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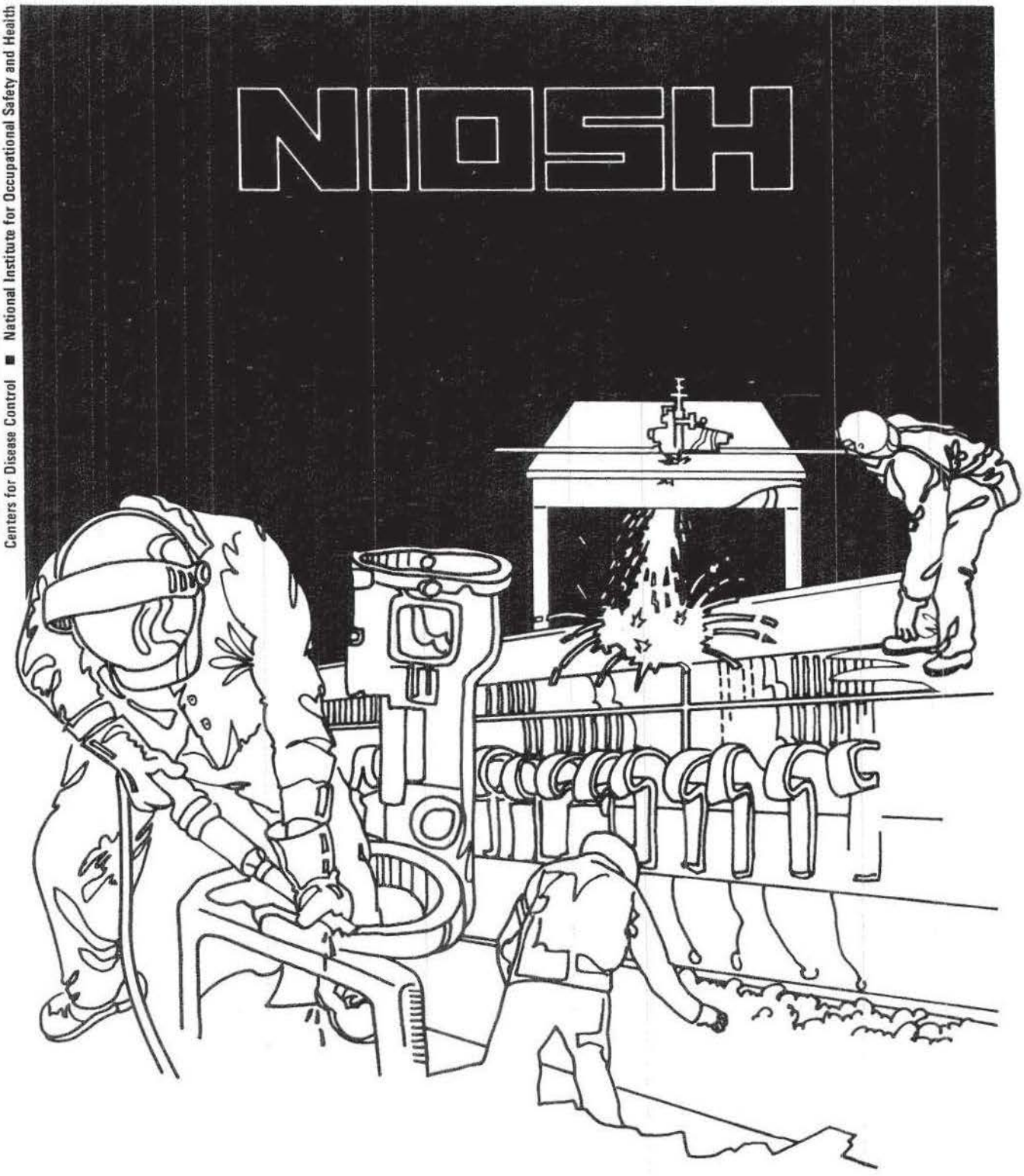

Health Hazard Evaluation Report

HHE 79-158-819
MORRILTON PLASTICS CORPORATION
MORRILTON, ARKANSAS

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 699(a)(6), which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

HHE 79-158-819
FEBRUARY, 1981
MORRILTON PLASTICS, CORP.
MORRILTON, ARKANSAS

NIOSH INVESTIGATIONS:
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I. SUMMARY

In September 1979 the National Institute for Occupational Safety and Health (NIOSH) received a request from an authorized representative of employees of Morrilton Plastics Corporation to evaluate employee exposure in the production area to various solvents, glues, and other potentially toxic compounds. Approximately 125 employees work in the production area, where plastic air conditioning vacuum harness assemblies for automobiles are manufactured.

