

TO	FIELD POINT OR DEPT. & BLOS. NO.	DATE YOUR LETTER
M. D. Rider-M. H. Sperry	Avon Lake	25-1599
FROM	FIELD POINT OR DEPT. & BLOS. NO.	DATE THIS LETTER
R. D. Hardesty	Brecksville R & D Center, D/8506	July 23, 1976
SUBJECT		

Analysis of Personal Monitor Samples of Air Pollutants

The carbon tube personal monitor samples which arrived on the indicated date have been analyzed. Corporate Environmental Services Lab has measured each amount of adsorbed air pollutant. These samples have been given the following log number or numbers: 158.

Richard D. Hardesty
Richard D. Hardesty

Sue Kurtz
O. Sue Kurtz

jb

cc: P. M. Zakriski
R & D Files.
E. B. Katzenmeyer, Jr.
L. B. Crider
J. A. Klupar

BFG-4512-1-3 7/74 LITHO USA

BFG20338

22365001

HARDESTY

di.
methylene chloride

Name. Hardesty
Shift. P-4

LOQ

PERSONNEL MONITORING - VINYL CHLORIDE MONOMER, BENDIX FLASHER

DATE 7/19/76

Page 1 of 1

15

S	TEST CODE NO.	TUBE NO.	S	TEST TIME (Min.)	S	FLN. START	S	AVG. FLOW cc/min.	S	SAMPLE VOLUME (cc)	L	MICRO-GRAMS $me ch_2$	L	% VCM ON Tube 2	L	TOTAL MICRO-GRAMS $me ch_2$	L	BREAK-THRU YES/NO	L	REPORT PPM $me ch_2$	SPECIAL COMMENTS Pump Peak #
1.	1A001A/E	60	68.8	73.4	86	5060	40.58	~	~	~	~	~	~	~	~	~	~	~	~	~	~
2.	1ND. WET WELL	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
3.	DOWN WIND	120	45.0	48.6	129	15380	32.17	~	~	~	~	~	~	~	~	~	~	~	~	~	~
4.	ALGC EFFLUENT	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
5.	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
6.	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
7.	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
8.	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
9.	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~
10.	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~	~

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Comparison with Steam Stripping

This desorption data, obtained for many different resins, including B.F. Goodrich Geons, have been compared qualitatively and quantitatively with steam-stripping data for the same resin slurries - data obtained using six-inch and 30-inch perforated-tray columns. The relative ease of steam-stripping a particular resin is predicted by the Desorption Test. In addition, the Desorption Test indicates the minimum residual vinyl chloride content practicably attainable, and indicates the nominal residence time required for six-inch column stripping a high vinyl chloride content feed to a specified vinyl chloride level.

The qualitative comparison of the steam stripping and the Desorption Test results can be seen in Table I where the several resins were ranked based on time required to remove one-half of the vinyl chloride present.

TABLE I
Qualitative Comparison of the Desorption Test
with Steam Stripping

<u>Sample</u>	<u>Desorption Test</u> 90°C		<u>Steam Strip</u> 6-in Col.	
	<u>t (1/2)</u>	<u>Rank</u>	<u>t (1/2)</u>	<u>Rank</u>
A	0.19	1	0.9	1
B	0.25	2	1.0	2
E	.36	3	1.1	3
D	0.55	4	1.7	4
F	0.72	5	2.9	6
C	.95	6	1.8	5

*70 - 100 lb/hr.
105 - 100 lb/hr.

Typical data on which Table I is based are illustrated in Figures 1 and 2 for sample "B".

