

ENVIRONMENTAL 401-3EM-80-0127-001
EMISSIONS PVC

Determination of Potential Personnel Exposure
to Respirable and Total PVC Particulates
Collected at Polymer Science Building, T. R.
Evans Research Center, Concord, Ohio
April - July, 1980

OCC 10026

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PVC DUST SAMPLES - 4/16/80: 11205-19-

Location: (Building and Room No.)

Archives, Life Science Research Building

4/15-1(respirable), 4/15-8(total), 4/15-2(respirable),
4/15-9(total), 4/15-10(total), 4/15-3(respirable)4/17/80: 11205-19-4/15-5(respirable), 4/15-11(total),
4/15-4(respirable), 4/15-12(total), 4/15-14(total)5/12/80: 11205-19-4/15-7(respirable), 4/15-19(total),
4/15-18(respirable), 4/15-20(total), 4/15-16(respirable),
4/15-6(respirable)7/1/80: 11205-19-6/26-2(respirable), 6/26-6(total),
6/26-4(respirable), 6/26-7(total), 6/26-3(respirable)

Specimens:

No Samples retained or stored.

Location: (Building and Room No.)

of Principle Investigator

G. J. Manning

Name of Study Director

OCC 10027

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DEPARTMENT OF SAFETY ASSESSMENT
ENVIRONMENTAL SCIENCES UNIT

REPORT

DOCUMENT NUMBER: 401-3EM-80-0127-001

DETERMINATION OF POTENTIAL PERSONNEL EXPOSURES TO RESPIRABLE AND
TOTAL PVC PARTICULATES COLLECTED AT POLYMER SCIENCE BUILDING,
T. R. EVANS RESEARCH CENTER, CONCORD, OHIO APRIL - JULY, 1980

REPORT

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TOTAL PVC PARTICULATES COLLECTED AT POLYMER SCIENCE BUILDING,
T. R. EVANS RESEARCH CENTER, CONCORD, OHIO APRIL - JULY, 1980

DOCUMENT NUMBER: 401-3EM-80-0127-001

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INTRODUCTION

The Polymer Science Division of Diamond Shamrock Corporation expressed concern for the potential personnel exposures to respirable PVC dust during a variety of operating conditions. Recent studies conducted in England have shown that PVC dust may have some effect on the respiratory system. OSHA currently categorizes PVC dust as an "Inert or Nuisance Dust," with an 8-hour time-weighted average (TWA) permissible exposure level (PEL) of 5 mg/m^3 of air for respirable dust and 15 mg/m^3 for total dust. Personnel and area type samples were collected at the Polymer Science Building, T. R. Evans Research Center, Diamond Shamrock Corporation from April 16 through July 1, 1980.

The sample collection descriptions for eleven (11) respirable PVC dust samples are summarized in TABLE 1. The sample collection descriptions for eleven (11) total PVC dust samples are summarized in TABLE 2.

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TABLE 1

RESPIRABLE PVC DUST SAMPLES COLLECTED AT POLYMER SCIENCE BUILDING
APRIL 16 - JULY 1, 1980

Name or Area (Sample No.)	Date	Time		Flow Rate (lpm)		Comments
		On	Off	Initial	Final	
Granville E. Taylor (11205-19-4/15-1)	4/16/80	0935	1130	1.8	N.R.	Dumping resin at coolers. Pappenmeir cooler - 14 cycles, approx. 320 lb. Littleford cooler - 2 cycles.
Hubert N. Alexander (11205-19-4/15-2)	4/16/80	0943	1135	1.8	N.R.	Pappenmeir mixer and cooler
Gerold G. Popely (11205-19-4/15-3)	4/16/80	1023	1429	1.8	N.R.	Extrusion processing area - NRM extruder
Ceryl I. Clark (11205-19-4/15-4)	4/17/80	0953	1055	1.8	N.R.	Paste Resin Lab - mixed 5 different lots of PVC paste resin. (Type 753 - Lot Nos. 1417, 1370, 8985, 8971, 1359)
Gregory I. Gebean (11205-19-4/15-5)	4/17/80	1027	1131	1.8	N.R.	Paste Resin Lab Storage Area - filled 40 lb. "fiber paks" from 50 lb. PVC dispersion resin bag.
Office Area (11205-19-4/15-6)	5/12/80	0952	1605	1.8	1.75	Coffee area, approx. 2 ft. above floor
Dust Collector (11205-19-4/15-7)	5/12/80	0936	1552	1.8	1.75	Removes dust from Littleford cooler and the Pappenmeir mixer - directly under collector between fan and sox collector, approx. 3 ft. above floor
Mixing Deck (11205-19-4/15-18)	5/12/80	0920	1455	1.8	1.75	Six 50 lb. bags of resin poured into mixer and stabilizer added (Pipe compound, Notebook No. 10080-109-4)