A preliminary environmental/medical survey was performed at the facility on November 6, 1979. Fourteen (14) employees were interviewed, either on this visit or by telephone in the succeeding weeks concerning health problems, working conditions, and reactions to the product LOCTITE, a cyanoacrylate adhesive previously used at the plant.

A follow-up evaluation was performed on April 8, 1980. Personal breathing-zone and general area air samples were collected, and a directed self-administered questionnaire was distributed to the production area employees. The questionnaire sought data on mucous membrane irritation, skin conditions, neurologic symptoms, allergic history, smoking history, and previous employment.

Environmental sampling results, showing, (number of samples * mean concentration * range of concentration) for the various compounds are as follows: 1,1,1 - trichloroethane (8 * 22mg/M^3 * 16-28mg/M^3); tetrahydrofuran (8 * 48mg/M^3 * 25-104mg/M^3 * 8-29mg/M^3); acetone (10 * 34mg/M^3 * 28 - 37mg/M^3); methylene chloride (10 * 159mg/M^3 * 88-269mg/M^3); phenol (3 * < detection limit); and vinyl chloride (7 * < detection limit). With the exception of the exposure to one employee --- where the methylene chloride concentration exceeded the NIOSH recommended exposure level --- , the results for each substance, when considered individually and as a mixture, did not exceed "recommended permissible exposure limits."

Results of the questionnaire did not reveal significant differences in responses between those regularly exposed to solvents (assemblers) and those not exposed. However, over forty percent of all respondents reported occasional or frequent headaches, eye irritation, tiredness, or nasal stuffiness during the preceding seven months.

On the basis of data obtained in this investigation, NIOSH determined that a hazard from overexposure to 1,1,1 - trichloroethane, tetrahydrofuran, methyl ethyl ketone, toluene, acetone, methylene chloride, phenol and vinyl chloride did not exist at the time of this survey. Recommendations have, however, been made to improve work practices relating to the handling and use of chemicals in the production area.

KEYWORDS: SIC 3079; LOCTITE (ethyl cyanoacrylate); solvent exposure (1,1,1 trichloroethane, tetrahydrofuran, methyl ethyl ketone, toluene, acetone, methylene chloride); phenol; vinyl chloride.

II. INTRODUCTION

Under the Occupational Safety and Health Act (OSHA) of 1970, NIOSH is authorized to investigate the toxic effects of substances found in the workplace. On September 21, 1979, NIOSH received such a request from the International Union, United Automobile, Aerospace, and Agricultural Implement Workers of America (UAW), Local No. 1000, to investigate production area employee exposure to various solvents, glues, and other potentially toxic compounds [i.e., 1,1,1-trichloroethane, tetrahydrofuran (THF), methyl ethyl ketone (MEK), toluene, acetone, methylene chloride, phenol and vinyl chloride] at Morrilton Plastics Corporation, Morrilton, Arkansas.

III. BACKGROUND

This plant produces plastic air conditioning vacuum harness assemblies for automobiles. The raw polyvinyl chloride material (virgin resin or regrind material) is fed into machines and progresses through various heating cycles, where the material is plasticized. It is then extruded through dies in the form of a tube which is cooled by water, and ultimately becomes a "finished" piece of tubing.

Additional raw polyvinyl chloride material also progresses through machines, heating cycles, etc., and is injected through molds which determine the configuration of specific components such as ells and tees. These extrusion/injection molding processes are followed by the bonding and assembly of the tubing and components in the assembly area.

The company had a workforce of approximately 180 employees at the time of the walk-through survey in November 1979, and approximately 120 employees at the time of the follow-up survey in April 1980. With the exception of a few employees who work at the extruder-injection machines on the second shift, all other employees perform duties on the day shift.

IV. EVALUATION DESIGN AND PROCEDURES

A. Environmental

An initial walk-through survey was performed at the facility on November 6, 1979. The purpose of that visit was to gather information on all substances used in the production area, as well as the conditions of their use. All areas within the plant where significant exposure to applicable chemicals might occur were identified.

To evaluate employee exposure to chemicals being used in the manufacture of the vacuum harness assemblies, environmental sampling was performed on April 8, 1980.

