSP A	PM-10 P	PM-10 A	SOx P	SOx A	NOx P	NOx A	CO P	CO A	VOC P	VOC A	PB P	PB A	NC (TPY) TOTAL P	NC (TPY) TOTAL A	NESHAPS? ODORS? REMARKS
Emission Point #1 Thermal Oxidizer	SIP	8760	1	AP42	0.41	0.29	0.41	0.29	0.08	0.06	19.3	13.7	4.8	3.4	11.3	8.05					
Emission Points 2+3 Couple Mixing Tank	SIP	8760	2/3	5	9.0	6.4	9.0	6.4													
Tank #14 (Polyester Resin) Polyester Resin	SIP	8760		AP42											0.84	0.84					
TANK #15 Proplylene Glycol	SIP	8760		AP42											0.0031	0.0031					
TANK #16 Maleic Anhydride	SIP	8760		AP42											0.0030	0.0030					
Tank #17 Phtalic Anhydride	SIP	8760		AP42											0.0017	0.0017					
TANK #2 Dipropylene Glycol	SIP	8760		AP42											1.5×10^{-5}	1.5×10^{-5}					
TANK #3	SIP	8760		AP42											1.5×10^{-5}	1.5×10^{-5}					
TANK #4 Ethylene Glycol	SIP	8760		AP42											8.2×10^{-5}	8.2×10^{-5}					
Tank #9 + #10 Propylene Glycol	SIP	8760		AP42											0.001	0.001					
TANK #12 Acetone	SIP	8760		AP42											0.071	0.071					
TANK #18 Gasoline	SIP	8760		AP42											1.2×10^{-5}	1.2×10^{-5}					
TOTAL, TPY					9.4	6.7	9.4	6.7	0.08	0.06	19.3	13.7	4.8	3.4	12.2	8.91					

Is SARA 313 report required?____

EPA SOURCE CLASSIFICATION FOR TOTAL FACILITY (CIRCLE ONE): A1, A2, OR B							
POLLUTANT BASIS: LIST A1, A2, OR B FOR EACH POLLUTANT							
FOR EACH APPLICABLE CASE:	TSP	PM-10	SOx	NOx	CO	HC	Pb
Total Stationary Source							
Air Program -							
Air Program -							

Notes and explanations on reverse side.

cc: John Morrill
with Permit Issuance

Notes and explanations:

1. Air program - PSD
   NSPS
   SIP (state rules only)
   Non-attain.

   Identify the air program applicable to each point or emissions unit.

2. Operating Schedule - Hours of operating, load factor percent of capacity, etc.; specify

3. References - 1) Information provided by the Permittee
   2) AP-42
   3) Stack Test
   4) Engineering Estimate
   5) Permit limitations

4. P = Potential
   A = Actual
   TPY = tons per year
   NC= Non-Criteria

5. Non-criteria emissions - list total of all TPY
   - attach additional detailed information for toxics review

6. EPA Classification - A1, A2, B
   1) Identify overall facility classification.
   2) Total Facility - Identify the classification of the total facility for each pollutant (for example are TSP emissions A1, A2, or B?).
   3) Air Program - For the group of all emissions points/units under a single air program (all NSPS units for instance), identify the classification (A1, A2, B) for each pollutant for that air program. Each air program listed in the detailed listing above should be identified here and the classification identified for each pollutant emitted under that air program.

7. SARA 313 reporting requirements
   1) SIC codes 20-39; and
   2 ten (10) or more employees; and
   3) use more than 10,000 lbs. of a substance or manufacture or process more than 25,000 lbs. of a substance per year.
   4) If it appears that the Permittee should be reporting but has not done so, inform emission emission inventory staff (Kim Sandrock).