N.R.: Not Recorded

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Table 1 (cont.)

Name or Area (Sample No.)	Date	Time		Flow Rate (lpm)		Comments
		On	Off	Initial	Final	
Background-Outside Area (11205-19-6/26-2)	7/01/80	0925	1539	1.8	1.75	Rear of building on bench
Warehouse (11205-19-6/26-3)	7/01/80	0901	1548	1.8	1.8	Area approx. 20 ft. from Pappenmeir and Littleford mixers, approx. 5 ft. above floor
John T. Beahon 11205-19-6/26-4)	7/01/80	0934	1543	1.8	1.7	Small mixing area - Welex mixer; resin weighed into 20 lb. bag

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TABLE 2

TOTAL PVC DUST SAMPLES COLLECTED AT POLYMER SCIENCE BUILDING
APRIL 16 - JUNE 26, 1980

Name or Area (Sample No.)	Date	Time		Flow Rate (lpm)		Comments
		On	Off	Initial	Final	
Granville E. Taylor (11205-19-4/15-8)	4/16/80	0938	1133	1.8	N.R.	"Low flow" indication on DuPont pump. Dumping resin at coolers. Pappenmeir cooler - 14 cycles approx. 320 lb. Littleford cooler - 2 cycles.
Hubert N. Alexander (11205-19-4/15-9)	4/16/80	0948	1137	1.8	N.R.	Pappenmeir mixer and cooler
Gerold G. Popely (11205-19-4/15-10)	4/16/80	1022	1428	1.8	N.R.	Extrusion processing area - NRM extruder
Cheryl I. Clark (11205-19-4/15-11)	4/17/80	0954	1056	1.8	N.R.	Paste Resin Lab - mixed 5 different lots of PVC paste resin. (Type 753 - Lot Nos. 1417, 1370, 8985, 8971, 1359)
Gregory I. Gebean (11205-19-4/15-12)	4/17/80	1031	1132	1.8	N.R.	Paste Resin Lab Storage Area - filled 40 lb. "fiber paks" from 50 lb. PVC dispersion resin bag.
Warehouse Area (11205-19-4/15-14)	4/17/80	0921	1545	1.8	N.R.	Ground floor of warehouse, approx. 25 ft. from Pappenmeir mixer, approx. 5 ft. above floor on top of resin bags.
Office Area (11205-19-4/15-15)	4/17/80	0924	1547	1.8	N.R.	Coffee area, approx. 2 ft. above floor
Dust Collector (11205-19-4/15-19)	5/12/80	0938	1554	1.8	1.8	Removes dust from Littleford cooler and the Pappenmeir mixer - directly under collector between fan and sox collector, approx. 3 ft. above floor

N.R.: Not Recorded

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Table 2 (cont.)

