UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

50c

SUBJECT: PCB Inspection, Monsanto Krummrich Plant, Sauget, Illinois. DATE: March 9, 1976

FROM: Chief, Air Surveillance Branch, Surveillance and Analysis Division

TO: Karl Bremer, Member, Lake Michigan Toxic Substances Committee

A preliminary survey was made of the above installation to identify and sample point sources of potential PCB emissions to the atmosphere. The sampling and analysis were carried out at this source to furnish information to arrive at a further decision that may require an intensive testing program to quantify the PCB emissions. The sample analysis revealed the following:

SAMPLING LOCATION	NO. OF SAMPLES	PCB CONCENTRATION ug/M³
Steam Ejector - Ground Level, Site #1	2	* 3A - 27.5 3B - 33.9
Steam Ejector - Top Level, Site #2	2	3A - N.A. 3B - N.A.
Calculated Storage Tank Emissions Virgin Product Product Loading and Waste Storage		59.7 ~~687.4~~ Kg/year 0.02 Kg/year

Monsanto has performed a stack test at the Sauget location quantifying the PCB emissions to the atmosphere. Stack-sampling and other reports describing process and sampling methodology used at this site are attached.

* 3A - Right Side of sampling train - 3B - Left Side

EPA Form 1320-6 (Rev. 6-72)

MONS 054012

510

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

SUBJECT: Emissions of PCB from the Incinerator at Monsanto - Sauget, Illinois. DATE: February 11, 1976

FROM: R. Edwin Zylstra, Technical Advisor, Special Projects Section

TO: Chief, Air Surveillance Branch

On January 27-28, 1976 sampling was conducted at the Krummrich Plant of Monsanto in Sauget, Illinois to determine emissions to the air. The samples were taken near the exits of the steam jet ejectors of the non-fractionating distillation process. The exits of the fractionating distillation steam ejector were not sampled because of inaccessibility. The incinerator used to destroy waste PCB's was not sampled because Monsanto had tested the stack and the results were made available to us.

I have reviewed the test procedures and the data from three stack tests and I feel that the test results accurately indicate the quantity of PCB being emitted into the atmosphere from the incinerator. The Monsanto procedure for stack testing the incinerator for PCB and particulate is shown in Appendix A. The method is a modified EPA Method 5. The front half is identical to Method 5 and consists of a sample nozzle, a heated probe, and a heated glass fiber filter. The back half is as follows: 1. First impinger empty; 2. Second impinger with 150 ml. of N, N-dimethyl formamide; 3. Third impinger with 75 ml. NaOH solution and 75 ml. Na_2SO_3 solution; 4. Fourth impinger with 200 g silica gel. Sampling is performed the same as Method 5. To determine the PCB emissions the sample is handled as follow:

1. Probe, nozzle and filter are rinsed with hexane. The rinse is mixed with any condensate from the first impinger and then analyzed for PCB by means of electron capture gas chromotograph.

2. The NN dimethy formamide in the second impinger is analyzed for PCB by means of electron capture gas chromotograph.

The table shows the results of stack tests for PCB on the incinerator performed by Monsanto. Emission ranged from .00001 to .000248 lbs/hr. Computer printouts of data collected and the results of the last three tests performed were supplied to us for evaluation. The calculations were checked and no errors were found. Monsanto's and our computer printouts are in Appendix B.

cc:

MONS 054013

EPA-Form 1320-6 (Rev. 6-72)

STACK TESTS ON MONSANTO PCB INCINERATOR

The following tests were made using a modification of Illinois EPA Method 5 and both flow and concentrations were determined.

Date	PCB conc^{n} in mg/m^{3}	Flow m^{3}/min.	Lbs/hr
7/25/73	0.0063	63.5	.53 x
8/7/73	0.0157	94.8	2.09 x
8/16/73	0.0176	06.5	2.48 x
8/24/73	0.0166	06.8	2.34 x
10/26/73	0.0077	48.3	.49 x
11/7/73	0.0056	58.1	.4 x
11/20/73	0.0119	63.8	.1 x
11/28/73	0.0013	66.7	.11 x
8/23/74	0.0143	71.1	1.40 x
9/12/74	0.0289	51.1	1.95 x
5/23/75	0.0300	44.5	1.76 x
10/1/75	0.0182	92.2	2.2 x

APPENDIX A

MONSANTO PROCEDURE FOR STACK TESTING FOR PCDs

INCINERATOR STACK TEST FOR PCB'S AND PARTICULATES

SCOPE: This procedure determines the amount of PCB's and particulates present in the incinerator stack gas.

EQUIPMENT:

1. R.A.C. portable stack gas sampler
   a. sample box
   b. unbilical cord 25 feet (2 each)
   c. nozzles 0.250 or 0.375
   d. clamps (10 each) 28/15 Fisher 5-885F
   e. 3' combination probe and pitot tube (glass)
   f. glass connectors (4 each)
   g. 500 ml Greenburg-Smith impinger (4 each) Fisher Scientific Company, St. Louis, MO cat. no. 9-257, or equivalent. The fourth impinger is modified by replacing the standard tip with a 1/2 inch ID glass tube extending to one-half inch from bottom of impinger flask.
2. Glass orifice to regulate air flow through pitot tube. (2each) Can be made from broken thermometer.
3. Thermometer 0-220°F
4. Thermocouple and potentiometer
5. Nomograph
6. Clip board
7. Air Pump (Dyna pump)
8. Stopwatch (2 each)
9. Tape ruler
10. 3 way plug
11. Stopcock grease
12. 50 ft. of 5/8" rope
13. Adjustable wrenches (2 each)

FOR PARTICULATE TEST ADD:

1. Cyclone and Erlenmeyer flask
2. Clamps 2 each 28/15

3. Glass fiber filter holder

4. Glass fiber size 7.0 CM (Fisher cat. no. 9-873F)
Dry in oven and leave in desiciator.

REAGENTS:

a. Sodium Sulfite, Fisher Scientific Company, St. Louis, Missour Cat. No. S-430 in unstandardized solution. Weight 63 grams; dissolve in water and make up to 1 liter.

b. N,N-Dimethyl Formamide, Fisher Scientific CO., St. Louis, Missouri, Cat. No. D-119.

c. Sodium Hydroxide 50% solution, Fisher Scientific Company, St. Louis, Missouri, Cat. No. SO-S-254, in unstandardized solution. Add 52.4 ml to 500 ml distilled water and make up to a liter.

d. Hexane; nonograde (Mallinckrodt Chemical Works, St. Louis, Missouri, Cat. No. 4159)

e. Silica Gel Grade 938 Darison Code 938-08-08-226 Davison Chemical; Baltimore, Maryland, 21203.

f. Crushed ice.

SAMPLING PROCEDURE:

1. Measure stack diameter and determine minimum number of sampling points needed.
2. Measure stack temperature
3. Determine percent moisture. This may be found from previous tests.
4. Place sample box on duorail and assemble impingers. Leaving the first impinger empty. Fill the second impinger with 150 ml of DMF solution. Add 75 ml in NaOH plus 75 ml in Na_2SO_3 in the third impinger. The last impinger will contain 200 g silica gel in a modified impinger. (Weigh silica gel for water determination later).
5. Place the cyclone and glass fiber filter in the heat chamber and connect to impingers.
6. Connect vacuum line of umbilical cord to inlet of meter box and outlet of last impimger. Plug up the inlet to the filter holder and pull 15 in. Hg vacuum to check for leaks. Leakage rate should not exceed 0.02 C.F.M.
7. Connect glass probe to cyclone.
8. Complete all connections on umbilical cord.
9. Purge air through pitot tube using tubing which is attached to umbilical cord and connect to air pump.
10. Pack ice around impinger and add water.
11. Make a traverse of stack on one side to determine velocity and stack pressure. Be sure you have balanced draft gage before you take your readings.
12. Heat probe and chamber in box to a temperature of 10° higher than the stack temperature.
13. Record temperature at gas meter. (inlet and outlet.)
14. Use Nomograph to determine nozzle size and isokinetic sampling rate.
15. Record gas meter readings.
16. As soon as heat chamber in sampling box is up to temperature start your test.

SAMPLE TRAIN OPERATION

1. For each run, record the data required on the example sheet shown in Figure 1-2.

2. Determine the time required at each sampling point. A minimum time of one hour is required for this test.

3. To begin sampling, position the nozzle at the first traverse point with the tip pointing directly into the gas stream. Immediately start the pump and adjust the flow to isokinetic conditions. Sample for at least 5 minutes at each traverse point; sampling time must be the same for each point.

4. Record temperature at gas meter inlet and outlet, about one minute before it is time to change traverse points. Also be sure to read temperature of last impinger.

5. Add more ice during test to keep the temperature of gases leaving the last impinger as low as possible and preferably at 70° F or less.

6. Turn off pumps at the conclusion of sample run and record final reading.

7. Remove probe from stack and disconnect from impingers. Take probe and impingers and prepare them for lab analysis.

8. Measure the increase in volume of each impinger plus the increase in weight of the silica gel to determine percent water.

9. Rinse probe and cyclone with hexane and pass rinsing through glass fiber filter. Mix this extract with the water (condensate) from the first impinger.

10. Carefully remove the filter pad plus rubber washer and dry in oven then place in desicator before weighing for particulates.

11. Collect all washings and give to lab for analysis.

12. Upon receipt of analysis from lab, record results in grams on sheet shown in Figure 1-1 and complete for computer run.