Personal breathing-zone and general area air samples were collected to evaluate employee exposure to 1,1,1 - trichloroethane, tetrahydrofuran, methyl ethyl ketone, toluene, acetone, methylene chloride, phenol and vinyl chloride. Samples were collected by using both midget impingers

and standard charcoal tubes, depending on the prescribed sampling/analytical method. Analytical methods utilized were gas chromatography/flame ionization and gas chromatography/mass spectrometry.

B. Medical

During the initial visit on November 6, 1979, six employees were interviewed. Over the succeeding weeks, eight more present and past employees were interviewed by telephone. During these interviews, emphasis was placed on health problems, working conditions, and reactions to the product, LOCTITE, a cyanoacrylate adhesive previously utilized at the plant, but which had been discontinued in October 1979. Entries made in the OSHA Log and Summary of Occupational Injuries and Diseases (OSHA-200) were also reviewed.

During the April 8, 1980 follow-up evaluation, a directed self-administered questionnaire was passed out to all employees present (total employment that day was about 120). Employees were asked whether or not they had experienced headaches, nausea, eye or nose irritation, skin rash, numbness in the fingers, drowsiness, or dizziness during the previous two days. They were also asked about the occurrence of these symptoms during the previous seven months. Other questions were directed toward allergic history, smoking history, history of pneumonia or bronchitis, and previous employment.

Assemblers who had worked with a solvent or glue during the two weeks preceding the survey were considered "exposed." Of the 114 employees who returned the questionnaire, 52, all women, fell into this exposed group. Of the remaining 62 employees, 42 had a small enough exposure to chemicals to warrant their use as an unexposed, or control group. The twenty remaining employees were not included in the analysis. Six of these were men, excluded because all of the assemblers were women. The other 14 were excluded because their history of exposures to chemicals could not be determined.

V. EVALUATION CRITERIA

A. Environmental Standards

Environmental standards and criteria considered applicable to this evaluation are shown below.

Substances	NIOSH, 8-10 hr. TWA Recommendation (mg/M^3)*	ACGIH, TLV Committee (mg/M^3)*	OSHA, 8 hr. TWA Standard (mg/M^3)*
1,1,1 - Trichloroethane	1086	1900	2400
Tetrahydrofuran	xx	590	590
Methyl ethyl ketone	590	590	590
Toluene	375	375	750
Acetone	xx	2400	2400

Substances	NIOSH, 8-10 hr. TWA Recommendation (mg/M^3)*	ACGIH, TLV Committee (mg/M^3)*	OSHA, 8 hr. TWA Standard (mg/M^3)*
Methylene Chloride	261	700	1750
Phenol	20	19	19
Vinyl Chloride	xx	10	2

*Eight or ten-hour time-weighted-average (TWA) concentrations in milligrams of substance per cubic meter of air sampled.

ACGIH - American Conference of Governmental Industrial Hygienists, Threshold Limit Value Committee; OSHA - Occupational Safety and Health Administration.

B. Toxic Effects

1,1,1-Trichloroethane (Methyl Chloroform) can cause headache, dizziness, and drowsiness. Severe exposures may result in liver and kidney damage. It has caused neoplasms in some animal studies.

Tetrahydrofuran (THF) is an irritant of the eyes and mucous membranes (nose and throat). It may cause headache, dizziness, and drowsiness. No chronic health effects are known.

Methyl ethyl ketone (MEK), another solvent, is an irritant of the eyes and skin. Contact may cause numbness of the fingers, arms, legs, and, in high concentrations, dizziness and numbness.

Toluene may also cause fatigue, weakness, dizziness, headache, and nervousness. Like many other solvents, it can defat the skin, resulting in drying and irritation.

Acetone is an irritant of the eyes and mucous membranes. High concentrations can result in dizziness and drowsiness, but it is of relatively low toxicity.

Methylene Chloride is an irritant to the eyes, skin, and respiratory tract. It may cause headache, giddiness, numbness of the limbs, and irritability.

Phenol is an irritant of the eyes, mucous membranes, and skin. Significant absorption, which usually occurs through the skin, can result in weight loss, liver and kidney damage, loss of appetite, and convulsions.

Polyvinyl Chloride (PVC) is, in itself, generally considered non-toxic although recent evidence has suggested that exposure to PVC dust over long periods may cause lung disease or lung cancer. It does not decompose to vinyl chloride, which is a known carcinogen. Under normal operating conditions, decomposition products from PVC are negligible. If overheated (to above 400°F), it may produce hydrochloric acid, which is an irritant of the eyes, mucous membranes, and skin, and some other substances, including benzene.

LOCTITE, a trade name for an adhesive composed predominantly of ethyl cyanoacrylate, is irritating to the eyes and mucous membranes. Cyanoacrylate adhesives have been known to cause dermatitis.