Name or Area (Sample No.)	Date	Time		Flow Rate (lpm)		Comments
		On	Off	Initial	Final	
Mixing Deck (11205-19-4/15-20)	5/12/80	0923	1455	1.8	1.65	Six 50 lb. bags of resin poured into mixer and stabilizer added (Pipe compound, Notebook No. 10080-109-4)
Background-Outside Area (11205-19-6/26-6)	7/01/80	0923	1541	1.8	1.75	Rear of building on bench
John T. Beahon (11205-19-6/26-7)	7/01/80	0933	1545	1.8	1.8	Small mixing area - Welex mixer; resin weighed into 20 lb. bag

CONDUCT OF STUDY

Six (6) personal and five (5) area respirable PVC dust samples, and six (6) personal and five (5) area total PVC dust samples were collected as described in TABLE 1 and TABLE 2 by K. A. Thompson, Chemist, Environmental Sciences Unit, Department of Safety Assessment, Diamond Shamrock Corporation. The analyses were conducted from April 14, 1980 through July 23, 1980 at the Physical Sciences Building, T. R. Evans Research Center, Diamond Shamrock Corporation, 7528 Auburn Road, Painesville, Ohio and the Concord Woods Laboratories, 11211 Spear Road, Painesville, Ohio 44077. K. A. Thompson performed the analyses.

SUPPORTIVE DATA AND DOCUMENTATION

Data and documentation supportive to this study are contained in Diamond Shamrock Research Notebook 10927, and in the Department of Safety Assessment Archives, Life Sciences Research Building, T. R. Evans Research Center, Diamond Shamrock Corporation.

SAMPLE IDENTIFICATION

Samples were identified by the Environmental Sciences Unit sample reference numbers:

11205-19-4/15-1	11205-19-4/15-10	11205-19-4/15-22
11205-19-4/15-2	11205-19-4/15-11	11205-19-6/26-1
11205-19-4/15-3	11205-19-4/15-12	11205-19-6/26-2
11205-19-4/15-4	11205-19-4/15-13	11205-19-6/26-3
11205-19-4/15-5	11205-19-4/15-14	11205-19-6/26-4
11205-19-4/15-6	11205-19-4/15-15	11205-19-6/26-5
11205-19-4/15-7	11205-19-4/15-18	11205-19-6/26-6
11205-19-4/15-8	11205-19-4/15-19	11205-19-6/26-7
11205-19-4/15-9	11205-19-4/15-20	

ANALYTICAL METHODS

The samples were collected and analyzed for particulate weight using procedures specified by the "National Institute for Occupational Safety and Health (NIOSH) Manual of Sampling Data Sheets," 1977 Ed., Method 29.02. The method is included in the APPENDIX of this report.

The method consists of collecting particulates in the worker's breathing zone to determine the TWA exposure to total or respirable dust. Total dust samples were collected on 5 um pore size PVC filters, which have been preweighted to the nearest 0.01 mg. Respirable dust samples were collected on the same type of filters, after passing through a 10 mm nylon cyclone to drop out particulates larger than approximately 10 um, when collected at a sampling rate of 1.7 lpm. The DuPont P-4000, constant flow, sampling pumps were calibrated using a Magnehelic flow rate meter, which had been calibrated with a bubble tube.

The sampling pump collection flow rates were inadvertently calibrated at 1.8 liters per minute (lpm) instead of the recommended 1.7 lpm for the respirable dust and 1.5 lpm for the total dust samples. The assumption that this deviation should have no significant effect on these results was confirmed in a September 3, 1980 telephone conversation with David Taylor, Chief of Inorganic Methods Development Section, Measurement Research Branch, Division of Physical Sciences and Engineering, NIOSH, Cincinnati, Ohio.

The analytical results are summarized in TABLE 3.