DISCUSSION: MONS 054020

The collection system in this test may also be used to determine other components of the stack gas. The ones of most interest would be HCl, H_3PO_4, and Cl_2. To do this have the lab save all aqueous layers from washing used in preparing the solutions for PCB analysis. Take the aqueous layer from the first impinger (water condensate) and run for HCl and H_3PO_4 analysis. Analyze the dimethyl formamide from the second impinger for Cl_2 and H_3PO_4 and the Na_2SO_3 impinger for Cl_2.

1. [11] Number of sets of data
(1-2)

2 [14] Number of components to be analyzed
(1-2)

3 [NOV 28 1973] [1:30 PM] [INCINERATOR STACK]
(1-12) Date (13-20) Time (21-44) Stack Sampled

[8311] [8] Zones [19.0] in [29.82] in Hg [0.375] in. [ ] in.
(45-48) Source OpNo. (49-50) (51-56) StackDiam. (57-61) Bar. (62-66) Nozzle (67-72) Stack Width

4 [634.0] [POUNDS PER HOUR]
(1-5) Process Wt. (6-40) Units of production per hour

5 [NEIL SULLIVAN AND DALE RACHELL]
(1-50) Sampling done by:

6 [EPA METHOD 45 + DMF AND NaOSO3 IMPINGERS]
(1-48) Sampling Method - indicate modifications.

Correction Factors

K [.506] FS [0.83] Degree: [FA] CEntigrade or FAhrenheit M [1.02]
(51-54) Orifice (55-58) Pitot (59-60) (61-64) Meter

Gas Analysis in MoleFractions (Identify Component Z if present by M.W. and name or formula)

7 [0.028] [0.824] [0.148] [0.0] [ ] [0.0] [0.0] [NONE]
(1-5) O_2 (6-10) N_2 (11-15) CO_2 (16-20) CO (21-25) H_2O (26-30) Z (31-34) MWZ (35-43) name of Z

Moisture determination by absorption on Drierite Ascarite and weighing Leak test on Sampler

[42.12] C.F. [81.6] [0.0] "Hg [727.95] g [927.41] g [0.002] [15.0] "Hg
(1-6) SampleVol. (7-11) Temp. (12-15) Press (16-23) Tare wt. (24-31) Gross wt. (32-36) CFM at (37-41) Press

Analysis for Components

PARTICULATE	29.0	4.3503	4.5220	BY WEIGHT
P.C.B.	250.	0.0	0.00000185	
[illegible]	98.0	0.0	0.0001	
[illegible]	71.0	0.0	0.0053	
(1-11) Name of Comp.	(12-15) M.W.	(16-25) Tare Wt.(g)	(26-35) Gross Wt.(g)	(36-47) How determined

M.W. Fr. HCl = 36.5

MONS 054021

ZONE	Pitot Velocity Head HP (3-7)	Stack Temp. Deg. TS (8-13)	Stack Press inches H_2O PS (14-18)	Time at end of ZONE Min T (19-23)	Meter Volume at end ZONE Cu.ft. VM (24-29)	Temp. W=Wet D=Dry Deg. TC (30-34)	Meter Temp. Inlet at end ZONE TMI (35-39)	Meter Temp. Outlet at end ZONE TMO (40-44)	Meter Press. At start of ZONE In Hg PM1 (45-49)	Meter Press. At end of ZONE In Hg PM2 (50-54)	Pressure across Orifice HO (55-59)
1		140.00	0.700	0.0	218.60	D	64.0	60.0			
1	0.130	140.00	0.700	7.0	223.58	42.0	75.0	61.0			2.100
2	0.160	140.00	0.700	14.0	229.01	46.0	87.0	64.0			2.590
3	0.170	140.00	0.700	21.0	234.71	50.0	96.0	68.0			2.750
4	0.160	140.00	0.700	28.0	240.29	52.0	100.0	72.0			2.590
5	0.100	140.00	0.700	35.0	244.69	46.0	93.0	77.0			1.610
6	0.130	140.00	0.700	42.0	249.76	50.0	101.0	79.0			2.100
7	0.160	140.00	0.700	49.0	255.80	56.0	106.0	81.0			2.590
8	0.140	140.00	0.700	56.0	260.72	60.0	102.0	82.0			2.230

MONS 054022

APPENDIX B

STACK TEST COMPUTER PRINTOUTS

SANTO INDUSTRIAL CHEMICALS CO.

. KRUMMRICH PLANT SAUGET,IL 62201. ID NO. 63 121 AAC
E SEPT 12 1974 START TIME 1:00 PM
SAMPLED- INCINERATOR SOURCE OPERATION NO. 831
LING DONE BY NEIL SULLIVAN AND ED HEUMANN

ING METHOD-EPA METHOD #5 + DMF AND NA2SO3 IMPINGERS

ATION OF EMISSION RATE OF
A:PARTICULATE
B:P.C.B.
C:HCL
D:H3PO4
WEIGHT RATE= 772.00 POUNDS PER HOUR
SULT:

	/ACTUAL CFM AT / STACK CONDITIONS/	/STD CFM AT 70 DEG.F	DRY STD CFM / AND 29.92 IN. HG/
CK VOLUME	1903.1	1803.8	1711.6

T,MIST,OR GAS CONCENTRATION IN WET & DRY STACK GAS AT STD CONDITIO

POINT	GRAINS PER CUBIC FT	LBS. PER MILLION CUBIC FT	LBS. PER 1000 LBS. GAS	MGS. PER CUBIC METER	PARTS PER MILLION	
A:	0.0708	10.1163	0.1331	162.0486	134.9248	IN WET GAS
A:	0.0746	10.6611	0.1374	170.7756	142.1910	IN DRY GAS
B:	0.0000	0.0018	0.0000	0.0289	0.0028	IN WET GAS
B:	0.0000	0.0019	0.0000	0.0304	0.0029	IN DRY GAS
C:	0.0307	4.3816	0.0576	70.1866	46.4308	IN WET GAS
C:	0.0323	4.6176	0.0595	73.9665	48.9313	IN DRY GAS
D:	0.0827	11.8131	0.1554	189.2287	46.6235	IN WET GAS
D:	0.0871	12.4493	0.1604	199.4194	49.1344	IN DRY GAS

SSION RATE:

POINT	LBS. PER HOUR	GRAMS PER SEC.	LBS. PER UNIT OF PRODUCTION
A:	1.0948	0.1379	0.0014
B:	0.0002	0.0000	0.0000
C:	0.4742	0.0597	0.0006
D:	1.2785	0.1611	0.0017

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MONSANTO INDUSTRIAL CHEMICALS CO.

W.G. KRUMMRICH PLANT SAUGET,IL 62201. ID NO. 63 121 AAC
DATE SEPT 12 1974 START TIME 1:00 PM
STACK SAMPLED- INCINERATOR SOURCE OPERATION NO. 831

FIELD DATA:

ORIFICE CONSTANT K=0.506 PITOT TUBE FACTOR FS= 0.83
TEMPS. RECORDED IN FA DEGREES
METER CORRECTION FACTOR= 1.02

GAS ANALYSIS: Z=NONE MOLECULAR WT OF Z= 0.0
MOLECULAR WT. OF STACK GAS = 29.40
DRY MOLECULAR WT. OF GAS = 30.02

O2	N2	CO2	CO	H2O	Z	VOL	TW	PW	
0.106	0.802	0.092	0.0	0.051	0.0	40.630	100.20	29.64	43.

PARTICULATE	DETERMINED BY	BY WEIGHT	=	0.1884 GRAMS
P.C.B.	DETERMINED BY	BY WEIGHT	=	0.0000 GRAMS
HCL	DETERMINED BY	BY WEIGHT	=	0.0816 GRAMS
H3PO4	DETERMINED BY	BY WEIGHT	=	0.2200 GRAMS

LEAK TEST ON EQUIPMENT=0.001 CFM AT 15.00 IN.HG
BAROMETER= 29.64 IN.HG; STACK DIAM= 19.000 INCH NOZZLE DIAM = 0.375

ZONE	VEL HEAD HP	STACK TEMP TS	STACK PRESS H2O	TIME AT END ZONE	VOLAT END ZONE	CONV TEMP	METER TEMP IN	METER TEMP OUT	METER PRESS START HG	METER PRESS FIN HG	FLOWM ORIFI H2O
0	0.0	95.0	0.8	0.0	935.30	D	90.0	90.0	0.0	0.0	0.0
1	0.060	95.0	0.8	8.0	939.71	64.0	98.0	90.0	0.0	0.0	1.16
2	0.080	95.0	0.8	16.0	944.74	64.0	106.0	91.0	0.0	0.0	1.58
3	0.095	95.0	0.8	24.0	950.22	65.0	111.0	92.0	0.0	0.0	1.85
4	0.095	95.0	0.8	32.0	955.71	65.0	111.0	94.0	0.0	0.0	1.85
5	0.065	95.0	0.8	40.0	960.50	63.0	106.0	95.0	0.0	0.0	1.28
6	0.080	95.0	0.8	48.0	965.28	64.0	110.0	98.0	0.0	0.0	1.58
7	0.090	95.0	0.8	56.0	970.65	65.0	113.0	97.0	0.0	0.0	1.75
8	0.090	95.0	0.8	62.0	975.93	68.0	114.0	97.0	0.0	0.0	1.75

MONSANTO INDUSTRIAL CHEMICALS CO.

