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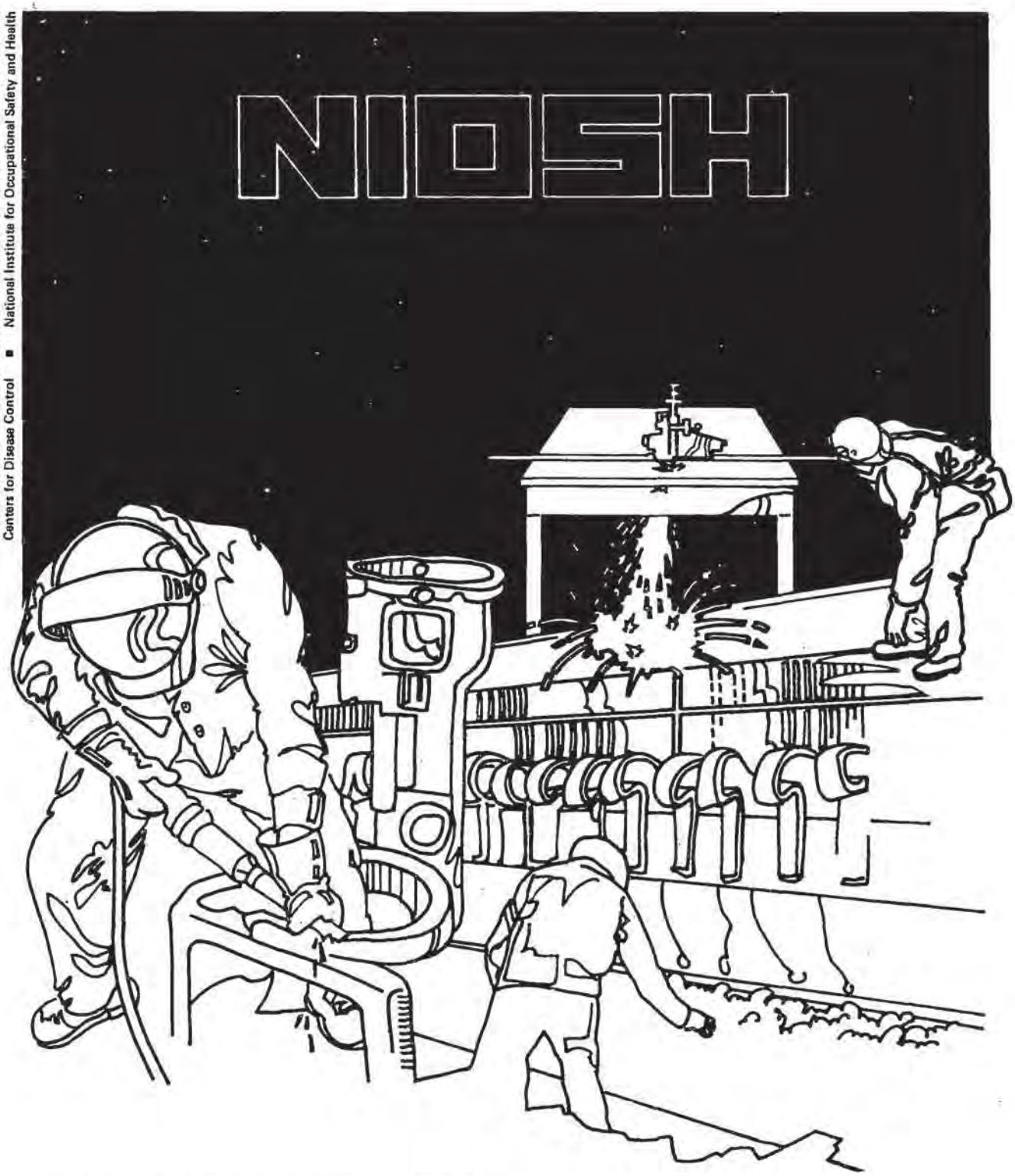
NIOSH



Health Hazard Evaluation Report

HETA 83-010-1313
DETROIT GASKET
FREMENT, OHIO

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. 669(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.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

HETA 83-010-1313
MAY 1983
DETROIT GASKET
FREMENT, OHIO

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I.SUMMARY

On October 19, 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request to determine the nature and frequency of adverse reproductive outcomes among employees at Detroit Gasket, an automobile seaming lace manufacturing plant in Fremont, Ohio. According to the request, only five "perfectly healthy" children were born over the past three years.