TABLE 3
SUMMARY OF ANALYTICAL RESULTS

Name or Area (Sample No.)	Respirable & Total Particulates (mg)	
	Gross	Net
Granville E. Taylor (11205-19-4/15-1)	0.111	0.105 ^A
Hubert E. Alexander (11205-19-4/15-2)	0.106	0.100 ^A
Gerald G. Popely (11205-19-4/15-3)	1.095	1.089 ^A
Cheryl I. Clark (11205-19-4/15-4)	0.052	0.046 ^A
Gregory I. Gebeau (11205-19-4/15-5)	-0.061	-0.067 ^A
Office Area (11205-19-4/15-6)	0.011	-0.005 ^B
Dust Collector (11205-19-4/15-7)	0.008	-0.008 ^B
Granville E. Taylor (11205-19-4/15-8)	1.206	1.200 ^A
Hubert E. Alexander (11205-19-4/15-9)	1.241	1.235 ^A
Gerald G. Popely (11205-19-4/15-10)	9.421	9.415 ^A
Cheryl I. Clark (11205-19-4/15-11)	0.040	0.034 ^A

^A Blank Filter No. 11205-19-4/15-22 used for weight correction.

^B Blank Filter No. 11205-19-4/15-13 used for weight correction.

^C Blank Filter Nos. 11205-19-6/26-1 and 11205-19-6/26-5 averaged and used for weight correction.

Table 3 (cont.)

Name or Area (Sample No.)	Respirable & Total Particulates (mg)	
	Gross	Net
Gregory I. Gebeau (11205-19-4/15-12)	0.089	0.083 ^A
Blank (11205-19-4/15-13)	0.016	-- ^B
Warehouse Area (11205-19-4/15-14)	0.270	0.264 ^A
Office Area (11205-19-4/15-15)	0.084	0.078 ^A
Mixing Deck Area (11205-19-4/15-18)	0.221	0.205 ^B
Dust Collector (11205-19-4/15-19)	0.101	0.085 ^B
Mixing Deck Area (11205-19-4/15-20)	1.450	1.434 ^B
Blank (11205-19-4/15-22)	0.006	-- ^A
Blank (11205-19-6/26-1)	-0.08	-- ^C
Background-Outside Area (11205-19-6/26-2)	0.13	0.19 ^C
Warehouse Area (11205-19-6/26-3)	0.48	0.54 ^C

^A Blank Filter No. 11205-19-4/15-22 used for weight correction.

^B Blank Filter No. 11205-19-4/15-13 used for weight correction.

^C Blank Filter Nos. 11205-19-6/26-1 and 11205-19-6/26-5 averaged and used for weight correction.

Table 3 (cont.)

Name or Area (Sample No.)	Respirable & Total Particulates (mg)	
	Gross	Net
John T. Beahon (11205-19-6/26-4)	0.08	0.14 ^C
Blank (11205-19-6/26-5)	-0.04	-- ^C
Background-Outside Area (11205-19-6/26-6)	0.06	0.12 ^C
John T. Beahon (11205-19-6/26-7)	0.52	0.58 ^C

^A Blank Filter No. 11205-19-4/15-22 used for weight correction.

^B Blank Filter No. 11205-19-4/15-13 used for weight correction.

^C Blank Filter Nos. 11205-19-6/26-1 and 11205-19-6/26-5 averaged and used for weight correction.

RESULTS

The results from the respirable and total PVC dust samples are given in TABLE 5 and 6, respectively. The OSHA PEL concentrations are given below and are specified as 8-hour TWA concentrations.

Respirable Dust: 5 mg/m³
Total Dust: 15 mg/m³

TABLE 4
SUMMARY OF RESPIRABLE PVC DUST RESULTS

Name or Area (Sample No.)	Avg. Flow Rate (lpm)	Collection Time Pd. (min.)	Sample Volume (m ³)	Respirable Particulate Concentration (mg/m ³)
Granville E. Taylor (11205-19-4/15-1)	1.8	115	0.207	0.507
Hubert E. Alexander (11205-19-4/15-2)	1.8	112	0.202	0.496
Gerald G. Popely (11205-19-4/15-3)	1.8	246	0.443	2.46
Cheryl I. Clark (11205-19-4/15-4)	1.8	62	0.112	0.412
Gregory I. Gebeau (11205-19-4/15-5)	1.8	64	0.115	<0.087
Office Area (11205-19-4/15-6)	1.78	373	0.662	<0.015
Dust Collector (11205-19-4/15-7)	1.78	376	0.667	<0.015
Mixing Deck Area (11205-19-4/15-18)	1.78	335	0.595	0.345
Background-Outside Area (11205-19-6/26-2)	1.78	374	0.664	0.286
Warehouse Area (11205-19-6/26-3)	1.8	407	0.733	0.737
John T. Beahon (11205-19-6/26-4)	1.75	369	0.646	0.217

¹Initial and final flow rates were averaged; if the final was not recorded, it was assumed to be constant.

