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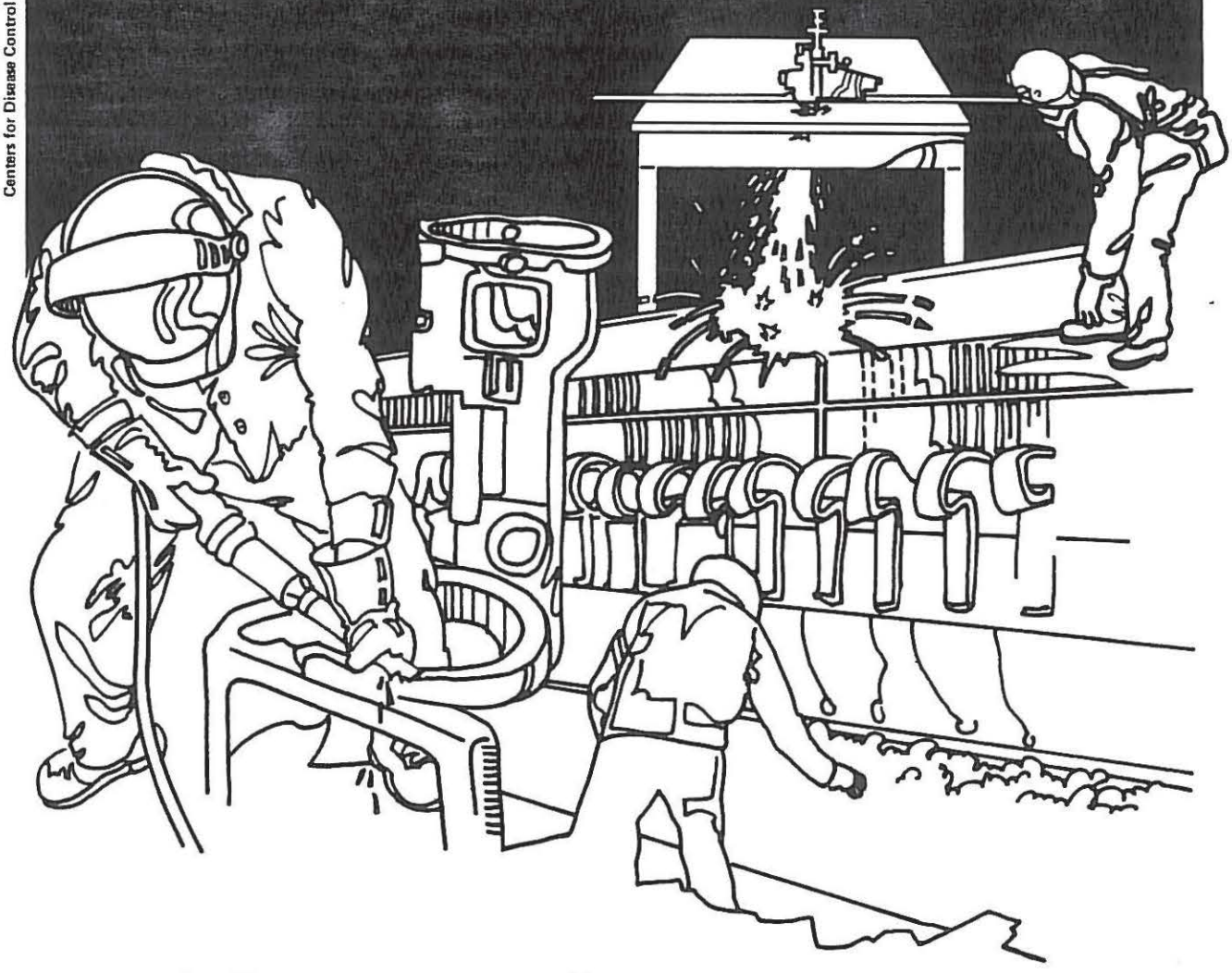

Health Hazard Evaluation Report

HHE 79-128-806
BOB GERREN FORD, INC.
MANISTEE, MICHIGAN

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.

HHE 79-128-806
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Bob Gerren Ford, Inc.
Manistee, Michigan

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I. SUMMARY

On August 6, 1979 the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate complaints of fatigue, headache, and respiratory symptoms in workers employed at Bob Gerren Ford, Inc. in Manistee, Michigan. To evaluate the cause of these symptoms, NIOSH conducted an industrial hygiene evaluation on August 15, even though the building was by then no longer in use, and a medical evaluation on August 22 and 23. Air samples were obtained to evaluate concentrations of isocyanates, formaldehyde, acrolein, and other organic compounds. Bulk samples of the urethane foam insulation on the ceiling of the truck bay were heated to 80, 100, and 120° F to determine if the foam emitted formaldehyde or toluene diisocyanate (TDI). A detailed health and occupational history questionnaire was administered to the owner and to eleven employees. In addition, medical records from private physicians were reviewed when available.