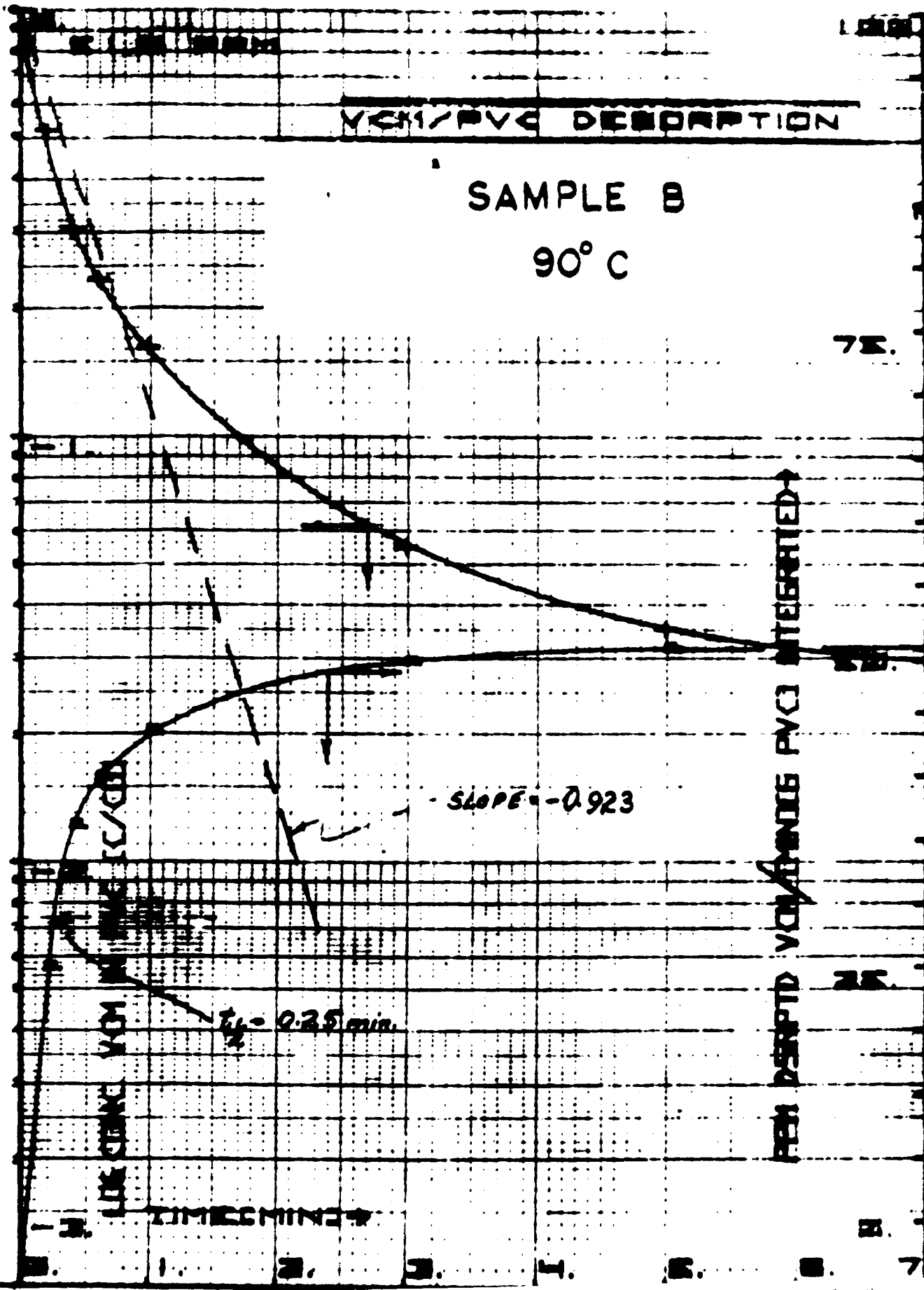
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NO. 340 1.310 GASTHERM GRAPH PAPER
SEMI LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH

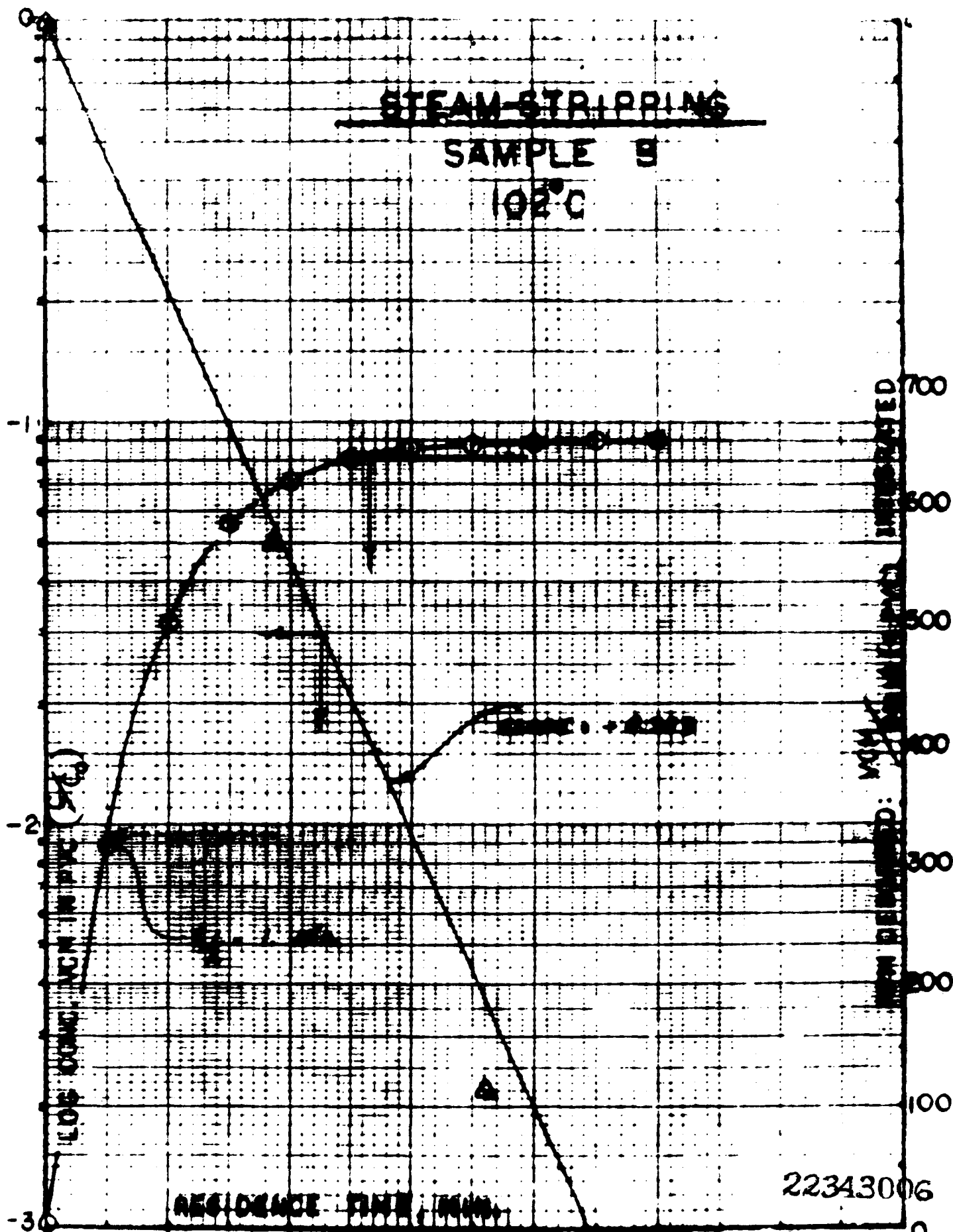
COLUMBIA GRAPHIC CO.
MADE IN U.S.A.



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SEMI-LOGARITHMIC
3 CYCLES X 10 DIVISIONS PER INCH



With more data obtainable, a quantitative comparison has been made between the log concentration gradient/residence time data from six-inch steam stripping columns with that obtained by the Description Test - using the 0.2, 0.4, 0.6 and 1 minute Description Test data. These data are shown in Table II for seven different resins (stripping data at 103-104°C; Description Test data at 90°C and 104°C) and for three additional Geon resins (stripping data at 103-104°C; Description Test data at 104°C). While seven-minute Description Test data are used in these comparisons, the actual experiments are performed using a 35 minute description time. The concentration of vinyl chloride in the polymer at the end of the Description Test (C/C_0 at 35 minutes $\times C_0$) is listed in Table II as "C35, ppm."