TABLE 5
SUMMARY OF TOTAL PVC DUST RESULTS

Name or Area (Sample No.)	1		Sample Volume (m ³)	Total Particulate Concentration (mg/m ³)
	Avg. Flow Rate (lpm)	Collection Time Pd. (min.)		
Granville E. Taylor (11205-19-4/15-8)	1.8	115	0.207	5.80
Hubert E. Alexander (11205-19-4/15-9)	1.8	109	0.196	6.29
Gerald G. Popely (11205-19-4/15-10)	1.8	246	0.443	21.3
Cheryl I. Clark (11205-19-4/15-11)	1.8	62	0.112	0.305
Gregory I. Gebeau (11205-19-4/15-12)	1.8	61	0.110	0.756
Office Area (11205-19-4/15-15)	1.8	383	0.689	0.113
Dust Collector (11205-19-4/15-19)	1.8	376	0.677	0.126
Mixing Deck Area (11205-19-4/15-20)	1.73	332	0.573	2.50
Background-Outside Area (11205-19-6/26-6)	1.78	378	0.671	0.179
Warehouse Area (11205-19-4/15-14)	1.8	384	0.691	0.382
John T. Beahon (11205-19-6/26-7)	1.8	372	0.670	0.866

¹Initial and final flow rates were averaged; if the final was not recorded, it was assumed to be constant.

DISCUSSION

All of the respirable PVC dust sample results were below the OSHA PEL of 5 mg/m^3 . Ten of the samples were less than 15% of the PEL and one sample (G. G. Popely, No. 11205-19-4/15-3) was less than 50% of the PEL.

One of the total PVC dust sample results (G. G. Popely, No. 11205-19-4/15-10) had a TWA concentration of 21.3 mg/m^3 , which exceeded the OSHA 8-hour PEL of 15 mg/m^3 . All of the remaining samples were less than 45% of the PEL.

Two points should be noted with respect to these samples. First, the sample collections were generally stopped at the end of a particular operation. More specifically, none of these samples actually span a full 8 hours (480 min.). Thus, if the collection had continued during a less dusty operation for the remainder of the 8-hour period, the resulting TWA concentration would be lower than these reported values.

Secondly, the method used here to determine the "respirable" particulate concentration is only an index of the truly respirable fraction of the total particulate concentration. This method, NIOSH Sampling Data Sheet #29.02, achieves a preseparation of the larger particles using a 10 mm nylon cyclone prior to the collection of the measured "respirable" particulates on a 5 μm pore size PVC filter.

Approximately half of the particles actually retained in the lungs are less than 0.5 μm in diameter and less than 0.2% of the total number will be larger than 5 μm in diameter.*

* "The Industrial Environment - Its Evaluation and Control," U.S. Department of H.E.W., Public Health Service, Center for Disease Control, National Institute for Occupational Safety and Health, 1973, page 496.

DIAMOND SHAMROCK CORPORATION
DEPARTMENT OF SAFETY ASSESSMENT

QUALITY ASSURANCE STATEMENT

Based on review of the final report, it is concluded that this report accurately reflects the data for "Determination of Potential Personnel Exposures to Respirable and Total PVC Particulates Collected at Polymer Science Building, T. R. Evans Research Center, Concord, Ohio April - July, 1980," Document Number 401-3EM-80-0127-001.