Form 2

Significant Emission Rate Screening

Facility Name Interplastic
Permit or File number 1176

Address 2015 N. E. Broadway

Date review completed 03-28-91
Reviewer LAB

Chemical	CAS #	Maximum Aggregate Emissions			Significant Emisison Rate In units of:			Table/ Appendix	Table/ Appendix Date	SER Exceeded	BART level exceeded
		lbs/hr	lb/day	ton/yr	lb/hr	lb/day	ton/yr			Y/N	Y/N/NA
Styrene	100-42-5	2.7	64	11.7*			2.5	C	2/91	Y **	NA
dicyclopentadiene	77-73-6			0.0044			2.7×10^{-2}	B	2/91	N	
propylene glycol		9.4×10^{-4}	0.022	0.0041				—			
Maleic Anhydride	108-36-6	4.6×10^{-6}	0.011	0.002		0.0443		App 1	2/91	N	
Phthalic Anhydride		3.9×10^{-5}	9.3×10^{-4}	0.00017		0.26				N	
Dipropylene Glycol		2.2×10^{-5}	5.2×10^{-4}	9.53×10^{-5}		—		—			
Ethylene Glycol		1.9×10^{-5}	4.5×10^{-4}	8.2×10^{-5}							
Acetone	67-64-1	0.016	0.39	0.071	4.8			A	2/91	N	

Ceiling

* Assumes all of the emissions from the incinerator stack are Styrene

** See attached modeling results

maleic anhydride

$$\frac{1\,mg/m^3}{1000} = 0.001\,mg/M^3\,(44.3) =$$

phthalic anhydride

$$6/1000\,(44.3)$$

Form 2

Significant Emission Rate Screening

Facility Name Interplastic
Permit or File number 1176

Address 2015 N.E. Broadway

Date review completed 3-28-91
Reviewer JAB

Chemical	CAS #	Maximum Aggregate Emissions			Significant Emisison Rate In units of:			Table/ Appendix	Table/ Appendix Date	SER Exceeded	BART level exceeded
		lbs/hr	lb/day	ton/yr	lb/hr	lb/day	ton/yr			Y/N	Y/N/NA
Gasoline N-Pentane		4.3×10^{-7}	1.0×10^{-5}	1.9×10^{-6}				—			
Gasoline N-Butane		6.8×10^{-7}	1.6×10^{-5}	3.0×10^{-6}		84.2				N	
Iso-Butane		3.9×10^{-7}	9.3×10^{-6}	1.7×10^{-6}		84.2				N	

MINNESOTA POLLUTION CONTROL AGENCY

DESIGN AND CALCULATION SHEET

Subject Interplastic (Actual Emission)

Job No.

Project

Sheet No. of

By LAB

Emission Pt # 1 24 hrs/day × 5 days/week × 52 weeks/yr

= 6240 hrs/yr

VOC's 11.3 tpy $\left(\frac{6240 \text{ hrs/yr}}{8760 \text{ hrs/yr}}\right)$ = 8.[illegible] tpy NOx 19.3 $\left(\frac{6240}{8760}\right)$ = 13.7 tpy

CO 4.8 $\left(\frac{6240}{8760}\right)$ = 3.4 tpy SOx = 0.08 $\left(\frac{6240}{8760}\right)$ = 0.06 tpy TSP/PM'D 0.[illegible] $\left(\frac{6240}{8760}\right)$ = 0

Emission Points 2+3 9.0 $\left(\frac{6240}{8760}\right)$ = 6.41 tpy

TANK #14, #15, #16, #17, #2, #3, #4, #9, 10#, #[illegible], #18

would all be the same

Minnesota Pollution Control Agency

Design and Calculation Sheet

Subject INTERPLASTIC CORPORATION TANK CALCULATIONS

Job No. DAQ 1176

Sheet No. 1 of

By [illegible]

Project

$L = L_B + L_W$

where L_B = fixed roof breathing loss (lb/yr)

L_W = fixed roof working loss (lb/yr)

$L_B = 2.26 \times 10^{-2} M_V \left(\frac{P}{P_A - P}\right)^{0.67} D^{1.73} H^{0.51} \Delta T^{0.50} F_P C K_C$

where M_V = Molecular weight of vapor in tank (lb/lb mole)