The procedures for obtaining these comparisons are illustrated by Figures 1 and 3 (Description Test data) and Figure 2 (Steam Stripping data) again for Sample "B".

The data from Table II are plotted in Figure 4, showing the correspondence between the early time Description Test data and the steam stripping data for the five samples ranked in Table I (90°C Description Test vs. six-inch column performance) and for four additional resins - Sample "G", Geon 109, 102ZF 75 and 103ZF 776. Steam-stripping data for the Geons were obtained from 30-in column performance and Description Test data obtained at 104°C. Steam-stripping data for sample G was obtained at 104°C with a six-inch column.

Linear regression analysis of the Description/steam-stripping relationship gives a 99% correlation coefficient and a 95% confidence limit with standard error of (+) 7 per cent.

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TABLE II

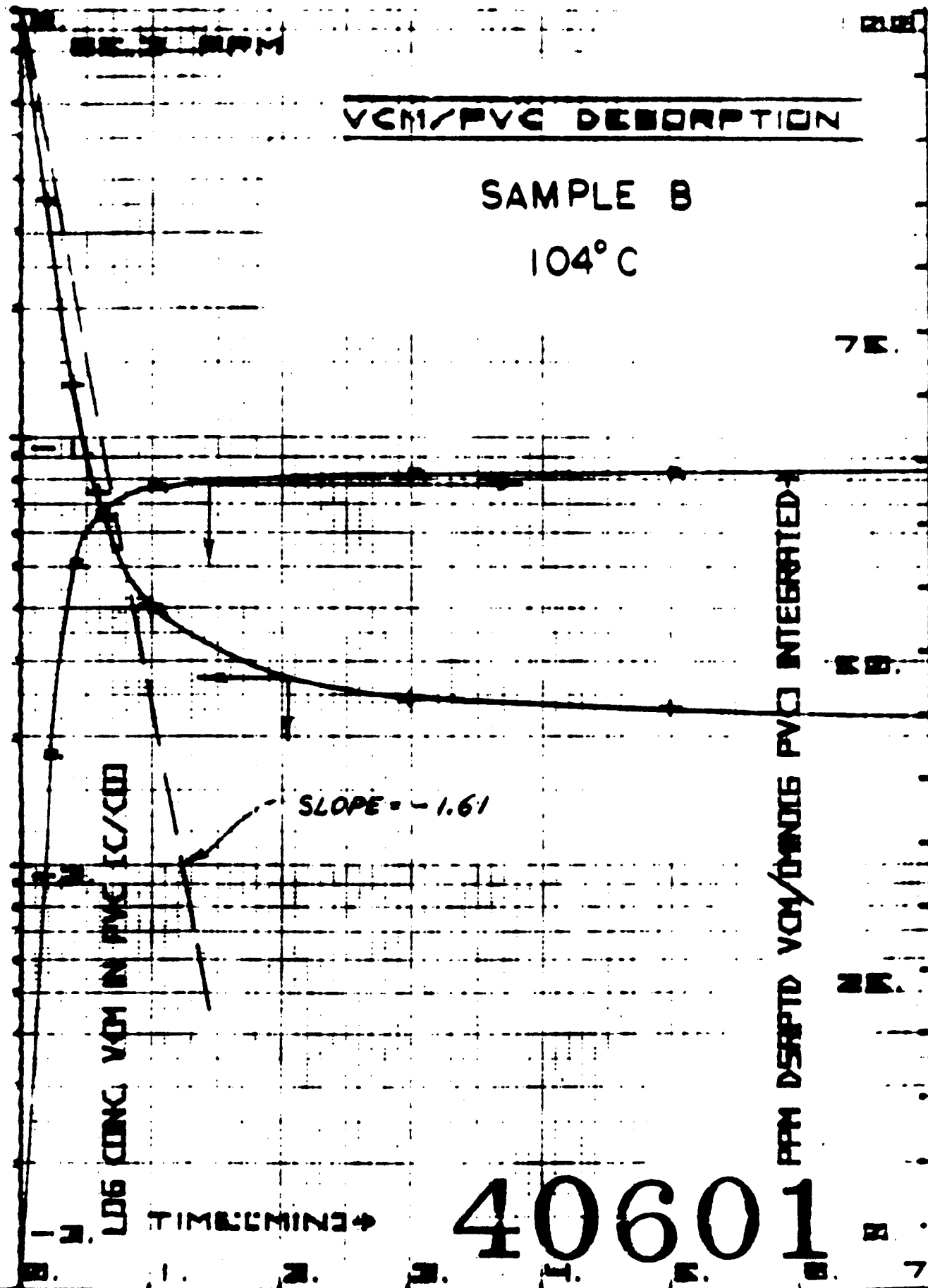
Quantitative Comparison of the Desorption Test with Steam Stripping