W.G. KRUMMRICH PLANT SAUGET,IL 62201. ID NO. 63 121 AAC
DATE SEPT 12 1974 START TIME 1:00 PM
STACK SAMPLED- INCINERATOR SOURCE OPERATION NO. 831
CALCULATION AND EVALUATION:
THE ISOKINETIC CONSTANT HO/HP FOR THIS EQUIPMENT IS 23.6264
THE TABLE BELOW SHOWS FOR EACH ZONE THE METER VOL. AND THE AVG. METER T
AND PRESS. IN ABSOLUTE UNITS. FROM THIS IS CALCULATED THE EQUIVALENT VO
STACK CONDITIONS AND DIVIDED BY TIME TO GIVE THE FLOW IN THE NOZZLE. TH
COMPARED WITH THE ISOKINETIC FLOW RATE CALCULATED FROM THE STACK VELOCI
PERCENTAGE DEVIATION IS RECORDED.

ZONE	SAMPLE/STACK/AVG. TIME	VEL.	METER	PRESS/ AVG. STACK	METER	TEMP/SAMPLE VOL./SAMPLE RATE /P.C. METER	STACK	METER	STACK	ACTUAL	ISOKIN	DEV
1	8.0	13.8	29.7	29.7	552.0	555.0	4.4	4.8	0.60	0.64		-6.34
2	8.0	16.0	29.8	29.7	556.3	555.0	5.0	5.4	0.68	0.74		-8.09
3	8.0	17.4	29.8	29.7	560.0	555.0	5.5	5.9	0.73	0.80		-8.67
4	8.0	17.4	29.8	29.7	562.0	555.0	5.5	5.8	0.73	0.80		-8.83
5	8.0	14.4	29.7	29.7	561.5	555.0	4.8	5.1	0.64	0.66		-3.88
6	8.0	16.0	29.8	29.7	562.3	555.0	4.8	5.1	0.64	0.74		-13.60
7	8.0	16.9	29.8	29.7	564.5	555.0	5.4	5.7	0.71	0.78		-8.81
8	6.0	16.9	29.8	29.7	565.3	555.0	5.3	5.6	0.93	0.78		19.39
TOTAL												
	62.0	16.1	29.8	29.7	560.5	555.0	40.6	43.3	0.70	0.74		-5.75
	T	AV	AV	AV	AV	AV	T	T	AV	AV		AV

TOTAL SAMPLE VOL. CORRECTED FROM STACK CONDITIONS TO STD CONDITIONS=
41.06 CUBIC FT. OF WET GAS
TOTAL SAMPLE VOL. CORRECTED TO DRY STD CONDITIONS = 38.96 CUBIC FT.

MONSANTO INDUSTRIAL CHEMICALS CO.

W.G. KRUMMRICH PLANT SAUGET,IL 62201. ID NO. 63 121 AAC
DATE OCT 1 1975 START TIME 1:30 PM
STACK SAMPLED- INCINERATOR SOURCE OPERATION NO. 831
SAMPLING DONE BY NEIL SULLIVAN AND ED HEUMANN

SAMPLING METHOD-EPA METHOD #5 + DMF AND NA2SO3 IMPINGERS

DETERMINATION OF EMISSION RATE OF

A:PARTICULATE
B:P.C.B.
C:CL2

PROCESS WEIGHT RATE= 0.90 THOUSAND POUNDS PER HOUR
TEST RESULT:

	/ACTUAL CFM AT / STACK CONDITIONS/	/STD CFM AT 70 DEG.F	DRY STD CFM AND 29.92 IN. HG/
STACK VOLUME	3749.6	3257.1	2353.4

DUST,MIST,OR GAS CONCENTRATION IN WET & DRY STACK GAS AT STD CONDITIONS

COMPONENT	GRAINS PER CUBIC FT	LBS. PER MILLION CUBIC FT	LBS. PER 1000 LBS. GAS	MGS. PER CUBIC METER	PARTS PER MILLION	
A:	0.0725	10.3620	0.1494	165.9835	138.2010	IN WET GAS
A:	0.1004	14.3408	0.1836	229.7183	191.2679	IN DRY GAS
B:	0.0000	0.0011	0.0000	0.0182	0.0018	IN WET GAS
B:	0.0000	0.0016	0.0000	0.0252	0.0024	IN DRY GAS
C:	0.0079	1.1335	0.0163	18.1570	6.1749	IN WET GAS
C:	0.0110	1.5687	0.0201	25.1290	8.5460	IN DRY GAS

EMISSION RATE:

COMPONENT	LBS. PER HOUR	GRAMS PER SEC.	LBS. PER UNIT OF PRODUCTION
A:	2.0250	0.2551	2.2450
B:	0.0002	0.0000	0.0002
C:	0.2215	0.0279	0.2456

[illegible] CHEMICALS CO.

W.G. KRUMMRICH PLANT SAUGET, IL 62201. ID NO. 63 121 AAC 525
DATE OCT 1 1975 START TIME 1:30 PM
STACK SAMPLED- INCINERATOR SOURCE OPERATION NO. 831

FIELD DATA:

ORIFICE CONSTANT K=0.506 PITOT TUBE FACTOR FS= 0.83
TEMPS. RECORDED IN FA DEGREES
METER CORRECTION FACTOR= 1.02

GAS ANALYSIS: Z=NONE MOLECULAR WT OF Z= 0.0
MOLECULAR WT. OF STACK GAS = 26.83
DRY MOLECULAR WT. OF GAS = 30.22

O2	N2	CO2	CO	H2O	Z	VOL	TW	PW	WC
0.068	0.818	0.114	0.0	0.277	0.0	30.200	70.89	29.90	244.6

PARTICULATE	DETERMINED BY	BY WEIGHT GC	=	0.2002 GRAMS
P.C.B.	DETERMINED BY	BY ~~TITRATION~~	=	0.0000 GRAMS
CL2	DETERMINED BY	BY TITRATION	=	0.0219 GRAMS

LEAK TEST ON EQUIPMENT=0.005 CFM AT 15.00 IN.HG
BAROMETER= 29.90 IN.HG; STACK DIAM= 19.000 IN.; NOZZLE DIAM = 0.375

ZONE	VEL HEAD HP	STACK TEMP TS	STACK PRESS H2O	TIME ATEND ZONE	VOLAT END ZONE	COND TEMP	METER TEMP IN	METER TEMP OUT	METER PRESS START HG	METER PRESS FIN HG	FLOWME ORIFIC H2O
0	0.0	149.0	-0.4	0.0	428.50	D	64.0	64.0	0.0	0.0	0.0
1	0.200	149.0	-0.4	8.0	431.84	51.0	68.0	64.0	0.0	0.0	0.650
2	0.300	149.0	-0.4	16.0	435.82	51.0	74.0	64.0	0.0	0.0	0.960
3	0.340	149.0	-0.4	24.0	439.97	53.0	80.0	65.0	0.0	0.0	1.100
4	0.330	149.0	-0.4	32.0	444.11	55.0	80.0	66.0	0.0	0.0	1.070
5	0.170	149.0	-0.4	40.0	447.29	53.0	74.0	66.0	0.0	0.0	0.569
6	0.230	149.0	-0.4	48.0	450.84	54.0	80.0	66.0	0.0	0.0	0.740
7	0.300	149.0	-0.4	56.0	454.84	56.0	83.0	68.0	0.0	0.0	0.960
8	0.270	149.0	-0.4	64.0	458.70	58.0	82.0	68.0	0.0	0.0	0.870

MONS 054028

W.G. KRUMMRICH PLANT SAUGET,IL 62201. ID NO. 63 121 AAC 526
DATE OCT 1 1975 START TIME 1:30 PM
STACK SAMPLED- INCINERATOR SOURCE OPERATION NO. 031
CALCULATION AND EVALUATION:
THE ISOKINETIC CONSTANT HO/IP FOR THIS EQUIPMENT IS 13.0114
THE TAHLE BELOW SHOWS,FOR EACH ZONE,THE METER VOL. AND THE AVG. METER AND PRESS. IN ABSOLUTE UNITS. FROM THIS IS CALCULATED THE EQUIVALENT VO STACK CONDITIONS AND DIVIDED BY TIME TO GIVE THE FLOW IN THE NOZZLE. TH COMPARED WITH THE ISOKINETIC FLOW RATE CALCULATED FROM THE STACK VELOCI PERCENTAGE DEVIATION IS RECORDED.

ZONE	SAMPLE/STACK/AVG. TIME	VEL.	METER	PRESS/ AVG. STACK	METER	TEMP/SAMPLE VOL./SAMPLE RATE /P.C. STACK	METER	STACK	ACTUAL	ISOKIN DEV
1	8.0	27.6	29.9	29.9	525.0	609.0	3.3	5.5	0.69	1.27-46.07
2	8.0	33.8	30.0	29.9	527.5	609.0	4.0	6.5	0.81	1.56-47.74
3	8.0	36.0	30.0	29.9	530.8	609.0	4.2	6.7	0.84	1.66-49.10
4	8.0	35.5	30.0	29.9	532.8	609.0	4.1	6.7	0.84	1.63-48.66
5	8.0	25.5	29.9	29.9	531.5	609.0	3.2	5.2	0.64	1.17-45.00
6	8.0	29.6	30.0	29.9	531.5	609.0	3.6	5.8	0.72	1.36-47.19
7	8.0	33.8	30.0	29.9	534.3	609.0	4.0	6.5	0.81	1.56-48.14
8	8.0	32.1	30.0	29.9	535.3	609.0	3.9	6.2	0.78	1.48-47.35
TOTAL	64.0	31.7	30.0	29.9	531.1	609.0	30.2	49.0	0.77	1.46-47.55
	T	AV	AV	AV	AV	AV	T	T	AV	AV	AV

TOTAL SAMPLE VOL. CORRECTED FROM STACK CONDITIONS TO STD CONDITIONS=
42.59 CUBIC FT. OF WET GAS
TOTAL SAMPLE VOL. CORRECTED TO DRY STD CONDITIONS = 30.78 CUBIC FT.