On October 27, 1982, NIOSH investigators conducted a walk-through survey of the plant. NIOSH investigators returned to the plant on December 13-14, 1982, to administer a reproductive questionnaire to all female employees.

No industrial hygiene sampling was conducted, since exposures were considered either to be slight or of a skin contact nature, and the medical questionnaire did not reveal information to contradict this initial impression.

Incidence of adverse reproductive outcomes in pregnancies which occurred when the employee worked at Detroit Gasket (exposed or study group) was compared to that when the employee did not work at Detroit Gasket (non-exposed or comparison group). Incidence rates at the plant were also compared to rates in the general population.

Frequency of birth defects, spontaneous abortions, induced abortions, and stillbirths was similar in the study and comparison groups. A significantly higher percentage of live-born children in the exposed group had health problems as infants. However, there is no evidence that those illnesses are related to occupational exposures or that they are necessarily of prenatal etiology.

Frequency of health problems other than those of a reproductive nature was similar in upstairs compared to downstairs employees with the exception of skin rash, which was statistically significantly higher in upstairs employees.

Based on these results, NIOSH concluded that there is no evidence of an increased incidence of adverse reproductive outcomes among Detroit Gasket employees which might be related to workplace chemical exposures. Some of the skin problems among upstairs employees are probably due to contact with the adhesives used, or to irritation from debris resulting from the machining of the beading. Recommendations to help minimize these exposures are presented in Section IX of this report.

KEYWORDS: SIC 2396 (Automotive Trimmings), reproductive, dermatitis

II. INTRODUCTION

On October 19, 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation at Detroit Gasket in Fremont, Ohio. The request, submitted by the United Auto Workers International Union, asked NIOSH to determine the nature and frequency of adverse reproductive outcomes among employees and health problems in their children. According to the request, it was estimated that over the past three years, only five "perfectly healthy" children were born to workers at the plant.

Potentially toxic substances of concern that were listed on the request were vinyl chloride (VC) gas in polyvinyl chloride (PVC) pellets; fire retardants, such as Fyrol, on cloth; plasticizers, such as dioctyl phthalate, in PVC pellets and polyethylene pellets; and carbon monoxide from truck exhaust.

On October 27, 1982, two NIOSH physicians and an industrial hygienist visited the plant to begin their evaluation. Two NIOSH physicians returned to the plant on December 13-14, 1982, to administer a reproductive health questionnaire to all female employees.

III. BACKGROUND

Detroit Gasket in Fremont, Ohio, one of five similar plants, produces seaming lace for General Motors' (GM) vehicles. This seaming lace, consisting of a plastic core of either PVC or polyethylene, and covered by various types of treated cloth, is used as trim on vehicle seat covers.

There is a fair amount of employee turnover at Detroit Gasket. At the time of the NIOSH surveys, there were approximately 65 employees over two 8-hour shifts. Approximately 10% were male. Twelve employees worked on second shift.

The plant has been in operation since 1966. The process was mostly product assembly until 1978, when extrusion operations were added. Currently there are three extruders on the first floor, two which are used for polyethylene, and one of which is used for PVC.

PVC and polyethylene pellets are emptied from a hopper into the extruding machines, where they are heated and formed into strands. These strands are cooled in a water bath prior to use. Each extruder requires one operator, who also is responsible for maintenance of the machine and quality control of the product.

The operating range of the extruders is 290°-340°F for polyethylene, and 320°F for PVC. The PVC extruder is somewhat different in that the extruded PVC is formed around a cloth-encased polyethylene core. Apparently the configuration of the extruder, and the additional materials used, result in the emission of visible amounts of smoke at the point of extrusion, which are not present in the other two machines.

Rolls of cloth, which are treated by manufacturers to GM specifications, are received and cut into strips on what is known as run-off machines (3 machines, 1 operator each). These strips are run-off into boxes and transported to forming machines (5 machines, 1 operator each). Forming machines place glue on the strip of cloth and form it around a polyethylene core. Some cloth strips are taken to another area where they are sewn around a polyethylene core and cut with scissors to a specific length. These operators are located on the second floor.