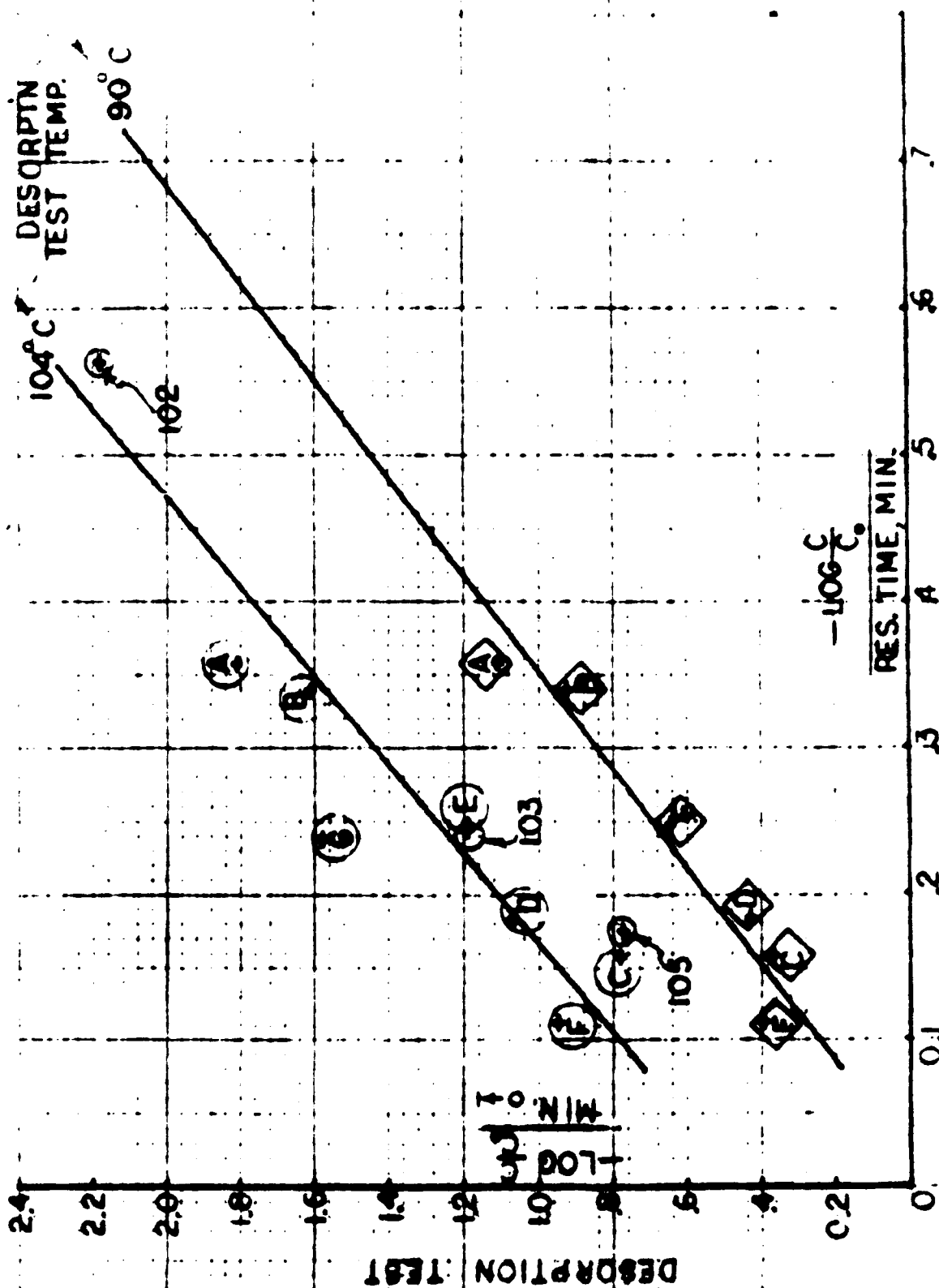
Material	Steam Stripping 103 - 104°C				90°C				VCM Desorption				104°C			
	Log C/C ₀ hrs. min.		TA No.	Co ppm	C ₃₅ ppm	Log C/C ₀ File	Chart No.	TA No.	Co ppm	C ₃₅ ppm	Log C/C ₀ File	Chart No.				
	Co ppm	Log C/C ₀														
A	1150	-0.327	1-6	55	0.256	-1.11	189	1-6	64.2	0.105	-1.81	217				
B	656	-0.339	4-1	51.6	.129	-0.923	193	4-1	65.3	.195	-1.61	219				
C	665	-0.198	1-5	58	1.29	-0.367	185	1-5	61.9	.050	-0.781	216				
D	777	-0.184	1-13	49.7	.200	-0.428	179	2-1	64.9	.144	-1.07	223				
E	2443	-0.257	1-3	63	.040	-0.644	184	2-2	66.1	.036	-1.19	229				
F	1085	-0.112	1-9	49.8	.434	-0.392	177	1-9	61.6	.057	-0.348	218				
G	331	-0.238						11-2	45.2	.305	-1.58	208				
Green 105	2510	-0.175						2-19-2	64.1	.244	-0.774	233				
Green 102HP 75	522	-0.563						10-1	50.1	.146	-2.18	262				
Green 103HP 776	98	-0.244						10-3	41.5	.360	-1.19	264				