Reviewed by:

Barbara L. Haley
Barbara L. Haley, Quality Assurance Specialist

9/04/80
Date

OCC 10047

APPENDIX

Sampling Data Sheet # 29.02 Class D

April 23, 1975

Substance :

Inert or Nuisance Dust

Standard :

8-hour time-weighted average for respirable dust: 5 mg/m^3 8-hour time-weighted average for total dust: 15 mg/m^3

Reference: 29 CFR 1910.93

Analytical Method:

The amount of material on a filter is determined by filter weight gain. Before sampling, the filter is pre-weighed to the nearest 0.01 mg. After sampling, the filter is reweighed. The difference in the filters weight is assumed to be the mass of material collected.

Sampling Equipment:

Pump: A calibrated personal sampling pump whose flow can be determined to an accuracy of $\pm 5\%$. The pump must have been calibrated with a representative filter and filter holder in line. If the respirable dust concentration is being measured, the pump must have a pulsation dampener and be certified under 30 CFR 74.

Filter Holder: 2 or 3-piece, 37-mm filter holder held together by tape or shrinking band.

Filter: 37-mm diameter, 5.0 micrometer pore size polyvinyl chloride filter or equivalent that has been pre-weighed to the nearest 0.01 mg. These filters must be hydrophobic. The filter should be supported with a back-up pad.

Cyclone: 10-mm nylon cyclone. When the respirable dust concentration is measured, it is used with a 2-piece filter holder.

Sampling Head Assembly: This assembly must hold the filter holder, cyclone, and coupler together rigidly so that air enters only at the cyclone inlet.

Sample Size :

A minimum sampling period of 60 minutes is recommended and longer periods up to eight hours are preferable. If the respirable dust concentration is being measured, a flow rate of 1.7 liters per minute must be used. To determine total dust concentration, use a flow rate of 1.5 liters per minute.

Sampling Procedure:

1. Assemble the filter and three-piece filter cassette and close firmly to insure that the center ring seals the edge of the filter. Examine the holder for a good filter seal. If the cassette will not seal tightly, it should be discarded. If respirable dust is being measured, the center ring is not included in the filter holder. The filter cassette should be held together by a shrinking band or tape.
2. If total nuisance dust is being sampled, remove the filter holder plugs. Attach the filter holder to the sampling pump with a 1/4 inch diameter, 3-foot piece of tubing and an adaptor. The adaptor is used to provide a tight connection between the filter holder and tubing.
3. If the respirable dust is being sampled, assemble the two-piece filter holder, coupler, cyclone, and sampling head. The sampling head rigidly holds together the cyclone and filter holder. The outlet of the sampling head is connected to the pump by a 3-foot piece of 1/4 inch flexible tubing.
4. Clip the cassette or cyclone assembly to the worker's lapel.
5. Turn the pump on and begin sample collection. The pump flow rate should be checked periodically and readjusted if necessary.
6. Terminate sampling after the predetermined time and note sample flow rate, collection time, and ambient temperature and pressure. If a pressure reading is unavailable, record the elevation.
7. Collected sample cassette should be firmly sealed with the plugs in both the inlet and outlet.
8. With each batch of samples, submit one filter subjected to exactly the same handling as for the samples except that no air is drawn through it. Label these as blanks.

Special Considerations :

1. Filter holders molded from cellulose-acetate-butyrate, which is commonly known as Tenite plastic, have been shown to cause blank filter weight gains and must not be used.
2. The alignment of the filter holder and cyclone in the sampling head must be checked. If these parts are not aligned properly, leakage can result.
3. Before use, the cyclones grit cap or vortex finder should be removed and the interior of the cyclone should be inspected. If the inside of the cyclone is visibly scored, this cyclone should be discarded since the dust separation characteristics of the cyclone might be altered. If it is dirty, the interior of the cyclone should be cleaned before use. This will prevent the reentrainment of this dirt.

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Data Sheet #29.02

Shipping :

After sampling, the samples and the blank should be shipped in a suitable container designed to prevent damage in transit.

Reference:

"Sampling and Evaluating Respirable Coal Mine Dust", US Bureau of Mines, Pittsburgh, Pa. Information Circular 8503, February, 1971, p. 47.