In various locations on the first floor are operations which put finishing touches on the product. Eleven notching machines (1 operator each) put notches in the beading. Eight tabbing machines (1 operator each) remove the core from the ends of a length of beading. Two machines known as clickers (1 operator each) notch the beading in a particular fashion so that the operator can apply glue on the ends of the beading. Finally, there are machines which will notch wider-cored beading, and which will split double-width beading into single-width portions.

IV. EVALUATION DESIGN AND METHODS

B. ENVIRONMENTAL

In the processes evaluated potential exposure to toxic materials occurs when workers come in skin contact with glues or breathe emissions from extruding PVC and from gasoline powered forklifts. Skin and inhalation exposure can also occur from dusts generated by the sewing, cutting, slitting, and notching operations. Gasoline-powered forklifts are a potential source of carbon monoxide exposure.

No industrial hygiene sampling was conducted since exposures were considered either to be slight or of a skin contact nature, and the initial focus of the investigation was on reproductive outcome.

B. MEDICAL

In order to investigate the health problems as reported in the hazard evaluation request -- increased risk of miscarriages, stillbirths, and infants with health problems -- we designed a questionnaire to obtain information on the individual's health history, occupational history, reproductive history, and reported frequency of other symptoms associated with occupational exposure to chemicals used in the plant.

The survey included all currently employed female workers present at the plant on December 13-14, 1982. No workers unexposed to chemicals were available at the plant to serve as a comparison group. Thus, we compared incidence of adverse reproductive outcomes in pregnancies which occurred when the employee worked at Detroit Gasket (exposed group) to that when the employee did not work at Detroit Gasket (non-exposed, or comparison group). We also compared incidence rates at the plant to rates in the general population.

V. EVALUATION CRITERIA

The composition of the non-proprietary materials used at Detroit Gasket, and their potential health effects, are listed in Table 1.

Of the chemicals known to be used in the plant, only phthalate esters have been demonstrated to be associated with adverse reproductive outcomes. An experimental study in which laboratory animals were exposed to phthalate esters showed deleterious effects on the developing embryo or fetus from each of the eighjt compounds tested. Esters of lower molecular weight were more teratogenic (causing birth defects) (1).

VI. RESULTS

A. Environmental

With the exception of the PVC extruder, there were no operations which could, under conditions observed, result in excessive inhalation exposure. The PVC operation would be expected to present the potential for acute eye and respiratory irritation (due to the evolution of hydrogen chloride gas during extrusion) to the operator during instances where she is required to adjust the extruder to maintain quality control. We judge the inhalation hazard to the remainder of the workforce to be minor, given the small amounts of material evolved and the dilution factor of the large room in which the extruder is housed.

B. Medical

1. Reproductive Effects

Of 42 pregnancies which occurred while the employee worked at Detroit Gasket (exposed group), 36 (86%) resulted in live births. Of 114 pregnancies which occurred while the individual did not work at Detroit Gasket (non-exposed or comparison group), 103 (90%) resulted in live births, a difference which is not statistically significant (Table 2).

Among the exposed group, 4 of 42 pregnancies (10%) were reported to have terminated in a spontaneous abortion, while there was 1 stillbirth (2%) and 1 induced abortion (2%). The comparison group reported 9 spontaneous abortions (8%), 2 stillbirths (2%) and 2 induced abortions (2%). Birth defects were reported in 1 case by the comparison group (1%) and in 2 cases (6%) by the study group.

Among the exposed group, 7 of 36 (36%) of live births resulted in infants with neonatal and early childhood health problems other than birth defects, compared to 3 of 103 (3%) in the non-exposed group, a difference which is statistically significant. (X^2=10.8, df=1, P<.001). Respiratory illnesses and complications of prematurity comprise the majority of reported health problems (Table 3).

2. Non-reproductive effects

Eye and throat irritation were the most frequently reported symptoms (54% each), followed by headache (49%) and, to a lesser extent, nausea (14%) and skin rash (12%) (Table 4).