Time data: 0, 0.2, 0.4, 0.6, 1.0 minutes

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STEAM STRIPPING, 103°-104°C

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Use of the Test

From the Desorption Test, the relative ease of vinyl chloride removal and an indication of the nominal residence time in a steam stripping column can be established.

For example, a resin for which the initial concentration drop calculates to be: $-\log C/C_0 / t = 1.5$ at 104°C or 0.90 at 90°C indicates a residence time function $-(\log C - \log C_0) / t$ or $-\log C/C_0/t$ of 0.92 . Residence time for stripping from 1000 ppm to 1 ppm would be $-(0-3) / 0.92$ or 9.375 or $9-10$ minutes. The desired residence time in a steam stripping column, naturally will result in a balance between the residual vinyl chloride desired and the thermal stability of the particular resin.

This correlation of the Desorption Test and steam-stripping is based on a number of different resins which show a fairly wide latitude in ease-of-stripping. The capability of this correlation in predicting nominal residence time obviously is limited to resins performing within this range. However, the Desorption Test can readily identify a resin that would be very difficult to steam-strip. The type of data which would indicate this is demonstrated by the desorption curves shown in Figure 5. The shaded area bounded by Geon 103 and Geon 92 represents desorption performance for routinely strippable resins. Desorption performance of resin types which would be very difficult to strip are represented by the dotted lines (N) and (P).

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1. LUBRIC OIL FROM C.B.

2. GEON 105
3. GEON 103
4. GEON 92
5. GEON 101
6. GEON 102
7. GEON 104
8. GEON 106
9. GEON 107
10. GEON 108
11. GEON 109
12. GEON 110
13. GEON 111
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97. GEON 195
98. GEON 196
99. GEON 197
100. GEON 198
101. GEON 199
102. GEON 200

VCM/PVC DEGRADATION

104°C

7E.