An organic compound resembling naphtha was detected in general air samples at concentrations well below the NIOSH recommended standard. TDI, methylene bisphenyl isocyanate (MDI), acrolein, and formaldehyde were not detected. Heating of the bulk samples of the urethane foam produced formaldehyde and TDI only at 120° F.

The most commonly reported symptoms were fatigue and headache; most cases began during the latter half of 1978. Cases occurred throughout the building. Previous medical evaluations by private physicians revealed no consistent abnormalities.

On the basis of the data obtained in this investigation, NIOSH could not determine the cause of the persistent, non-specific illness among workers. The air sampling results, however, may not have adequately reflected the environmental conditions when the building was in use.

Keywords: SIC 5511 [Motor vehicle dealers (New and Used)], polyurethane foam, toluene diisocyanate (TDI), methylene bisphenyl isocyanate (MDI), naphtha, formaldehyde, acrolein.

II. INTRODUCTION

On August 6, 1979, the National Institute for Occupational Safety and Health (NIOSH) received a request from Bob Gerren Ford, Inc., Manistee, Michigan, to evaluate reports of fatigue, headache and respiratory symptoms among employees. These symptoms were thought to be related to substances associated with polyurethane foam insulation. To evaluate the cause of these symptoms, NIOSH conducted an industrial hygiene evaluation on August 15, 1979, and a medical evaluation of twelve persons on August 22 and 23, 1979. The owner was notified of the environmental findings December 4, 1979, and the medical findings March 20 and July 11, 1980.

III. BACKGROUND

Bob Gerren Ford was an automobile sales and service facility. The building was 20 years old at the time of the study and had had no other use. The building includes a large showroom, several offices, a parts department, a truck bay onto which a loft (above a small machine shop) opens, and a general service area.

In October 1975 polyurethane foam insulation was sprayed on the ceiling of the truck bay and loft, an area about 40 by 50 feet. The insulation was not covered underneath, and employees reportedly were able to smell "fumes" for about two weeks. During the winter of 1978/79 the truck bay roof reportedly leaked above a heater, and from that time the insulation was said to have changed color at an accelerated rate.

Because of the numerous reports of illness during the preceding year, and because investigations by the county and state health departments (November 1978 and May 1979, respectively), Michigan Occupational Safety and Health Administration (December 1978), and a private consultant (July 1979) all failed to detect any environmental exposures that would explain the illnesses, the owner had transferred all the company's activities elsewhere.

IV. METHODS

A. Environmental

Even though the building was no longer in use, general area air samples were obtained to evaluate airborne concentrations of isocyanates, formaldehyde, acrolein, and other organic compounds.

Samples for analysis of toluene diisocyanate (TDI) and methylene bisphenyl isocynate (MDI) were obtained with impingers containing approximately 15 milliliters (ml) of modified Marcali solution and MSA Model G sampling pumps operated at air flows of approximately 1.0 liters per minute (lpm). Samples were analyzed by NIOSH methods P and CAM 141[1] and 142[2] for TDI and MDI, respectively. Samples for acrolein analysis were obtained using Sipin pumps operated at 0.2 lpm using

molecular sieve tubes. These samples were dissolved in 1 ml of water and analyzed using gas chromatography (GC) and a Tenax GC column. Charcoal tube samples, to analyze for organic compounds, were collected with Sipin monitoring pumps with airflow rates of 0.2 lpm. The charcoal tubes were analyzed by GC using a 12-foot 10% SP 2100 column. Samples for formaldehyde analysis were obtained using Sipin monitoring pumps with specially impregnated charcoal tubes operated at 200 ml per minute and were analyzed by ion chromatography (IC)[3].

A 150 mg sample of the urethane foam was heated in a micro-furnace at 80, 100, and 120° F, and air was drawn off and analyzed for formaldehyde and TDI, using the techniques described above, to determine (a) whether these compounds could be released from the foam, and (b) whether the results were consistent with the presence or absence of the compounds in the general air samples.

B. Medical

A health and occupational history questionnaire was administered to the owner and the eleven available employees. The NIOSH medical officer contacted physicians who had examined the employees during their acute illnesses to obtain information regarding laboratory tests and medical diagnoses.

V. ENVIRONMENTAL EVALUATION CRITERIA

Occupational exposure evaluation criteria for the substances sampled for during this investigation are presented in Table I.