It should be apparent from the above summary that most solvents have some potential as irritants of the eyes, mucous membranes, respiratory tract, and skin, and can cause central nervous system effects. However, the exact effects, and the degree of toxicity vary, depending on the chemical.[1,2]

VI. RESULTS

A. Environmental

Results appearing in Tables 1-4 show that airborne concentrations of eight 1,1,1-trichloroethane; eight methyl ethyl ketone; three phenol; eight toluene; ten acetone; eight tetrahydrofuran; seven vinyl chloride; and nine methylene chloride personal breathing-zone/general area air samples were either below: (a) applicable NIOSH 8/10-hour recommended levels; (b) ACGIH, TLV Committee 8-hour TWA recommended levels; (c) OSHA 8-hour TWA or ceiling standards; or (d) the lower detection limit of the applicable analytical method. With the exception of the exposure of one employee -- where the methylene chloride concentration exceeded the NIOSH recommended exposure level -- the results for each substance, when considered individually and as a mixture, did not exceed "recommended permissible exposure limits."

B. Medical

Assemblers tended to be older (mean age 49 years) than controls (mean age 41 years). Assemblers and controls had worked at the plant for similar periods, 10 years and 9 years, respectively. Controls smoked more (57 percent) than did assemblers (37 percent).

Employees were asked about the presence or absence of various symptoms during the two days immediately preceeding the study. The results of their answers are summarized in Table 5. Assemblers and controls did not differ significantly in their listing of symptoms.

Workers were also provided a list of symptoms and asked to note whether each symptom had been occurring frequently, occasionally, or seldom during the previous seven months. Table 6 summarizes some of their responses. Within each group is listed the percentage having symptoms either occasionally or frequently. There are no statistically significant differences in the responses of the two groups.

Interviews performed during November 1979, both at the plant and by telephone, were not administered on a random basis. Therefore, they cannot be analyzed statistically, but will be further discussed in the following section of this report.

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[1]Proctor, N.H., and Hughes, J.P., Chemical Hazards of the Workplace, J.B. Lippincott Company, 1978.

[2]National Institute for Occupational Safety and Health (NIOSH), Occupational Disease: A Guide to Their Recognition, USPHS, 1977.

Review of the OSHA Administration Log and Summary of Occupational Injuries and Diseases (OSHA-200) from February 1978, through October 1979, revealed many complaints of skin rash or itching (at least 15 instances). There were also several instances of skin contact with various chemicals, including two occurrences of glue in the eyes of employees.

VII. DISCUSSION

Results of environmental sampling indicate that employees were not exposed to toxic levels of 1,1,1-trichloroethane, methyl ethyl ketone, phenol, toluene, acetone, tetrahydrofuran, vinyl chloride, or methylene chloride during the period of this evaluation. All measured exposures, with the exception of one employee's exposure to methylene chloride, were below the 8-hour TWA standards/recommendations imposed by OSHA, ACGIH or NIOSH. Excluding that one employee, and when considered as a mixture, those same exposures did not exceed 100 percent of the allowable daily dose for the highest concentrations measured.

The questionnaire did not reveal significant differences in symptom prevalence between those regularly exposed to solvents (that is, assemblers), and those not regularly exposed. The results listed in Table 6 suggest that, while many workers were not having symptoms during the two days preceding the survey of April 1980, a relatively large percentage of all workers had been experiencing these symptoms occasionally or frequently during the preceding seven months. Thus, of the ninety-four questionnaires tablulated, headaches were reported by sixty-one (51%); eye irritation by thirty-eight (40%); tiredness by forty-eight (51%); nasal stuffiness by forty (43%); and dizziness by twenty-four (26%). However, since both assemblers and controls reported these complaints, they are probably not the result of direct contact with chemicals in the workplace. This conclusion is corroborated by the results of the air sampling which, with the exception of methylene chloride, were well below established threshold limit values. Nor is this distribution of complaints explained by job rotation, of which there is little at this company.

The interviews performed during November 1979, revealed a similar set of symptoms. Several of those workers complained of having had considerable irritation from the use of LOCTITE, an adhesive composed predominantly of ethyl cyanoacrylate. Starting in June 1978, this adhesive was quite heavily used at the plant (its use was discontinued late in 1979). Symptoms noted included headache, nausea, sneezing, and respiratory tract irritation. No statistical analysis is possible from this anecdotal data, but it is apparent that many workers found this product noxious. It has been reported that dermatitis and other effects of cyanoacrylate adhesives are considerably reduced if humidity is maintained above fifty-five percent; thus, maintaining a relatively humid environment, as well as adequate ventilation, appears to be of importance in reducing symptoms.[3]

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[3] Calnan, C.D., "Cyanoacrylate Dermatitis," Contact Dermatitis, Volume 15 (3), pp. 165-165, May 15, 1979.