GEON 105

GEON 103

GEON 92

↑ DEGRADATION OF POLYMER IN VCM ↑

↑ DEGRADATION OF POLYMER IN VCM ↑

TIME (MIN)

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FIGURE 5

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Ease of Obtaining Data

The comparison shown in Table III summarizes the advantages of the Desorption Test in predicting the efficiency in steam-stripping vinyl chloride from polyvinyl chloride.

TABLE III

Characteristics of Desorption vs. Column Stripping

	<u>Six Inch Column</u>	<u>Desorption Test</u>
1. Size of Sample	55 gallon drum	1-2 gm dry polymer
2. Time of Test	1/2 to 1 day	2-3 samples/day
3. RVCM analysis	Samples from trays RVCM by head space 2-3 samples/run Initial concentration	None required None required None required None required
4. Data Reduction	Data from head space Manual calc Manual plot	Data from chart Programmed calc Programmed plot
5. Results	Does not reduce VCM to level to see break in curve reflecting glassy beads content	Can see glassy beads as predicted
6. Sample for testing	Yields lbs. of sample	No sample
7. General applicability	Wet system for VCM	Dry system applicable to almost any polymer/monomer/solvent system

The advantage of smaller sample size for the desorption test applies particularly to overseas potential licensees.

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**Effect of Steam Stripping on the Thermal
Stability of the Resin**

A check for any deleterious effect on potential thermal stability of the resin as a result of stripping was made using the Capillary Viscometer Heat Stability Test (CVHS). This test, used extensively in measuring thermal stability and melt-flow stability is described in a paper by Collins and Krier.(1) It consists of isothermally extruding the polymer at constant shear-rate and constant temperature while noting the time required to attain equilibrium viscosity, time at constant viscosity and time of onset and rate of subsequent viscosity increase. Reproducible color-change with time at constant viscosity are observed and recorded.

Plate 1 demonstrates that the steam-stripping of PVC resins 102EP F5, 103EP F76, and Resin 8, does not adversely affect the thermal stability of the resin. In some cases, where steam-stripping may remove contaminants as well as vinyl chloride, the thermal stability may actually be enhanced.

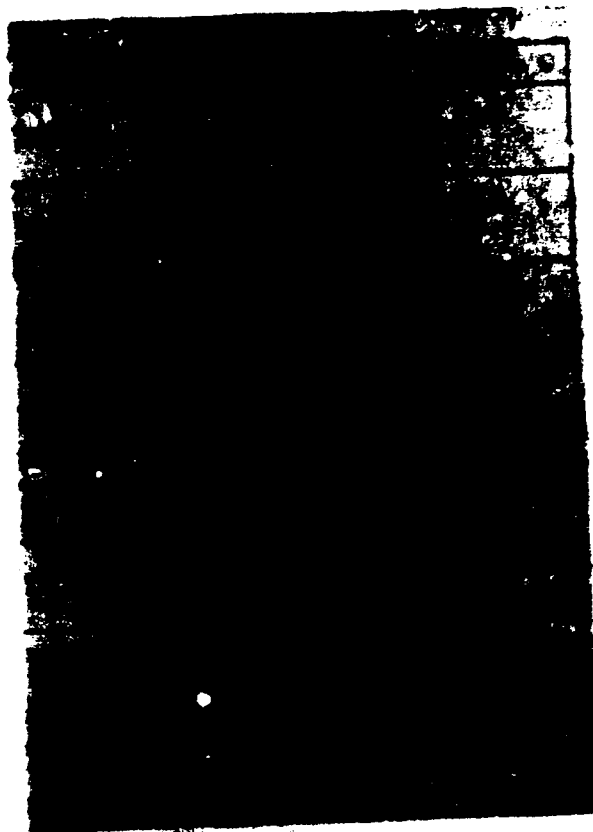


Plate I

CYR Thermal Stability Traces Before and After Storm Stripping

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REFERENCES

- (1) Collins, E.A. and Krier, C.A., "Poly (vinyl chloride) Thermal Stability. I. Evaluation by Melt Rheology." J.A.P.S. 10 pp. 1573-1589 (1966).