MONSANTO INDUSTRIAL CHEMICALS CO.

W.G. KRUMMRICH PLANT SAUGET, IL 62201. ID NO. 63 121 AAC
DATE MAY 23 1975 START TIME 10:30 AM
STACK SAMPLED INCINERATOR STACK SOURCE OPERATION NO. 831
SAMPLING DONE BY NEIL SULLIVAN AND ED H

SAMPLING METHOD-EPH METHOD #5 & DMF AND NA2SO3 IMPINGERS

DETERMINATION OF EMISSION RATE OF
A:PARTICULATE
B:P.C.B.
C:HCL
D:CL2

PROCESS WEIGHT RATE= 1.00 THOUSAND POUNDS PER HOUR
TEST RESULT:

	/ACTUAL CFM AT / STACK CONDITIONS/	/STD CFM AT 70 DEG.F	DRY STD CFM / AND 29.92 IN. HG/
STACK VOLUME	1711.6	1649.0	1569.5

DUST,MIST,OR GAS CONCENTRATION IN WET & DRY STACK GAS AT STD CONDIT

COMPONENT	GRAINS PER CUBIC FT	LBS. PER MILLION CUBIC FT	LBS. PER 1000 LBS. GAS	MGS. PER CUBIC METER	PARTS PER MILLION	
A:	0.0522	7.4602	0.0962	119.5008	99.4946	IN WET GAS
A:	0.0549	7.8383	0.0991	125.5580	104.5420	IN DRY GAS
B:	0.0000	0.0016	0.0000	0.0257	0.0026	IN WET GAS
B:	0.0000	0.0017	0.0000	0.0270	0.0026	IN DRY GAS
C:	0.0027	0.3787	0.0049	6.0656	4.0126	IN WET GAS
C:	0.0028	0.3979	0.0050	6.3731	4.2160	IN DRY GAS
D:	0.0021	0.2970	0.0038	4.7580	1.6181	IN WET GAS
D:	0.0022	0.3121	0.0039	4.9991	1.7001	IN DRY GAS

EMISSION RATE:

COMPONENT	LBS. PER HOUR	GRAMS PER SEC.	LBS. PER UNIT OF PRODUCTION
A:	0.7381	0.0930	0.7381
B:	0.0002	0.0000	0.0002
C:	0.0375	0.0047	0.0375
D:	0.0294	0.0037	0.0294

528

MONSANTO INDUSTRIAL CHEMICALS CO.

W.G. KRUMMRICH PLANT SAUGET,IL 62201. ID NO. 63 121 AAC
DATE MAY 23 1975 START TIME 10:30 AM
STACK SAMPLED- INCINERATOR STACK SOURCE OPERATION NO. 831

FIELD DATA:

ORIFICE CONSTANT K=0.506 PITOT TUBE FACTOR FS= 0.83
TEMPS. RECORDED IN FA DEGREES
METER CORRECTION FACTOR= 1.02

GAS ANALYSIS: Z=NONE MOLECULAR WT OF Z= 0.0
MOLECULAR WT. OF STACK GAS = 30.00
DRY MOLECULAR WT. OF GAS = 30.60

	O2	N2	CO2	CO	H2O	Z	VOL	TW	PW	WGT
	0.028	0.824	0.148	0.0	0.048	0.0	45.630	114.40	29.64	44.72

PARTICULATE	DETERMINED BY	KY WEIGHT	=	0.1517 GRAMS
P.C.B.	DETERMINED BY	KY WEIGHT	=	0.0000 GRAMS
HCL	DETERMINED BY	KY WEIGHT	=	0.0077 GRAMS
CL2	DETERMINED BY	KY WEIGHT	=	0.0060 GRAMS

LEAK TEST ON EQUIPMENT=0.004 CFM AT 15.00 IN.HG
BAROMETER= 29.64 IN.HG; STACK DIAM= 19.000 IN.; NOZZLE DIAM = 0.375

ZONE	VEL HEAD DP	STACK TEMP TS	STACK PRESS H2O	TIME ATEND ZONE	VOLAT END ZONE	COND TEMP		METER TEMP IN	METER TEMP OUT	METER PRESS START HG	METER PRESS FIN HG	FLOWMET ORIFICE H2O
0	0.0	86.0	0.8	0.0	926.60	D		86.0	86.0	0.0	0.0	0.0
1	0.080	86.0	0.8	8.0	932.60		0.0	106.0	94.0	0.0	0.0	1.920
2	0.090	86.0	0.8	16.0	938.71		0.0	122.0	104.0	0.0	0.0	2.160
3	0.060	86.0	0.8	24.0	944.48		0.0	132.0	104.0	0.0	0.0	1.450
4	0.060	86.0	0.8	32.0	950.04		0.0	134.0	108.0	0.0	0.0	1.450
5	0.050	86.0	0.8	40.0	955.74		0.0	128.0	110.0	0.0	0.0	1.200
6	0.070	86.0	0.8	48.0	960.50		0.0	134.0	112.0	0.0	0.0	1.700
7	0.070	86.0	0.8	56.0	967.85		0.0	134.0	114.0	0.0	0.0	1.700
8	0.070	86.0	0.8	64.0	972.23		0.0	134.0	118.0	0.0	0.0	1.700

529

MONSANTO INDUSTRIAL CHEMICALS CO.

W.G. KRUMMRICH PLANT SAUGET,IL 62201. ID NO. 63 121 AAC
DATE MAY 23 1975 START TIME 10:30 AM
STACK SAMPLED- INCINERATOR STACK SOURCE OPERATION NO. 831
CALCULATION AND EVALUATION:
THE ISOKINETIC CONSTANT KO/KP FOR THIS EQUIPMENT IS 24.7938
THE TABLE BELOW SHOWS FOR EACH ZONE THE METER VOL. AND THE AVG. METER TE
AND PRESS. IN ABSOLUTE UNITS. FROM THIS IS CALCULATED THE EQUIVALENT VOL.
STACK CONDITIONS AND DIVIDED BY TIME TO GIVE THE FLOW IN THE NOZZLE. THIS
COMPARED WITH THE ISOKINETIC FLOW RATE CALCULATED FROM THE STACK VELOCITY
PERCENTAGE DEVIATION IS RECORDED.

ZONE	SAMPLE/STACK/AVG. TIME	VEL.	METER	PRESS/ AVG. STACK	METER	TEMP/SAMPLE VOL./SAMPLE RATE /P.C. STACK	METER	STACK	ACTUAL	ISOKIN	DEV
1	8.0	15.7	29.8	29.7	553.0	546.0	6.0	6.4	0.80	0.72	10.23
2	8.0	16.6	29.8	29.7	566.5	546.0	6.1	6.3	0.79	0.77	3.38
3	8.0	13.6	29.7	29.7	575.5	546.0	5.8	5.9	0.73	0.63	17.49
4	8.0	13.6	29.7	29.7	579.5	546.0	5.6	5.6	0.70	0.63	10.52
5	8.0	12.4	29.7	29.7	580.0	546.0	5.7	5.8	0.72	0.57	26.[illegible]
6	8.0	14.7	29.8	29.7	581.0	546.0	4.8	4.8	0.60	0.68	-11.[illegible]
7	8.0	14.7	29.8	29.7	583.5	546.0	7.3	7.4	0.92	0.68	35.74
8	8.0	14.7	29.8	29.7	585.0	546.0	4.4	4.4	0.55	0.68	-18.72
TOTAL											
	64.0	14.5	29.8	29.7	575.5	546.0	45.6	46.5	0.73	0.67	9.04
	T	AV	AV	AV	AV	AV	T	T	AV	AV	AV

TOTAL SAMPLE VOL. CORRECTED FROM STACK CONDITIONS TO STD CONDITIONS=
44.83 CUBIC FT. OF WET GAS
TOTAL SAMPLE VOL. CORRECTED TO DRY STD CONDITIONS = 42.67 CUBIC FT.

530

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION V
AIR SURVEILLANCE BRANCH — FIELD SUPPORT SECTION
STACK TEST REVIEW

COMPANY MONSANTO

STACK IDENTIFICATION PCB INCINERATOR

RUN NUMBER _____ DATE OF RUN Sept. 2, 1976

1. Amount of water collected (milliliters) = 41.5
   Volume of water vapor collected (SCF) = 2.0553

2. Dry gas meter volume at meter conditions (cubic feet) = 40.63
   Barometric pressure (inches of mercury) = 29.64
   Average orifice pressure drop (inches of water) = 1.600
   Average meter temperature = 100 °F

3. Gas meter volume at STP (dry cubic feet) = 33.32

4. Percentage of moisture in gas stream = 5.19 %

5. Percent composition of gas stream:

   Oxygen..... 19.60%
   Nitrogen..... 69.20%
   Carbon Dioxide... 9.20%
   Carbon Monoxide... .00%

6. Percentage of excess air = 109.25%

7. Dry molecular weight of gas stream (lb./lb-mole) = 29.89
   Wet molecular weight of gas stream (lb./lb-mole) = 29.38

8. Pitot tube coefficient (dimensionless) = .83
   Number of pitot tube readings = 6
   Average of square roots of velocity pressures = .2852
   Average gas stream temperature (°F) = 93°F
   Gas stream velocity (ft/sec) = 16.165
   Pitot tube readings:

   .06 .08 .09 .09 .06 .08 .09
   .09

9. Stack dimensions, circular with diameter (feet) = 1.58
   Stack area (square feet) = 1.96
   Volumetric flow at STP (cubic feet/min) = 1719

10. Nozzle diameter used for sampling (inches) = .375
    Sampling time (minutes) = 62.00
    Weight of particulate matter collected (milligram) = .03