Because of the small number of employees at the plant, we stratified by broad work area (upstairs vs. downstairs) rather than by job title. Potential exposures downstairs would be to carbon monoxide, plastic fumes, phthalates and dyes. Potential exposures upstairs would be to adhesives and flame retardants. Comparing the 19 upstairs employees to the 33 downstairs employees, a statis- tically significant difference in percentage of employees reporting symptoms was found only for skin rash (X^2=6.27, df = 1, P <.05). (Seven plant-wide employees were omitted from this comparison.)

VII. DISCUSSION

The "expected" rate of spontaneous abortion among the U.S. general population is approximately 15% (2), and 3-5% of live-born children have congenital anomalies (3). Reported frequency of spontaneous abortion among both the exposed and unexposed groups was below the "expected", i.e., 10% and 8%, respectively. Similarly, reported frequency of stillbirths and birth defects was low.

A significantly higher percentage of live-born children in the exposed group had health problems as infants. Four of 7 (57%) of these pregnancies occurred while the employee worked on automatics, but this is not statistically significantly different from the proportion of all workers on automatics (17 of 59, 29%; X^2 = 2.4, df = 1, P > 0.1). Two of the seven health problems were secondary to prematurity. Prematurity, the largest single cause of neonatal mortality, would be expected in about 7% of all births (4). The causes of prematurity may include toxemia of pregnancy, chronic hypertension, hemorrhagic complications of pregnancy, heart disease, poor nutrition, and other factors which remain to be discovered. The remaining 5 cases involve some type of respiratory problem. While it is understandably of concern to employees that some workers' children are experiencing problems such as asthma, bronchiolitis, and bronchitis, there is no evidence that these illnesses are related to occupational exposures of the mothers or that they are necessarily of prenatal etiology.

A significantly higher percentage of dermatitis was reported among upstairs compared to downstairs workers. Some of these skin problems are probably due to contact with the adhesives used, or to irritation from debris resulting from the machining of the beading.

In an investigation of an air conditioning vacumm harnass plant which extruded PVC, Markel and Slovin (5) found that of 94 workers, 51% reported headache and 40% reported eye irritation. Environmental sampling revealed no exposures in excess of recommended criteria. In

our study, we found similar rates for headache and mucous membrane irritation. The reported rates did not differ significantly between first floor and second floor employees. If these problems were related to fugitive emissions from the extruders, we would expect a higher rate of these health problems among first floor employees.

VIII. RECOMMENDATIONS

1. Institute periodic housekeeping (vacuuming, not sweeping) to remove accumulations of waste cloth and cuttings around sewing and other machines. A minimum would be daily or whenever accumulation seems excessive.

2. Protective gloves, finger cots, and/or forearm covers, and a mechanical arrangement (similar to a clothespin) for holding glued parts until they adhere should be used to reduce skin contact with adhesives. Long sleeve shirts and/or blouses will reduce forearm contact with waste materials.

3. Install a local exhaust system to capture PVC extruder emissions. An air flow of two hundred cubic feet per minute per square foot of exhaust opening should be sufficient, although this rate is not critical. The critical point is that the contaminants are captured; since the emissions are visible, the effectiveness of the system can be easily observed. In order to adapt the existing system to your needs, either the size of the exhaust opening can be adjusted, or a damper and additional duct can be installed to regulate the flow of air. The exhaust opening (hood) should be positioned as close to the generation point as possible. Flexible elephant trunk ductwork will facilitate the adjustment of the hood for maintenance.

4. Truck operators near the shipping area are apparently not always following the posted instructions to shut off motors. This regulation should be strictly enforced. Exhaust fumes contain high levels of carbon monoxide. Also, gasoline-powered forklifts should be kept tuned up in order to minimize exhaust emissions.

5. In the areas where HM-904 hot-melt glue is used, local exhaust ventilation should be used over the pre-melting resevoir to minimize if eye and upper respiratory tract irritation is experienced.