VI. RESULTS AND DISCUSSION

A. Environmental

Naphtha (identified in the organic vapor samples), was present in general air samples at levels well below the NIOSH recommended standard (Table II). No acrolein, formaldehyde, TDI, or MDI was detected in general air samples (Tables II-IV).

No TDI or formaldehyde was detected in the emissions from the urethane foam heated to 80° or 100° F. Both were detected in the emissions from the foam heated to 120° F, formaldehyde (80 to 217 ug/g) at two hours and TDI (6.6 ug/g) at four hours.

B. Medical

Fatigue was spontaneously reported by all 12 persons interviewed and headache by seven; other symptoms were reported less frequently

(Table V). When questioned about specific irritant symptoms, a higher frequency of positive responses occurred. Again, fatigue and headache were the most common symptoms (Table VI). Half of the affected employees reported persistent fatigue despite not working in the building for over four weeks. On the other hand, no employee reported persistence of headache. With one exception, individuals employed before July 1978 had onset of symptoms between June and November 1978, with four onsets occurring in October; the exception was August 1976. The three newest employees had onsets one, three, and six months after beginning work.

Laboratory tests previously performed by private physicians on three individuals revealed no consistent abnormalities. One individual, a heavy smoker (40 pack-years), had abnormal pulmonary function tests suggestive of obstructive lung disease. One other individual had a white blood cell count of 13,000 without other abnormalities. Other diagnoses included "chronic obstructive pulmonary disease", "chronic bronchitis", and "allergy to toxic fumes - type unknown." One individual underwent extensive allergy testing and was diagnosed as having formaldehyde sensitivity.

Cases occurred in all areas of the building; "severely" ill cases occurred in all areas except the service area.

VII. CONCLUSIONS

A majority of workers were affected by a persistent illness characterized by fatigue, and headache. If there was a toxic etiology, the offending agent was most likely introduced during the spring or early summer of 1978. The continuing occurrence of illness among new employees during 1979 suggests that if a toxic agent was responsible the exposure was either intermittent or constant, with a variable latency period (up to several months). A chronic, low level exposure with a cumulative effect is possible. Considering the environmental data and the times of onset and distribution of cases throughout the building, the polyurethane foam does not seem to be a likely source.

Since the illnesses were not characteristic of any specific toxic substance, and since the environmental survey identified no toxic exposures, we could not determine the cause of the illnesses. The air sampling results must be interpreted with caution, however, since they may not have adequately reflected the environmental conditions when the building was in use.

VIII. AUTHORSHIP AND ACKNOWLEDGMENTS

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IX. REFERENCES

1. NIOSH Manual of Analytical Methods, Volume I, Second Edition, DHEW (NIOSH) Publication No. 77-157A, P & CAM 141, Cincinnati, Ohio 1977.

2. NIOSH Manual of Analytical Methods, Volume I, Second Edition, DHEW (NIOSH) Publication No. 77-157A, P & CAM 142, Cincinnati, Ohio 1977.

3. NIOSH Manual of Analytical Methods, Volume VI, Second Edition, DHEW (NIOSH) Publication No. 80-125, P & CAM 318, Cincinnati, Ohio 1980.

X. DISTRIBUTION AND AVAILABILITY

For the purpose of informing the "affected employees" the employer should post this report for at least 30 days in a prominent place(s) near where employees work.

Copies of this report will be available from NIOSH, Division of Technical Services, Information Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226 for 90 days. Thereafter, copies will be available from the National Technical Information Service (NTIS), Springfield, Virginia. Information concerning its availability through NTIS can be obtained from the NIOSH Publications Office at the above Cincinnati address.

External distribution:

Bob Gerren Ford, Inc.
U.S. Department of Labor, Region V
Michigan Department of Labor
Michigan State Department of Public Health
Manistee County Health Department

Table I

Exposure Criteria for Various Substances[1]

Bob Gerren Ford
Manistee, Michigan
HE 79-128

August 15, 1979

Substance	Source					
	NIOSH[2]		ACGIH[3]		OSHA[4]	
	TWA	Ceiling	TWA	Ceiling	TWA	Ceiling
TDI	0.035 mg/M^3	0.14 mg/M^3	0.014 mg/M^3	0.035 mg/M^3	0.14 mg/M^3	---
MDI	0.05 mg/M^3	0.20 mg/M^3	0.2 mg/M^3	---	0.2 mg/M^3	---
Formaldehyde		1.2 mg/M^3	3 mg/M^3	---	3 ppm[5]	5ppm
Acrolein	---	---	0.25 mg/M^3	0.8 mg/M^3	0.25 mg/M^3	---
Naphtha	350 mg/M^3	---	---	---	400 mg/M^3	---