P_A = Average atmospheric pressure at tank location (psia)

P = True vapor pressure at bulk liquid conditions (psia)

D = Tank diameter (ft)

H = Avg vapor space height including roof volume correction (ft)

ΔT = Average ambient diurnal temperature change (°F)

F_P = paint factor (dimensionless)

C = adjustment factor for small diameter tanks

K_C = product factor

T-1-7 8000 gal resin located inside

$L_B = 2.26 \times 10^{-2} (10{,}000) \left(\frac{0.0[illegible]}{[illegible]}\right)^{0.68} [illegible]^{1.73} [illegible] (5)^{0.5} [illegible]$

$= 2.26 \times 10^{-2} (10{,}000)(0.0331)([illegible])(4.24)([illegible])$

$= 1.83 \times 10^{3}$ lb/yr

Minnesota Pollution Control Agency

Design and Calculation Sheet

Subject Interplastic CORPORATION
TANK CALCULATION

Job No. DAQ 1176
Sheet No. 2 of
By KAB

Project

$L_W = 2.40 \times 10^{-5} M_V P V N K_N K_C$

M_V = Molecular weight of vapor in storage tank (lb/lb-mole)

P = True Vapor pressure at bulk liquid temperature (psia)

V = Tank capacity (gal)

N = Number of turnovers per year = [illegible]

K_N = Turnover Factor (Dimensionless)

K_C = Product Factor (Dimensionless)

$L_W = 2.40 \times 10^{-5} (10{,}000)(0.097)(2000)(4)(1) = 745$ lb/yr

$L = L_B + L_W = 1.83 \times 10^3$ lb/yr $+ 745$ lb/yr $= 2.57 \times 10^3$ lb/yr

$L = 1.29$ tpy

2 tanks = 2.58 tpy

T-3, 4, 5, 20, 21, 22, 23, 24, 25, 26, 27 11 tanks

$L_B = 2.26 \times 10^{-2} M_V \left(\frac{P}{P_A - P}\right)^{0.68} D^{1.73} H^{0.51} \Delta T^{0.50} F_P C K_C$

$= 2.26 \times 10^{-2} (10{,}000)\left(\frac{0.097}{14.7 - 0.097}\right)^{0.68} (100)^{1.73} (17)^{0.51} (5)^{0.5} (1.15)(0.5)$

$= 226 (0.0330)(53.7)(4.24)(2.24)(1.15)(0.5) = 2187$ lb/yr

$L_W = 2.40 \times 10^{-5} (M_V)(P)(V)(N)(K_N)(K_C)$

$= 2.40 \times 10^{-5} (10{,}000)(0.097)(10{,}000)(4)(1) = 931$ lb/yr

$L_{tot} = L_B + L_W = 2187 + 931 = 3.12 \times 10^3$ lb/yr =

3.12×10^3 lb/yr $\times \frac{1 \text{ ton}}{2000 \text{ lb}} = 1.56$ tpy per tank

1.56 tpy × 11 tanks = 17.2 tpy

Minnesota Pollution Control Agency

Design and Calculation Sheet

Subject Interplastic Corporation
TANK CALCULATION

Job No. DFO 176
Sheet No. 3 of
By [illegible]

Project

Tank No. T-6, T-7, T-8, T-9
1000 gal [illegible] D = 7.2 feet

$L_B = 2.26\times10^{-2} M_v \left(\frac{P}{P_A - P}\right)^{0.68} D^{1.73} H^{0.51} \Delta T^{0.50} F_p C K_c$

$= 2.26\times10^{-2}(10{,}000)(0.0330)(30.4)(3.24)(2.24)(1.15)(0.5) = 946$ lb/yr

$L_W = 2.40\times10^{-5} M_v P V N K_N K_c = 2.40\times10^{-5}(10{,}000)(0.097)(1000)(4)(1)$
$= 168$ lb/yr