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MATERIALS CODE

<u>Designation</u>	<u>Material</u>
A	Diamond PVC, Drum 4
B	Diamond PVC, Drum 4B
C	Diamond PVC, Drum 3B
D	Air Products PVC
E	Air Products PVC; Propylene Modified Series 400
F	Borden PVC; VC-260-22
G	Borden PVC 1222A
H	Firestone PVC 1140.

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Abstracts of Papers for the Fifteenth Annual Meeting of the
Society of Toxicology, Atlanta, Georgia
March 14-18, 1976

3. *Fate of [^{14}C]Vinyl Chloride Following Inhalation Exposure in Rats.* P. G. WATANABE, G. R. MCGOWAN, E. O. MADRIS and P. J. GEHRING, Toxicology Research Laboratory, The Dow Chemical Company, Midland, Michigan.

The objective of the present study was to determine the rate of inhaled [^{14}C]vinyl chloride (^{14}C -VC) at different exposure concentrations in rats. Male rats were exposed to 10 or 1000 ppm [^{14}C]VC for 6 hr and the routes and rates of elimination of ^{14}C activity were followed for 72 hr after termination of exposure. Following exposure to 10 ppm VC, urinary ^{14}C activity and expired VC comprised 68 and 2%, respectively, of the recovered radioactivity. After exposure to 1000 ppm VC, the proportion of the radioactivity in the urine decreased while that expired as VC increased, representing 56 and 12%, respectively. The pattern of pulmonary elimination of VC per se was described by similar monoexponential processes following 10 or 1000 ppm with respective half-lives of 20.4 and 22.4 min. The elimination of ^{14}C in the urine was described by a biexponential process; the half-lives for the initial phase of excretion were 4.6 and 4.1 hr following 10 and 1000 ppm, respectively. The percentage of the recovered ^{14}C remaining in the carcass after 72 hr was 14 and 15%, at the respective low and high exposure levels. The ^{14}C remaining in the tissues was comprised primarily of nonvolatile metabolites of VC rather than VC per se. The urinary ^{14}C was separated by high-pressure liquid chromatography into three major metabolites corresponding to *N*-acetyl-S-(2-hydroxyethyl) cysteine, thiodiglycolic acid, and a third unidentified metabolite. The proportions of the urinary metabolites were not markedly influenced by the exposure magnitude. The fate of inhaled [^{14}C]VC was shown to be dose-dependent and this is consistent with previous studies on the fate of VC following ingestion.

144. *Sensory Irritation Caused by the Decomposition Products of Polyvinyl Chloride.* CRAIG S. BARROW, YVES ALARIE and MARYANNE F. STOCK, Department of Occupational Health, Graduate School of Public Health, University of Pittsburgh, Pittsburgh, Pennsylvania.

The evaluation of potentially toxic gases has come to be recognized as one of the salient features of fire toxicity. This study was undertaken to quantitate the degree of sensory irritation to the upper respiratory tract of mice to the decomposition products of three different formulations (A, B, and C) of polyvinyl chloride (PVC). Polymer A contained a plasticizer, polymer B contained a plasticizer and fire retardant, and polymer C contained neither plasticizer nor fire retardant. Groups of three to four male Swiss-Webster mice were exposed to the decomposition products of approximately 50-60 mg of each polymer. The thermogravimetric analysis of each polymer demonstrated that two distinct weight loss fractions occurred during the decomposition process. By varying the dilution air through the exposure chamber a range of exposure concentrations was obtained for each weight loss fraction. Dose-response curves were plotted by utilizing the percentage decrease in respiratory rate during each exposure as the response parameter. The results showed that in terms of sensory irritation $\text{PVC-A} > \text{PVC-B} > \text{PVC-C}$ for the first weight loss fraction. Similar comparisons were made for the second weight loss fractions. Based on this work and previous studies of sensory irritation to other airborne chemicals, predictions of qualitative and quantitative human responses to sensory irritants such as the decomposition products of PVC are possible. (Supported under Research Grant No. 5-9005 from the National Bureau of Standards.)

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