As previously noted, many of the symptoms mentioned in the questionaires also appeared on the OSHA Log and Summary of Occupational Injuries and Diseases (OSHA-200). In addition, several injuries were listed. These listings were found most frequently for assemblers and suggest that there is too close a contact with the various chemicals being used in the plant.

While conducting the interviews, two cases of cancer (lung and naso-pharyngeal) were noted. It is not possible, on the basis of such limited data, to relate these illnesses to the work environment.

VIII. RECOMMENDATIONS

1. Most chemicals currently being used in the plant have an irritating effect on the skin. Frequent contact of these chemicals with the skin should be remedied by the use of appropriate personal protective equipment such as gloves, appropriate clothing, and safety glasses.

2. The current method of dispensing the solvents should be replaced by one in which the containers are not totally open to the plant atmosphere.

IX. REFERENCES

1. Proctor, N.H., and Hughes, J.P., Chemical Hazards of the Workplace, J.B. Lippincott Company, 1978.

2. National Institute for Occupational Safety and Health (NIOSH), Occupational Disease: A Guide to Their Recognition, USPHS, 1977.

3. Calnan, C.D., "Cyanoacrylate Dermatitis," Contact Dermatitis, Volume 15 (3), pp. 165-167, May 15, 1979.

X. AUTHORSHIP AND ACKNOWLEDGEMENTS

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XI. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available, upon request, from NIOSH, Division of Technical Services, Information and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After ninety (90) days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office, at the Cincinnati, Ohio, address.

Copies of this report have been sent to:

a) Morrilton Plastics Corporation, Morrilton, Arkansas
b) Authorized Representative of Employees
c) U.S. Department of Labor, Region VI
d) NIOSH, Region VI
e) Arkansas State Department of Health

For purposes of informing the approximately 125 affected employees, a copy of this report shall be posted in a prominent place, accessible to the employees, for a period of thirty (30) calendar days.

Table 1

1,1,1-Trichloroethane, Tetrahydrofuran (THF), Methyl Ethyl Ketone (MEK), and Toluene Concentrations

Morrilton Plastics Corporation
Morrilton, Arkansas

April 8, 1980

ple ber	*Type of Sample	Location	Sampling Period	**Concentration (mg/M^3)			
				1,1,1-Tri-chloro-ethane	Tetra-hydrofuran	Methyl Ethyl Ketone	Toluene
L	P	Line 053-Spiker	0803 - 1355	< 21	25	37	< 11
3	P	Line 053-Assembler	0805 - 1353	< 26	38	65	15
5	P	Line 053-Assembler	0804 - 1054	(a)	(a)	(a)	(a)
7	P	Line 053-Assembler	0810 - 1353	< 17	62	112	< 9
9	P	Line 053-Assembler	0812 - 1353	< 26	37	72	< 13
1	P	Line 747-Assembler	0817 - 1401	< 21	56	75	29
3	P	Line 747-Assembler	0822 - 1359	< 22	32	38	< 11
5	P	Line 747-Assembler	0827 - 1359	< 21	31	34	< 10
7	P	Line 747-Assembler	0831 - 1401	< 29	104	164	< 15
A 8-hr. TWA Standard				2400	590	590	750
A Ceiling Standard				xx	xx	xx	1125
SH 8-10 hr. TWA Recommendation				1086	xx	590	375
CH 8-hr. TWA Recommendation				1900	590	590	375

*Personal
mg/M^3 - Milligrams of substances per cubic meter of air sampled
Pump malfunction -- invalid sample
Less than