11. Particulate concentration (lb./SCF) = .0000200
    Particulate concentration (grain/SCF) = .000013
    Particulate concentration corrected to 50 % excess air (lb./CF) = .0000200
    Particulate concentration corrected to 50 % excess air (grain/CF) = .000013

12. Isokinetic rate (%) = 92.15

13. Mass emission rate (lb./hr) = .03

Date Feb. 10, 1976

Signature R. Edwin Felton

531

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION V
AIR SURVEILLANCE BRANCH FIELD SUPPORT SECTION
STACK TEST REVIEW

COMPANY MONSANTO

STACK IDENTIFICATION NO1 INCINERATOR

RUN NUMBER _____ DATE OF RUN May 23, 1975

1. Amount of water collected (milliliters) = 44.70
   Volume of water vapor collected (SCF) = 2.11378

2. Dry gas meter volume at meter conditions (cubic feet) = 45.63
   Barometric pressure (inches of mercury) = 29.66
   Average orifice pressure drop (inches of water) = 1.660
   Average meter temperature = 114 °F

3. Gas meter volume at STP (dry cubic feet) = 41.87

4. Percentage of moisture in gas stream = 4.81 %

5. Percent composition of gas stream:

   Oxygen..... 2.80%
   Nitrogen..... 82.40%
   Carbon Dioxide... 14.80%
   Carbon Monoxide.. .0%

6. Percentage of excess air = 14.77%

7. Dry molecular weight of gas stream (lb./lb-mole) = 30.48
   Wet molecular weight of gas stream (lb./lb-mole) = 29.87

8. Pitot tube coefficient (dimensionless) = .83
   Number of pitot tube readings = 8
   Average of square roots of velocity pressures = .2612
   Average gas stream temperature (°F) = 86°F
   Gas stream velocity (ft/sec) = 14.539
   Pitot tube readings:

   .09 .09 .06 .06 .05 .07 .07 .07

9. Stack dimensions, circular with diameter (feet) = 1.38
   Stack area (square feet) = 1.96
   Volumetric flow at STP (cubic feet/min) = 1568

10. Nozzle diameter used for sampling (inches) = .375
    Sampling time (minutes) = 64.00
    Weight of particulate matter collected (milligram) = .03

11. Particulate concentration (lb./SCF) = .0000000
    Particulate concentration (grain/SCF) = .000012
    Particulate concentration corrected to 50 % excess air (lb./CF) = .0000000
    Particulate concentration corrected to 50 % excess air (grain/CF) = .000000

12. Isokinetic rate (%) = 106.64

13. Mass emission rate (lb./hr) = .00

Date Feb. 10, 1976

Signature _____

MONS 054034

532

COMPANY Monsanto

STACK IDENTIFICATION PCB Incinerator

RUN NUMBER _____ DATE OF RUN Oct. 1,1975

1. Amount of water collected (milliliters) = 244.61
   Volume of water vapor collected (STP) = 11.59451

2. Dry gas meter volume at meter conditions (cubic feet) = 30.20
   Barometric pressure (inches of mercury) = 29.90
   Average orifice pressure drop (inches of water) = .360
   Average meter temperature = 71 °F

3. Gas meter volume at STP (dry cubic feet) = 30.18

4. Percentage of moisture in gas stream = 27.75 %

5. Percent composition of gas stream:

   Oxygen..... 6.80%
   Nitrogen..... 81.80%
   Carbon Dioxide... 11.40%
   Carbon Monoxide.. .00%

6. Percentage of excess air = 45.96%

7. Dry molecular weight of gas stream (lb./lb-mole) = 30.00
   Wet molecular weight of gas stream (lb./lb-mole) = 26.73

8. Pitot tube coefficient (dimensionless) = .83
   Number of pitot tube readings = 8
   Average of square roots of velocity pressures = .5139
   Average gas stream temperature (°F) = 140°F
   Gas stream velocity (ft/sec) = 31.025
   Pitot tube readings:

   .20 .30 .34 .33 .17 .23 .30 .27

9. Stack dimensions, circular with diameter (feet) = 1.58
   Stack area (square feet) = 1.96
   Volumetric flow at STP (cubic feet/min) = 2352

10. Nozzle diameter used for sampling (inches) = .375
    Sampling time (minutes) = 64.00
    Weight of particulate matter collected (milligram) = .02

11. Particulate concentration (lb./SCF) = .0000000
    Particulate concentration (grain/SCF) = .000011
    Particulate concentration corrected to 50 % excess air (lb./CF) = .0000000
    Particulate concentration corrected to 50 % excess air (grain/CF) = .000012

12. Isokinetic rate (%) = 51.23

13. Mass emission rate (lb./hr) = .00

MONS 054035

Date Feb. 6, 1976

535

MONSANTO INDUSTRIAL CHEMICALS CO.

W.G. KRUMMRICH PLANT SAUGET, IL 62201. ID NO. 63 121 AAC
DATE MAY 23 1975 START TIME 10:30 AM
STACK SAMPLED- INCINERATOR STACK SOURCE OPERATION NO. 831
CALCULATION AND EVALUATION:
THE ISOKINETIC CONSTANT HO/HP FOR THIS EQUIPMENT IS 24.7938
THE TABLE BELOW SHOWS FOR EACH ZONE THE METER VOL. AND THE AVG. METER TEMP. AND PRESS. IN ABSOLUTE UNITS. FROM THIS IS CALCULATED THE EQUIVALENT VOL. AT STACK CONDITIONS AND DIVIDED BY TIME TO GIVE THE FLOW IN THE NOZZLE. THIS IS COMPARED WITH THE ISOKINETIC FLOW RATE CALCULATED FROM THE STACK VELOCITY. PERCENTAGE DEVIATION IS RECORDED.

ZONE	SAMPLE/STACK/AVG. TIME	VEL.	METER	PRESS/ AVG. STACK	METER	TEMP/SAMPLE VOL./ STACK	METER	STACK	SAMPLE RATE ACTUAL	/P.C. ISOKIN	DEV
1	8.0	15.7	29.8	29.7	553.0	546.0	6.0	6.4	0.80	0.72	10.23
2	8.0	16.6	29.8	29.7	566.5	546.0	6.1	6.3	0.79	0.77	3.38
3	8.0	13.6	29.7	29.7	575.5	546.0	5.8	5.9	0.73	0.63	17.49
4	8.0	13.6	29.7	29.7	579.5	546.0	5.6	5.6	0.70	0.63	12.42
5	8.0	12.4	29.7	29.7	580.0	546.0	5.7	5.8	0.72	0.57	26.08
6	8.0	14.7	29.8	29.7	581.0	546.0	4.8	4.8	0.60	0.68	-11.06
7	8.0	14.7	29.8	29.7	583.5	546.0	7.3	7.4	0.92	0.68	36.74
8	8.0	14.7	29.8	29.7	585.0	546.0	4.4	4.4	0.55	0.68	-18.72
TOTAL											
	64.0	14.5	29.8	29.7	575.5	546.0	45.6	46.5	0.73	0.67	9.04
	T	AV	AV	AV	AV	AV	T	T	AV	AV	AV

TOTAL SAMPLE VOL. CORRECTED FROM STACK CONDITIONS TO STD CONDITIONS=
44.83 CUBIC FT. OF NET GAS
TOTAL SAMPLE VOL. CORRECTED TO DRY STD CONDITIONS = 42.67 CUBIC FT.

MONSANTO INDUSTRIAL CHEMICALS CO.

W.G. KRUMMRICH PLANT SAUGET,IL 62201. ID NO. 63 121 AAC
DATE OCT 1 1975 START TIME 1:30 PM
STACK SAMPLED- INCINERATOR SOURCE OPERATION NO. 831
SAMPLING DONE BY NEIL SULLIVAN AND ED HEUMANN

SAMPLING METHOD-EPA METHOD #5 + DMF AND NA2SO3 IMPINGERS

DETERMINATION OF EMISSION RATE OF
A:PARTICULATE
B:P.C.B.
C:CL2

PROCESS WEIGHT RATE= 0.90 THOUSAND POUNDS PER HOUR
TEST RESULT:

	/ACTUAL CFM AT / STACK CONDITIONS/	/STD CFM AT 70 DEG.F	DRY STD CFM / AND 29.92 IN. HG/
STACK VOLUME	3749.6	3257.1	2353.4

DUST,MIST,OR GAS CONCENTRATION IN WET & DRY STACK GAS AT STD CONDITIONS

COMPONENT	GRAINS PER CUBIC FT	LBS. PER MILLION CUBIC FT	LBS. PER 1000 LBS. GAS	MGS. PER CUBIC METER	PARTS PER MILLION	
A:	0.0725	10.3620	0.1494	165.9835	138.2010	IN WET GAS
A:	0.1004	14.3408	0.1836	229.7183	191.2679	IN DRY GAS
B:	0.0000	0.0011	0.0000	0.0182	0.0018	IN WET GAS
B:	0.0000	0.0016	0.0000	0.0252	0.0024	IN DRY GAS
C:	0.0079	1.1335	0.0163	18.1570	6.1749	IN WET GAS
C:	0.0110	1.5687	0.0201	25.1290	8.5460	IN DRY GAS

EMISSION RATE:

COMPONENT	LBS. PER HOUR	GRAMS PER SEC.	LBS. PER UNIT OF PRODUCTION
A:	2.0250	0.2551	2.2450
B:	0.0002	0.0000	0.0002
C:	0.2215	0.0279	0.2456

535

W.G. KRUMMRICH PLANT SAUGET,IL 62201. ID NO. 63 121 AAC
DATE OCT 1 1975 START TIME 1:30 PM
STACK SAMPLED= INCINERATOR SOURCE OPERATION NO. 831