IX. REFERENCES

1. Singh AR, Lawrence WH, Autian J, Teratogenicity of phthalate esters in rats. J. Pharm. Sci. 1972; 61,51-55

2. Porter IH Genetic aspects of preventive medicine in Maxcy-Rosenau Public Health and Preventive Medicine. JM Last, ed. 11th edition Appleton-Century Crofts, New York 1980

3. Kline J et al. Spontaneous Abortion Studies: Role in Surveillance in Proceedings of a Workshop on Methodology for Assessing Reproductive Hazards in the Workplace, National Institutes of Health, Bethesda, Maryland, April 19-22, 1978,

4. Whitridge J, Maternal Health Services in Maxcy-Rosenau Public Health and Preventive Medicine, Sartwell PE, ed. 9th edition: Appleton-Century Crofts, New York, 1965

5. Markel HL and Slovin D. Health Hazard Evaluation Report No. 79-158-819, NIOSH, February, 1981.

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XI. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. Information regarding its availability through NTIS can be obtained from NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. U.A.W. Local 969, Fremont, Oh.
2. U.A.W. International Union, Detroit, Mi.
3. Detroit, Gasket, Detroit, Mi.
4. NIOSH, Region V
5. OSHA, Region V

For the purpose of informing affected employees, copies of this report shall be posted by the employer in a prominent place accessible to the employees for a period of 30 calendar days.

Table I

Materials used at Detroit Gasket
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Material	Components	Health Effects
Polyvinyl chloride	vinyl chloride monomer	Eye, nose, and throat irritation from evolution of hydrogen choride gas during thermal decomposition. Vinyl chloride monomer is a carcinogen and contact should be minimized. Plasticizers can cause eye and upper respiratory tract irritation, and may be sensitizers.
Polyvin 8428-0113	proprietary plasticizers & additives	
PVC/661C-88	coloring agents	
Polyethylene	ethylene gas	Tumorgenic agent when implanted beneath skin
HM-904 hot melt glue	Proprietary. Components are not volatile at room temperature	Carbon monoxide is evolved during thermal decomposition. High levels of CO can cause headache and accelerated heart rate. Dermatitis upon prolonged or repeated contact.
AP-503D	Proprietary.	Dermatitis upon prolonged or repeated contact. May produce hazardous fumes (CO) when heated to composition.
PPG Hu-Glue (HC-4605-H)	no response from manufacturer	
Latex Glue (HC-4467-S)	" " " "	
Remay treated polyester	vinyl chloride monomer	
Geon latex	vinyl chloride, dioctylphthalate, didecylphthalate, phosphate ester plasticizers, ammonium hydroxide	Ammonium hydroxide can cause skin and eye irritation.
Prima cloth	no response from manufacturer	
Lori cloth	" " " "	
Beemis cloth	" " " "	
Backed PVC cloth	vinyl chloride monomer, phthalate, methyl ethyl ketone (trace), stabilizers and other additives pigments	MEK can cause eye, nose and throat irritation
Sandfords' rubber cement	hexane and isoprene	Dermatitis upon prolonged or repeated contact. Hexane has been shown to cause neurologic effects.

Table 2

Reported Pregnancy Outcome in Exposed* and Comparison* Groups

	Exposed group	Comparison group
Total no. pregnancies	42	114**
No. live births	36 (86%)	103 (90%)
Birth defects	2	1
Other neonatal or early childhood health problems	7	3
No. spontaneous abortions	4 (10%)	9 (8%)
No. induced abortions	1 (2%)	2 (2%)
No. stillbirths	1 (2%)	2 (2%)

* See text for definition

** Includes two sets of twins. Each set of twins was counted as one pregnancy.

Table 3

Health Problems in Employees' Children

Exposed group*

1. Died five days after birth -- four months premature
2. Twins died at six months -- three months premature
3. Bronchitis throughout first year
4. Asthma since six weeks of age
5. Numerous respiratory problems since four months of age
6. On apnea monitor for three months because of heart arrhythmia and increased periodic breathing
7. On apnea monitor for six months, reason undetermined

Comparison group*

1. Died four hours after birth -- cause unknown
2. Died one hour after birth -- two and a half months premature
3. Died eight hours after birth -- three months premature

* See text for definition

Table 4

Frequency of Reported Symptoms and Health Problems Among Employees

	Total(N=59)	Upstairs(N=19)	Downstairs(N=33)	Plantwide (N=7)
Eye irritation	32(54%)	10(53%)	20(61%)	2(29%)
Throat irritation	32(54%)	13(68%)	16(48%)	3(43%)
Headache	29(49%)	9(47%)	17(52%)	3(43%)
Nausea	8(14%)	3(16%)	5(15%)	0
Rash	7(12%)	5(26%)	1(3%)	1(14%)
Shortness of breath	2(3%)	0	2(6%)	0