Table 2

Acetone and Methylene Chloride Concentrations

Morrilton Plastics Corporation
Morrilton, Arkansas

April 8, 1980

Sample Number	*Type of Sample	Location	Sampling Period	**Concentration (mg/M^3)	
				Acetone	Methylene Chloride
CT-2	P	Line 053-Assembler	0837 - 1054	< 34	155
CT-16	P		1305 - 1506	36	16
CT-6	P	Line 053-Assembler	0840 - 1054	< 32	143
CT-14	P		1305 - 1506	< 36	171
CT-8	P	Line 053-Assembler	0842 - 1055	< 27	103
CT-12	P		1307 - 1504	< 30	134
CT-20	P	Line 053-Assembler	0843 - 1055	< 30	325
CT-18	P		1311 - 1507	44	187
CT-4	P	Line 053-Assembler	0838 - 1054	< 38	96
CT-10	P	Line 747-Assembler	1308 - 1505	33	225
OSHA, 8-10 hr. TWA Standard				2400	1750
OSHA, Ceiling Standard				xx	3500
NIOSH, 8-hr. TWA Recommendation				xx	261
ACGIH, 8-hr. TWA Recommendation				2400	700
ACGIH, 8-hr. TWA Proposed				1780	360

* P=Personal
** mg/M^3 - Milligrams of substance per cubic meter of air sampled
< = Less than

Table 3

Phenol Concentrations

Morrilton Plastics Corporation
Morrilton, Arkansas

April 8, 1980

ple ber	*Type of Sample	Location	Sampling Period	**Concentration (mg/M^3)
	GA	Line 747 - Downwind, North	0858 - 1403	(a)
	GA	Line 747 - West Side	0859 - 1403	(a)
	GA	Line 747 - Upwind, South	0859 - 1403	(a)

A, 8-hr. TWA Standard	19
SH, 8-10 hr. TWA Recommendation	20
IH, 8-hr. TWA Recommendation	19

A = General Area
mg/M^3 = Milligrams of substance per cubic meter of air sampled
a Measured concentration below the lower limit of detection (1.0 mg/sample) for the analytical method.

Table 4

Vinyl Chloride Concentrations

Morrilton Plastics Corporation
Morrilton, Arkansas

April 8, 1980

Sample Number	*Type of Sample	Location	Sampling Period	**Concentration (mg/M^3)
VC-1	P	Injection Molding - Extruder #5	0925 - 1145	(a)
VC-2	P	Injection Molding - Extruder #4	0928 - 1145	(a)
VC-3	P	Injection Molding - Extruder #3	0929 - 1146	(a)
VC-4	P	Injection Molding - Extruder #1	0934 - 1146	(a)
VC-5	P	Injection Molding - Extruder #2	0937 - 1147	(a)
VC-6	GA	Injection Molding - Rear of Extruder #5	0950 - 1345	(a)
VC-7	GA	Injection Molding - Rear of Extruder #3	0950 - 1345	(a)

OSHA, 8-hr. TWA Standard	2
OSHA, Ceiling Standard (for 15 minutes)	10
ACGIH, 8-hr. TWA Recommendation	10

* P = Personal; GA = General Area
** mg/M^3 = Milligrams of substance per cubic meter of air sampled
(a) Measured concentration below the lower limit of detection (0.0001 mg/charcoal tube) for the analytical method

Table 5

Symptoms Noted By Workers During the Two Days Preceding the Study

Morrilton Plastics Corporation
Morrilton, Arkansas

April 8, 1980

Symptoms	Assemblers (52 Employees)	Controls (42 Employees)
A cold	10 (19%)	7 (14%)
Headache	14 (27%)	17 (40%)
Nausea	8 (15%)	10 (24%)
Eye irritation	17 (33%)[1]	11 (20%)
Stuffy nose	18 (35%)[2]	9 (21%)
Skin rash	4 (8%)	3 (7%)
Finger numbness	7 (13%)	5 (12%)
Drowsiness	6 (13%)	5 (12%)
Dizziness	6 (17%)	12 (29%)
Age (years)	49.1	41.5
Years employed at Morrilton	9.8	9.3
Smokers	19 (37%)	24 (57%)
Non-smokers	33 (63%)	18 (43%)

[1] $x^2 = 0.21$ (not significant)

[2] $x^2 = 1.38$ (not significant)

Table 6

Occurrence of Symptoms Between
September 1, 1979, and April 8, 1980

Morrilton Plastics Corporation
Morrilton, Arkansas

Symptoms		Assemblers (52 Employees)	Controls (42 Employees)
Headache	Occasionally	17	23
	Frequently	11	10
	Total	28 (54%)	33 (79%)
Eye Irritation	Occasionally	16	12
	Frequently	5	5
	Total	21 (40%)	17 (40%)
Tiredness	Occasionally	17	18
	Frequently	6	7
	Total	23 (44%)	25 (60%)
Nasal Stuffiness	Occasionally	14	13
	Frequently	8	5
	Total	22 (42%)	18 (43%)
Dizziness	Occasionally	9	13
	Frequently	0	2
	Total	9 (17%)	15 (36%)

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