$= 946 + 168 = 1114$ lb/yr $= 0.557$ tpy $\times 4 = \boxed{2.23 \text{ tpy}}$

TANK [illegible] 1000 gal [illegible] Turnover

$L_B = 2.26\times10^{-2} M_v \left(\frac{P}{P_A - P}\right)^{0.68} D^{1.73} H^{0.51} \Delta T^{0.50} F_p C K_c$

$= 2.26\times10^{-2}(10{,}000)(0.0330)(4.0)^{1.73}(11)^{0.51}(5)^{0.50}(1.15)(0.2)$

$= 2.26\times10^{-2}(10{,}000)(0.0330)(11.0)(3.40)(2.24)(1.15)(0.2)$

$= 144$ lb/yr

$L_W = 2.40\times10^{-5}(M_v)(P)(V)(N)(K_N)(K_c)$

$= 2.40\times10^{-5}(10{,}000)(0.097)(1000)(4)(1) = 93.1$ lb/yr

$144 + 93.1$ lb/yr $= 237$ lb/yr $\times 3 = 711$ lb/yr $= \boxed{0.356 \text{ tpy}}$

Styrene TANKS (underground) TANK
1, 8, 11, 13 15,000 gal DIA X LENGTH
breathing losses will be [illegible] [illegible]
[illegible] 67 turnovers [illegible] 1, 8, 11
[illegible] turnovers 13

$L_W = 2.40\times10^{-5}(M_v)(P)(V)(N)(K_N)(K_c)$

$= 2.40\times10^{-5}(104)(0.097)(15{,}000)(67)(0.55)(1)$

$= 134$ lb/yr $\times 3$ tanks $= 401$ lb/yr $= \boxed{0.200 \text{ tpy}}$

Minnesota Pollution Control Agency

Design and Calculation Sheet

Subject Interplastic CORPORATION TANK CALCULATIONS

Job No. DRC 176

Sheet No. 4 of

By KC

Project

TANK 13

$L_W = 2.40\times10^{-5}(M_V)(P)(V)(N)(K_N)(K_C)$

$L_W = 2.40\times10^{-5}(104)(0.097)(15,000)(60)(0.55)(1)$

$= 120$ lb/yr $\times$ 1 ton/2000 lb $= 0.0599$ tpy

Dicyclopentadiene Tank Above Ground

TANK No. 20 25,000 gal 40 turnovers

$M_W = 132$

$V_p = 5$ mm Hg = [illegible]

$L_W = 2.40\times10^{-5}(M_V)(P)(V)(N)(K_N)(K_C)$

$= 2.40\times10^{-5}(132)(0.097)(15,000)(40)(0.8)(1)$

$= 148$ lb/yr $\times$ 1 ton/2000 lb $= 0.074$ tpy

0.074 tpy $\times .06 = 0.0044$ tpy

0.0044 tpy $= 1.0\times10^{-3}$ lb/hr $\times 1.26\times10^{-4}$ g/s less than syndicate rate

Total VOC emission controlled by oxidizer

$2.58 + 17.2 + 2.23 + 0.356 + 0.200 + 0.0599 + 0.0044$

$= 22.7$ tpy $=$

Collection efficiency on thermal oxidizer

destruction efficiency $= 0.94$ control efficiency

22.7 tpy $\times 0.06 = 1.36$ tpy ←

Net Changes in emissions as a result of modification

MINNESOTA POLLUTION CONTROL AGENCY

DESIGN AND CALCULATION SHEET

Subject Interplastic

Job No. 1176

Project POTENTIAL EMISSIONS
Uncontrolled Tanks

Sheet No. of
By LAB

TANK #14 POLYESTER RESIN

20,000 gal Throughput 15,000 gal/yr

14 ft diameter = 18 feet high VP 4.5 mmHg × 0.019 psia/mmHg = 0.087 psia

mol MW = 5000

$L_B = 2.26\times10^{-2} M_V \left(\frac{P}{P_A - P}\right)^{0.68} D^{1.73} H^{0.51} \Delta T^{0.50} F_P C K_C$