FIELD DATA:

ORIFICE CONSTANT K=0.506 PITOT TUBE FACTOR FS= 0.83
TEMPS. RECORDED IN FA DEGREES
METER CORRECTION FACTOR= 1.02

GAS ANALYSIS: Z=NONE MOLECULAR WT OF Z= 0.0
MOLECULAR WT. OF STACK GAS = 26.83
DRY MOLECULAR WT. OF GAS = 30.22

O2	N2	CO2	CO	H2O	Z	VDL	TW	PW	WGT
0.068	0.818	0.114	0.0	0.277	0.0	30.200	70.89	29.90	244.61

PARTICULATE	DETERMINED BY	BY WEIGHT GC	=	0.2002	GRAMS
P.C.B.	DETERMINED BY	BY ~~TITRATION~~	=	0.0000	GRAMS 0.0
CL2	DETERMINED BY	BY TITRATION	=	0.0219	GRAMS

LEAK TEST ON EQUIPMENT=0.005 CFM AT 15.00 IN.HG
BAROMETER= 29.90 IN.HG; STACK DIAM= 19.000 IN.; NOZZLE DIAM = 0.375

ZONE	VEL HEAD HP	STACK TEMP TS	STACK PRESS H2O	TIME ATEND ZONE	VOLAT END ZONE	COND TEMP	METER TEMP IN	METER TEMP OUT	METER PRESS START HG	METER PRESS FIN HG	FLOWMETER ORIFICE H2O
0	0.0	149.0	-0.4	0.0	428.50	D	64.0	64.0	0.0	0.0	0.0
1	0.200	149.0	-0.4	8.0	431.84	51.0	68.0	64.0	0.0	0.0	0.650
2	0.300	149.0	-0.4	16.0	435.82	51.0	74.0	64.0	0.0	0.0	0.960
3	0.340	149.0	-0.4	24.0	439.97	53.0	80.0	65.0	0.0	0.0	1.100
4	0.330	149.0	-0.4	32.0	444.11	55.0	80.0	66.0	0.0	0.0	1.070
5	0.170	149.0	-0.4	40.0	447.29	53.0	74.0	66.0	0.0	0.0	0.569
6	0.230	149.0	-0.4	48.0	450.84	54.0	80.0	66.0	0.0	0.0	0.740
7	0.300	149.0	-0.4	56.0	454.84	56.0	83.0	68.0	0.0	0.0	0.960
8	0.270	149.0	-0.4	64.0	458.70	58.0	82.0	68.0	0.0	0.0	0.870

MONS 054038

536

W.G. KRUMMRICH PLANT SAUGET,IL 62201. ID NO. 63 121 AAC
DATE OCT 1 1975 START TIME 1:30 PM
STACK SAMPLED- INCINERATOR ..... SOURCE OPERATION NO.. 831 ...
CALCULATION AND EVALUATION:
THE ISOKINETIC CONSTANT HO/HP FOR THIS EQUIPMENT IS 13.0114
THE TABLE BELOW SHOWS,FOR EACH ZONE,THE METER VOL. AND THE AVG. METER TE
AND PRESS. IN ABSOLUTE UNITS. FROM THIS IS CALCULATED THE EQUIVALENT VOL.
STACK CONDITIONS AND DIVIDED BY TIME TO GIVE THE FLOW IN THE NOZZLE. THIS
COMPARED WITH THE ISOKINETIC FLOW RATE CALCULATED FROM THE STACK VELOCITY
PERCENTAGE DEVIATION IS RECORDED.

ZONE	SAMPLE TIME	STACK VEL.	AVG. METER	PRESS/ STACK	AVG. METER	TEMP/SAMPLE STACK	METER	VOL./SAMPLE STACK	ACTUAL	RATE ISOKIN	/P.C. DEV
1	8.0	27.6	29.9	29.9	525.0	609.0	3.3	5.5	0.69	1.27	-46.07
2	8.0	33.8	30.0	29.9	527.5	609.0	4.0	6.5	0.81	1.56	-47.74
3	8.0	36.0	30.0	29.9	530.8	609.0	4.2	6.7	0.84	1.66	-49.10
4	8.0	35.5	30.0	29.9	532.8	609.0	4.1	6.7	0.84	1.63	-48.66
5	8.0	25.5	29.9	29.9	531.5	609.0	3.2	5.2	0.64	1.17	-45.00
6	8.0	29.6	30.0	29.9	531.5	609.0	3.6	5.8	0.72	1.36	-47.19
7	8.0	33.8	30.0	29.9	534.3	609.0	4.0	6.5	0.81	1.56	-48.14
8	8.0	32.1	30.0	29.9	535.3	609.0	3.9	6.2	0.78	1.48	-47.35
TOTAL											
	64.0	31.7	30.0	29.9	531.1	609.0	30.2	49.0	0.77	1.46	-47.55
	T	AV	AV	AV	AV	AV	T	T	AV	AV	AV

TOTAL SAMPLE VOL. CORRECTED FROM STACK CONDITIONS TO STD CONDITIONS=
42.59 CUBIC FT. OF WET GAS
TOTAL SAMPLE VOL. CORRECTED TO DRY STD. CONDITIONS =..... 30.78 CUBIC FT.

MONS 054039

Facility: Monsanto Company
W.G. Krummrich Plant
Route 3
Sauget, IL 62201

Date of Inspection: January 27, 1976

Participants: Monsanto
Paul Heisler
Clarence Buckley

U.S. Environmental Protection Agency
Edwin Zylstra
John Connell
Charles Miller

Background:

Monsanto is the sole manufacturer of PCB in the United States. Production figures for the first nine months of 1975 are listed below:

Aroclor	Thousands of Pounds
1016	10350
1242	5120
1254	6980

Starting during the latter part of 1972, the only use for PCB compounds is in the manufacture of transformers and capacitors.

Process:

The chlorinator is charged with biphenyl and ferric chloride (catalyst) and then heated. Vaporized chlorine is fed into the chlorinator. The contact time varies from 12 to 36 hours, depending on the type of Aroclor to be produced, which determines the degree of chlorination. The vapor from the chlorinator (HCl containing PCB) goes to the scrubber where it is washed with liquid Aroclor. The gaseous HCl is sent to the purification section of the plant. The crude Aroclor goes to the Blower tank where it is blown with dry air for several hours. The air is scrubbed with water and vented to the atmosphere through a demister, the crude product is sent to a storage tank where a few tenths of 1% of alkali is added to react with any remaining hydrogen chloride or ferric chloride.

The method of distillation of the raw Aroclor varies depending upon the product to be produced. For types 1254, 1242, and 1221, the process is the same. Each is distilled in a vacuum still, the condensate being the finished product and the bottoms being the Montars which are sent to incineration. For Aroclor 1016, the crude aroclor is distilled in a vacuum distillation tower. The steam from the steam jet ejectors is partially condensed; the condensate being discharged into the plant discharge sump and the vapor exhausted to atmosphere. The overhead from the distillation tower is the product 1016 and is sent to storage. The bottoms are sent through another chlorination and distillation cycle. The overhead from this still is the finished product and the bottoms are the Montars which are sent to incineration. The three possible places where PCB can escape into the atmosphere are: vapor from jet ejectors, exhaust from the scrubber; and surface area evaporation (in general).

All aroclors are stored at 150°F with a layer of nitrogen on top of the liquid.

Incineration:

There are three points in the process that go to the incinerator: Montars, bottoms from separator sump, collection from all drip pans. In addition waste material from the users of PCB is sent to Monsanto to be destroyed. The type and concentration of these waste are unknown but it is estimated that they contain about 90% PCB. The amount of contaminated waste disposed of for the first nine months of 1975 is listed below:

	Thousands of Pounds
Customer returns, records exists	1109
Monsanto, records exists	322
Total receipts	1431
Destroyed by incineration	2808

The liquid waste stream is steam atomized and fed into the fire box. The feed is incinerated at a temperature above2200°F with natural gas used for combustion with 5% excess oxygen and a retention time of 2-3 seconds. The gases go through a quench pot, the exhaust of which passes through a venturi scrubber and then through a packed tower which is irrigated by the weak muriatic acid originating from the quench pot. The exhausts are vented to atmosphere through a demister and are monitored.

Loading and Unloading:

The majority of the PCB components and the products made using PCB are liquid and are transported in bulk or in steel drums. Bulk shipments are made in railroad tank car and tank trucks. Waste material shipped in from other locations in 55 gallon drums or tank trucks are unloaded into a concrete pit; the material in this pit is periodically pumped to one of four 20,000 gallon incinerator waste feed tanks. The waste material that is shipped in by rail truck is unloaded into a 500,000 gallon storage tank and is pumped into the feed tanks when required. In the truck or railcar loading area, drainage is directed into a small concrete pit which is periodically pumped into the basins located in the manufacturing area. Relief valve lines and atmosphere vents are routed through catch tanks or are redirected to underground settling basins.

OPTIONAL FORM NO. 10
MAY 1962 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

548

TO : Gerald F. Regan, Chief, Air Surveillance Branch

DATE: March 5, 1976

FROM : Technical Advisor, Special Projects Section
Air Surveillance Branch

SUBJECT: Calculation of PCB Air Emissions from Storage and Dispensing Operations at the Krummrich Plant of Monsanto

Potential air emissions from the storage and dispensing of PCB were calculated based on information supplied by Monsanto. The results of these calculations are:

Storage tanks for virgin product	- 597.4 kg/year
Product loading	- 0.0184 kg/year
Storage and handling waste aroclors	-- 0.00066 kg/year

R. Edwin Zylstra

R. Edwin Zylstra

Attachment (Calculations)

MONS 054043

Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan

Clarence Buckley of Monsanto estimated that storage and loading operations at the plant would displace the following volume of headspace gases:

1. Storage tanks 635,000 ft^3
2. Loading 460,000 ft^3

Calculation of emissions:

From Fig. 2.2 from the Draft Mitre report the vapor pressure of Aroclor 1242 is 3 mm Hg at 100°C and 10^{-4} at 21°C. The aroclors are stored at 100°C. It may be assumed that the temp. in the tanks being loaded would be approximately 70°F (21°C).