$= 2.26\times10^{-2} (5000)\left(\frac{0.0807}{14.7-0.0807}\right)^{0.68} (14\text{ ft})^{1.73} (18\text{ ft})^{0.51} (20°F)^{0.5} (1.40)(0.7)(1.2$

$= 3.29 \quad 96 \times 3.98 \times 4.5 \times 1.40 (0.7) = 5.$

$= 5500$ lb/yr $= 2.7$ tpy × .30 (styrene monomer) = 0.81 tpy

= 0.81 tpy

$L_W = 2.40\times10^{-5} M_V P V N K_N K_C$

$N = 15{,}000/20000 = 0.75$ $K_N = 1.0$ $K_C = 1.0$

$L_W = 2.40\times10^{-5}(0.087)(5000)(20{,}000)(0.75)(1)(1) = 1800$ lb/yr $= 0.078$ tpy

2.7 + 0.08 = 2.8 tpy × 0.30 Styrene monomer = 0.84 tpy

TANK #15 Propylene Glycol 25,000 gal 450,000 gal/yr 12 ft = D, 30 ft = H

0.1 mm × 0.019 psia/mmHg = 0.0019

$L_B = 2.26\times10^{-2} M_V \left(\frac{P}{P_A - P}\right)^{0.68} D^{1.73} H^{0.51} \Delta T^{0.50} F_P C K_C$

$= 2.26\times10^{-2} (76.1)\left(\frac{0.0019}{14.7-0.0019}\right)^{0.68} (12)^{1.73} (30\text{ ft})^{0.051} (20)^{0.50} (1.0)(0.63)(1)$

$= 0.0039 (5.7)(73.6)(4.47)(1.0)(0.63)$

$= 4.61$ lb/yr × 1 ton/2000 lb $= 0.0023$

$L_W = 2.40\times10^{-5} M_V \cdot P V N K_N K_C$

$= 2.40\times10^{-5}(76.1)(0.0019)(25{,}000)\left(\frac{450{,}000}{25{,}000}\right)(1)(1) = 1.56$ lb/yr $= 0.0008$

TPY = 0.0031

TANK 16 Insulated $\Delta T = 5°F$ maleic anhydride

$V = 15{,}000$ gal Throughput 600,000 gal/yr

$D = 12$ feet $H = 18$ feet $V_p = 0.16$ mmHg $= 0.003$ psia

aluminum

$$LB = 2.26\times10^{-2} M_V \left(\frac{P}{P_A - P}\right)^{0.68} D^{1.73} H^{0.51} \Delta T^{0.50} F_P C K_C$$

$$= 2.26\times10^{-2}(98.06)\left(\frac{0.003}{14.7-0.003}\right)^{0.68}(12)^{1.73}\,18^{0.51}\,5^{0.50}(1.30)(1)(0.63)$$

$$= 0.0077(73.6)(4.37)(2.2)(1.30)(0.63)$$

$$= 40.6\ \text{lb/yr} \times 1\ \text{ton}/2000\ \text{lb} = 0.02\ \text{tpy}$$

$$LW = 2.40\times10^{-5} M_V\ P\ V\ N\ K_N\ K_C$$

$$= 2.40\times10^{-5}(98.06)(0.003)(15{,}000)\left(\frac{600{,}000}{15{,}000}\right)$$

$$= 4.2\ \text{lb/yr} \boxed{= 0.002\ \text{tpy}}$$

TANK #17 Phthalic Anhydride 20,000 gal 500,000 gal/yr

$MW = 148.1$ $D = 14$ ft $H = 18$ ft 0.01 mmHg x 0.019 = 0.00019 psia

$$LB = 2.26\times10^{-2} M_V \left(\frac{P}{P_A - P}\right)^{0.68} D^{1.73} H^{0.51} \Delta T^{0.50} F_P C K_C$$