From Dolton's law of partial pressure:

$$Bx = \frac{Px}{P\ mix.}$$ where Bx = proportion by volume of a gas component

Px = partial pressure of gas component and
P mix. = absolute pressure of gas mixture.

$$Bx = \frac{3}{760} = \frac{0.0039}{1}$$ or 3900 ppm at 100°C

To change ppm to mg/M^3 use the following formula:

$$mg/M^3 = ppm \times \frac{mol.\ wt.}{molecular\ volume}$$

mol. wt. = 261

molecular volume = 30.62 liters/mol. at 100°C

$$mg/M^3 = 3900 \times \frac{261}{30.62} = 33242$$

Emissions from storage tanks:
Emissions kg/year = Vol. of gas displaced/year x concentration of PCB

$$Kg/yr = 635000\ ft^3 \times .0283 \frac{M^3}{ft^3} \times 33242 \times \frac{1\ kg}{10^6\ mg}$$

kg/year = 597.4

Emissions from loading operations:

$$Bx = \frac{Px}{P\ mix.} = \frac{10^{-4}}{760} = 1.3 \times 10^{-7}$$ or .13 ppm

$$mg/M^3 = .13 \times \frac{261}{24.04} = 1.41\ mg/M^3$$

Emissions:

$$\text{Kg/yr.} = 460{,}000 \times .0283 \times 1.41 \times \frac{1\ \text{kg}}{10^6\ \text{mg}}$$

$$\text{Kg/yr.} = 0.0184$$

Emissions from handling of waste aroclors:

Total waste material received into plant as reported by Monsanto for 9 mos. of 1975 - 1,431,000 lbs. Assume that all this material is received and stored at 70°F and that it displaced an equal volume of tank headspace gas at 70°F.

$$\text{Volume of produce} = 1{,}431{,}000\ \text{lbs.} \times \frac{1\ \text{gal.}}{11.5\ \text{lbs.}} \times 3.785\ \frac{\text{liter}}{\text{gal.}}$$

$$\frac{1}{X103\ \frac{\text{liters}}{M^3}} = 471\ M^3$$

The concentration would be the same as in the loading operation that is 1.41 mg/M^3.

Emissions:

$$\text{Kg/yr.} = 471\ M^3 \times 1.4\ \text{mg}/M^3 \times \frac{1\ \text{kg}}{10^6\ \text{mg}}$$

$$\text{Kg/yr.} = .00066$$

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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SUBJECT: PCB Monitoring - Monsanto, Krummrich Plant, Sauget, Illinois. DATE: FEB 13 1976

FROM: Charles Miller/Ed Zylstra/John Connell, Technical Advisors, SPS

TO: Gerald F. Regan, Chief, Air Surveillance Branch

On January 27, 1976, the SPS field team (Miller, Zylstra, Connell) performed ambient air monitoring for PCB's at the Monsanto Krummrich Plant, Sauget, Illinois. Although Monsanto presently manufactures PCB's at this facility, production of PCB's is to be gradually phased-out.

After a brief discussion and orientation period with Monsanto officials, ASB and ILDO personnel toured the PCB manufacturing area including the incinerator facility. The "plant" area where PCB's are manufactured is not an enclosed structure per se. It is an open structure constructed of steel grating (floors, stairs), safety railings, a maze of piping, collection and reaction vessels, valves, etc. all of which are completely exposed to the elements. Mr. Claire Buckley of Monsanto was assigned as escort for ASB personnel.

Only two locations were deemed appropriate as sampling sites for PCB's. Other possible sites were inaccessible or had recently been tested by Monsanto - ie. - the recent incinerator test results were furnished by Monsanto. These two sampling locations, the cleaning of glassware, equipment used, sampling procedure, samples obtained, etc. is described below:

Site Location #1 (SEG) - Steam Ejector - Ground Level.

This steam ejector pipe terminated just above a grate which covered a recessed concrete trough in the floor at ground level. For collection of the samples, the SPS field team used the glass bubblers, Y-connector with reducer coupling, U-tube, cold trap and vacuum pump. The H-frame base, and 2x4 manifold support and glass manifold were not used. Sampling was performed for a one-hour period, 1046 - 1146 hours.

Site Location #2 (SET) - Steam Ejector - Top Level or 2nd Level Above Ground.

These twin steam ejector pipes (somewhat of a candy-cane configuration) terminated out beyond the 2nd level safety railing. Sample collection was performed using the same equipment as at Site Location #1 and included the H-frame base, one section of 2x4 manifold support, and one section of glass manifold. Sampling was performed for a one-hour period, 1205 - 1305 hours.

The following narrative defines the process for cleaning of the sampling glassware, the actual preparation for sampling, and handling of the samples collected in the bubbler train.

The ASB, SPS field team cleaned all PCB monitoring glassware via the following procedure:

1. Thoroughly wash all glassware with a solution of PCB free detergent. The concentration of the detergent is determined by the manufacturer's instructions.

2. Rinse thoroughly with tap water.

3. Rinse thoroughly with distilled water.

4. Rinse thoroughly with acetone (reagent grade or better).

5. Rinse with hexane, rinse each bubbler three times with 50 ml. of hexane for each rinse and discard.

6. Wrap all small glass parts in aluminum foil and ensure proper sealing, crimping of the foil. Seal all ball joints of the bubblers with aluminum foil (alternately, appropriate ball joint fittings - sealed on one end and thoroughly cleaned - may be clamped in place instead of using aluminum foil; the purpose of the above is to prevent contamination of the now PCB free glassware).

Upon determination of a sampling site location, the sampling equipment supportive framework is set-up and all glassware bubbler box, pump, etc. are positioned. The sampling procedure is as follows:

1. Remove seals (foil or ground joints and clamps) from the bubblers.

2. Place 300 ml. hexane into bubbler #1, shake, pour into bubbler #2, shake, pour into bubbler #3, shake, pour into a sample bottle appropriately designated as a reagent blank. This procedure is performed for both sides (A and B) of the sampling train.

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3. Pour hexane, 400 ml., 200 ml., and 300 ml. into bubblers #1, #2, and #3, respectively.

4. Connect the entire sampling system - U-tube, manifold, reducer coupling, Y-tube, U-tubes between each bubbler and the copper tee (containing hypodermic needles - one for each side), the quick - disconnects between the tee and the cold trap and between the cold trap and the vacuum pump. Ensure that all ball joints are tightly clamped. Do not use any lubricant/sealing compound on the ground glass ball joints.

5. Fill the plywood box (containing 4 of the six bubblers) and the cold trap with crushed dry ice.

6. Start the vacuum pump; note the time and vacuum gage reading; sample for one-hour.

7. At the conclusion of the one-hour sampling period, note vacuum gage reading, tightly double the rubber hose between the copper tee and the quick-disconnect thus stopping air flow, pull both disconnects apart, and release the previously clamped or kinked rubber hose; shut off the vacuum pump.

8. Disconnect the Y-tube from the train.

9. Disconnect the bubbler U-tubes and the rubber hose - glass connection from last bubbler to the copper tee on one side of the train.

10. Pour the absorbing solutions from one side of the train (3-bubblers) into one sample bottle appropriately identified. All sample bottle screw caps must have Teflon liners. Absorbing solutions and rinses from each side of the train must be in separate sample bottles - 1 bottle per side of train.

11. Introduce approximately 50 ml. of hexane into bubbler #1, shake, pour into bubbler #2, shake, pour into bubbler #3, shake, and pour into the appropriate sample bottle from Step 10 above. Repeat this with another 50 ml. portion of hexane. Repeat for the second or other side of the sampling train.

12. Introduce 300 ml hexane into bubbler #1, shake, pour into bubbler #2, shake, pour into bubbler #3, shake, and pour into another appropriately identified sample bottle. This is also a reagent blank. Repeat for the other side of the train.

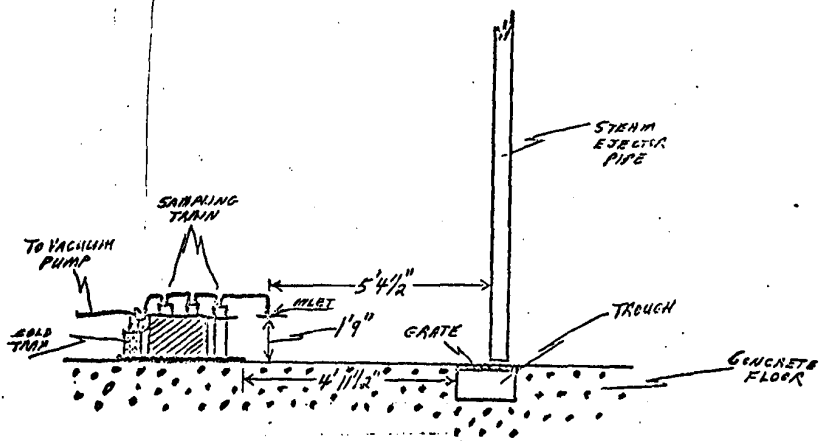
13. The bubblers can now be properly filled with the designated amounts of hexane (400 ml., 200 ml., 300 ml.) for the next sampling period. If additional sampling is not required, the equipment (glassware) must be wrapped/sealed as defined in Step #6 of the cleaning procedure.

cc: Timm
Wallgren
Torrez
Zylstra
Connell

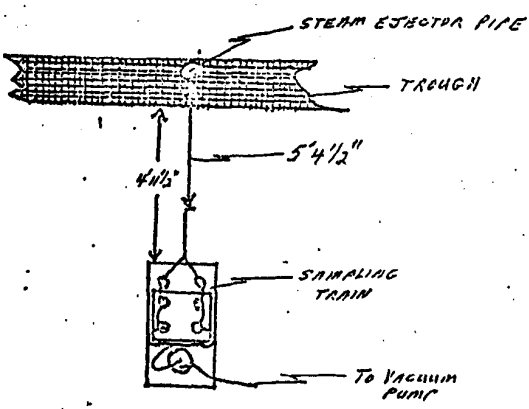
The table below defines the various samples collected at the Monsanto PCB manufacturing facility:

DATE	LOCATION	ASB DESIGNATION	LAB. NO.
1/27/76	Reagent Blank, Pre (SEG)	3A-T27-1	76-13656
1/27/76	Reagent Blank, Pre (SEG)	3B-T27-2	76-13657
1/27/76	Sample (SEG)	3A-T27-3	76-13658
1/27/76	Sample (SEG)	3B-T27-4	76-13659
1/27/76	Reagent Blank, Pre (SET)	3A-T27-5	76-13660
1/27/76	Reagent Blank, Pre (SET)	3B-T27-6	76-13661
1/27/76	Sample (SET)	3A-T27-7	76-13662
1/27/76	Sample (SET)	3B-T27-8	76-13663
1/27/76	Reagent Blank, After (SEG) Sample	3A-T27-9	76-13664
1/27/76	Reagent Blank, After (SEG) Sample	3B-T27-10	76-13665
1/27/76	Reagent Blank, After (SET) Sample	3A-T27-11	76-13666
1/27/76	Reagent Blank, After (SET) Sample	3B-T27-12	76-13667

SITE LOCATION #1 (SEG)



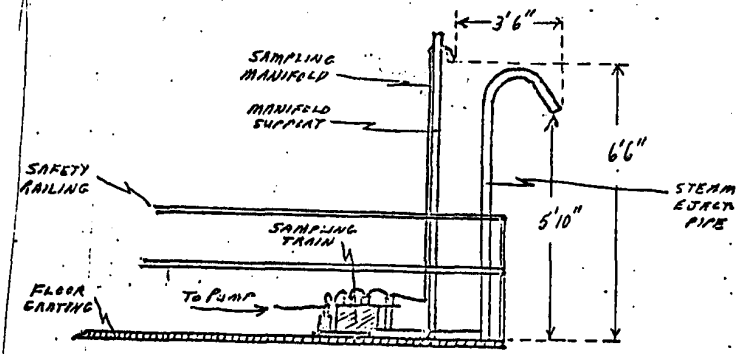
SIDE VIEW



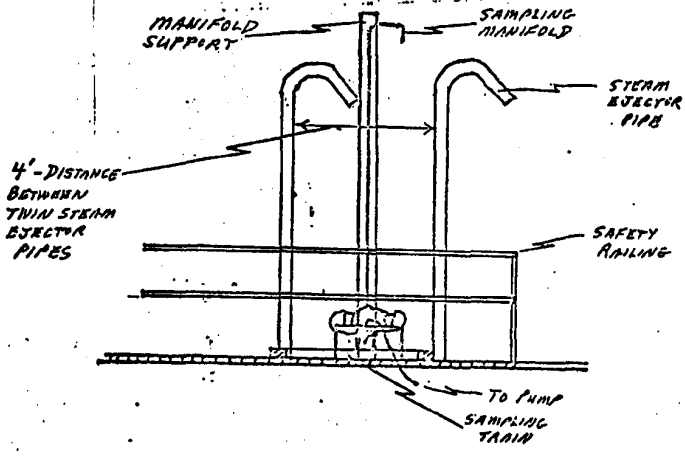
TOP VIEW.

MONS 054051

SITE LOCATION #2 (SET)



SIDE VIEW.



FRONT VIEW

55C

U. S. ENVIRONMENTAL PROTECTION AGENCY
REGION V, CENTRAL REGIONAL LABORATORY
1819 W. PERSHING ROAD, CHICAGO, ILLINOIS 60609

DATA TRANSMITTAL SLIP

Date Feb. 26, 1976

TO:

Chief, Air Surveillance Branch
Surv. & Anal. Division

DATA IDENTIFICATION

Data - Sample Numbers 13652--13667

RECEIVED
FEB 27 1976
AIR SURVEILLANCE BRANCH
EPA, REGION V

REMARKS

FROM

DATA COORDINATOR, CENTRAL REGIONAL LABORATORY

MONS 054053

CRL DSN ASDN...

ENVIRONMENTAL PROTECTION AGENCY, REGION V BASIC DATA FORM

AIR SURVEILLANCE BRANCH

Sampling Date 1-27-76 (Day Month Year) Lab Arrival Date 1-28-76 (Day Month Year) Analysis Due Date ____ (Month)

AIR SAMPLES (SAMPLE)

Account No. ____ Study [illegible]

All units are micrograms per liter or milligrams per kilogram

Water				39500	39504	39508	
CRL Sample Log Number			Aroclor 1016	Aroclor 1248	Aroclor 1254	Aroclor 1260	
Sediment	HYPO NEEDLE			39503	MICROGRAMS/m³	39511	MONSANTO - SAUGET, ILLINOIS
1 1 6 5 4	3A		7.0		9.80		REAGENT BLANK PRE-STEAM EJECTOR-GROUND LEVEL
1 1 6 5 7	3B		4.7		7.39		" " " "
1 1 6 5 8	3A		31.5		44.12		SAMPLE STEAM EJECTOR-GROUND LEVEL
1 1 6 5 9	3B		25.0		37.31		" " " "
1 1 6 6 0	3A	Sample Lost					REAGENT BLANK PRE STEAM EJECTOR-TOP LEVEL
1 1 6 6 1	3B		12.1		19.03		" " " "
1 1 6 6 2	3A) 3652		72.5 ore		101.54		SAMPLE STEAM EJECTOR-TOP LEVEL
1 1 6 6 3	3B						" " " " — SAMPLE BOTTLE CRACKED-HAD DEFECT
1 1 6 6 4	3A		16.8		23.53		REAGENT BLANK AFTER STEAM EJECTOR-GROUND LEVEL
1 1 6 6 5	3B		3.3		5.19		" " " " "
1 1 6 6 6	3A	Sample Lost					REAGENT BLANK AFTER STEAM EJECTOR-TOP LEVEL
1 1 6 6 7	3B		8.4		13.21		" " " " "

3A-FLOWRATE = .71402 m³/hr

[illegible] " " [illegible] m³/hr

MONS 054054

SP 11

Monsanto-Sauget, Illinois

Sampling Location	Sample No.	Critical Orifice Flowrate m^3/hour	Reagent Blank Values Before & After Each Sample ug/sample	Average Reagent Blank Values ug/sample	Sample Values ug/sample	Difference-Sample Minus Ave. Blank Value	Final Value ug/m^3
Site #1							
Steam Ejector-Ground Level (SEG)	76-13658	3A-0.71402	7.0 / 16.8	11.9	31.5	19.6	27.5
	76-13659	3B-0.63602	4.7 / 3.3	4.0	25.0	21.6	33.9
Site #2							
Steam Ejector-Top Level-(SET)	76-13662	3A-0.71402	N.A. / N.A.		72.5		
	76-13663	3B-0.63602	12.1 / 8.4	10.3	N.A.		

Interpretation of the data chart:-

Column 1- Sampling Location - corresponds to the preceding narrative defining sampling sites.

Column 2- Sample Numbers - assigned by ASB and for use by the analytical laboratory.

Column 3- Critical Orifice Flowrate (m3/hour) - calibrated flowrate of the critical orifice utilized on each side of the sampling train.

Column 4- Reagent Blank Values - Before and After Each Sample (ug/sample_ - defines the analytical results determined for each reagent blank.

Column 5- Average Reagent Blank Values - simply the average of the two values in the preceding column.

Column 6- Sample Values (ug/sample) - analytical results of the samples submitted.

Column 7- Difference - Sample Value Minus Average Blank Value - defines a value representing only the sample.

Column 8- Final Value (ug/m3) - defines the final or actual value of PCB's obtained at the particular sampling location; determined by dividing the true sampling air flowrate into the corrected value (Column 7).

Comments:

It is unfortunate that Reagent Blank Values (before and after sampling) are not available for all such samples that were submitted for analysis. Additionally, the loss of one sample (76-13663) occurred as a result of a manufacturing defect (stress/strain) in the particular sample bottle.

At this point in time, the only meaningful conclusion that can be made is that the manufacturer of PCBs has and maintains significantly superior control of atmospheric emissions during PCB manufacture than does the user or consumer who utilizes PCBs in the manufacture of a PCB containing product. However, the amount of PCBs released is still significant and should be greatly reduced by more stringent controls. However, at this point in time, Monsanto has publicly declared that PCB manufacture will be gradually reduced and eventually phased out.

In comparing the data for the Sauget and Bloomington monitoring efforts, it is noteworthy that the accord or agreement between the Sauget reagent blanks and sample values (at the same site) is much improved even though the basic equipment-absorbing solution, sampling and analytical procedures, and length of sampling period were identical.