$$= 2.26\times10^{-2}(148.1)\left(\frac{0.00019}{14.7-0.00019}\right)^{0.68}(14)^{1.73}(18)^{0.51}(5)^{0.50}\,1.30\,(1)(0.70)$$

$$= 1.59\times10^{-3}(96)(4.4)(2.2)(1.30)(0.70)$$

$$= 1.34\ \text{lb/yr} \boxed{= 1.92\times10^{-4}\ \text{tpy}}$$

$$LW = 2.40\times10^{-5}(148.1)(0.00019)(20{,}000)\left(\frac{500{,}000}{20{,}000}\right)$$

$$= 0.34\ \text{lb/yr} \boxed{= 0.00017\ \text{tpy}}$$

Tank # 2 underground – no breathing losses Di propylene Glycol

$$LW = 2.40\times10^{-5}(M_V)(P)(V)(N)(K_N)(K_C)$$

$$= 2.40\times10^{-5}(174.2)(0.0019)(15{,}000)\left(\frac{24{,}000}{15{,}000}\right)$$

$$= 0.191\ \text{lb/yr} = 9.53\times10^{-5}\ \text{tpy}$$

TANK #3 MW 160 0.2 mmHg x 0.019 = 0.0038

$$LW = 2.40\times10^{-5}(160)(0.0038)(6000)\left(\frac{2000}{6000}\right)$$

$$= 0.03\ \text{lb/yr} \boxed{= 1.5\times10^{-5}\ \text{tpy}}$$

MINNESOTA POLLUTION CONTROL AGENCY

DESIGN AND CALCULATION SHEET

Subject INTERPLASTIC

Job No. 1176

Project POTENTIAL EMISSIONS

UNCONTROLLED TANKS

Sheet No. of

By LAB

TANK # 4 Underground V = 6000 gal 100,000 gal/yr Ethylene glycol

$V_p = 0.06 mmHg = 0.0011 psia$

$L_W = 2.40 \times 10^{-5} (M_V)(P)(V)(N)(K_N)(K_C)$

$= 2.40 \times 10^{-5} (62)(0.0011)(6000)\left(\frac{100,000}{6000}\right)$

$= 0.164 \ lb/yr = 8.2 \times 10^{-5} \ tpy$

TANK # 9 + Tank # 10 Underground V = 15,000 gal × 2 Propylene glycol

$V_p = 0.1 mmHg = 0.0019 psia$ T = 300,000 gal/yr × 2

$L_W = 2.40 \times 10^{-5} (76.1)(0.0019)(15,000)(300000/15,000) \times 2$

$= 2.1 \ lb/yr = 0.001 \ tpy$

TANK # 12 V = 8000 gal T = 30,000 gal/yr Acetone

$V = 181 mm Hg \times 0.019 \frac{psia}{mm Hg} = 3.4 psia$

$L_W = 2.40 \times 10^{-5} (58)(3.4) 8000 \left(\frac{30000}{8000}\right)(K_N)(K_C)$

$= 142 \ lb/yr = 0.071 \ tpy$

TANK # 18 Gasoline 2000 gal 4000 gal/yr

$V_p = RVP 13 = 8.3$ MW = 62 ← Most conservative

$L_W = 2.40 \times 10^{-5} (62)(8.3)(2000 gal)\left(\frac{4000}{2000}\right)$

$= 0.025 \ lb/yr = 1.2 \times 10^{-5} \ tpy$

Pentane $1.2 \times 10^{-5} (0.161) = 1.9 \times 10^{-6} \ tpy$

n-Butane $1.2 \times 10^{-5} (0.25) = 3.0 \times 10^{-6} \ tpy$

iso-Butane $1.2 \times 10^{-5} (0.14) = 1.7 \times 10^{-6} \ tpy$

Emission Points 2, 3 Cowles Tank

1200 scfm × 0.1 gr/dscf × 2 = 240 gr/min

240 grains/minute × 60 minutes/hr × 1 lb/7000 gr × 1 ton/2000 lb × 8760 hrs/yr

= 9.0 tpy