1 - Expressed as milligrams of substance per cubic meter of air unless otherwise specified

2 - NIOSH: Criteria for a Recommended Standard ... Occupational Exposure to (Substance)

3 - American Conference of Governmental Industrial Hygienists: Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment with Intended Changes for 1980

4 - OSHA Standard: 29 CFR 1910.1000 (Tables Z-1, Z-2)

5 - Parts of substance per million parts of air

Table II

Results of Air Sampling for Naphtha and Acrolein

Bob Gerren Ford
Manistee, Michigan
HE 79-128

August 15, 1979

Sample Description	Time	Results (mg/M^3)* Naphtha	Acrolein
General Area (G.A.) Accounting Office	7:45-2:30	12.6	-
G.A. Middle of Loft Area for Spare Parts	7:50-2:36	23.6	-
G.A. Warranty Parts Room	7:55-2:38	44.6	-
G.A. Ceiling in Showroom Near Sink	7:59-2:44	7.6	-
G.A. Middle of Loft Area for Spare Parts	8:05-2:36	-	N.D.[1]
G.A. Ceiling in Showroom Near Sink	8:10-2:44	-	N.D.
Limit of Detection (L.O.D.)		0.05 ug/sample[2]	1.0 ug/sample

* - Approximate milligrams of substance per cubic meter air

1 - Non-detectable - below limit of detection

2 - ug/sample - Micrograms of substance per sample

Table III

Results of Air Sampling for Toluene Diisocyanate and
Methylene Bisphenyl Isocyanate

Bob Gerren Ford
Manistee, Michigan
HE 79-128

August 15, 1979

Sample Description	Time	Total TDI	Total MDI
General Area (G.A.) Accounting Office	0744-1430	N.D.[1]	N.D.
G.A. Middle of Loft Area for Spare Parts	0750-1436	N.D.	N.D.
G.A. Warranty Parts Room	0754-1438	N.D.	N.D.
G.A. Ceiling in Showroom Near Sink	0759-1444	N.D.	N.D.
Limit of Detection (L.O.D.)		0.2 ug/ml[2]	0.3 ug/ml

1 N.D. - not detectable - below the Limits of Detection

2 ug/ml - Micrograms of substance per milliliter of absorbing solution

Table IV

Results of Air Sampling for Formaldehyde

Bob Gerren Ford
Manistee, Michigan
HE 79-128

August 15, 1979

Sample Description	Time	Formaldehyde
General Area (G.A.) Accounting Office	7:45-2:30	N.D.[1]
G.A. Middle of Loft Area for Sample Parts	7:50-2:36	N.D.
G.A. Warranty Parts Room	7:55-2:38	N.D.
G.A. Ceiling in Showroom Near Sink	7:59-2:44	N.D.
Limit of Detection (L.O.D.)		10 ug/sample[2]

1 - Non-detectable - below the limit of detection

2 - ug/sample - microgram of substance per sample

TABLE V

"Spontaneously" Reported Symptoms among Employees

Bob Gerren Ford, Inc.
Manistee, Michigan

August, 1979

HHE 79-128

SYMPTOM	#	%
Constant Fatigue	12/12	100
Headache	7/12	58
Nausea	4/12	33
Diarrhea	4/12	33
Memory Loss, Irritability	3/12	25
Blurred Vision	3/12	25
Pleuritic Chest Pain	2/12	17
Raynauds Phenomena	2/12	17
Burning Feet	2/12	17
Cough	2/12	17
Dizzy, Lightheaded	2/12	17
Rash	1/12	8
Anorexia/Weight Loss	1/12	8

TABLE VI

Responses by Employees to Direct Inquiry about Specific Symptoms

Bob Gerren Ford, Inc.
Manistee, Michigan

August, 1979

HHE 79-128

SYMPTOM	While employed	(%)	Persistent symptoms despite termination of employment	(%)
Tiredness or Constant Fatigue	12/12	(100)	5/10	(50)
Headache	10/12	(83)	0/8	(0)
Dizzy, Lightheadedness	8/12	(67)	2/7	(29)
Non-Productive Cough	8/12	(67)	5/7	(71)
Chest Tightness, Soreness	7/12	(58)	2/6	(33)
Nausea	7/12	(58)	1/6	(17)
Dry or Sore Throat	7/12	(58)	1/6	(17)
Burning, Itchy Eyes	6/12	(50)	2/5	(40)
Stomach Pains	5/12	(42)	2/4	(50)
Frequent Urination	4/12	(33)	2/3	(67)
Skin Rash	4/12	(33)	1/3	(33)
Shortness of Breath	4/12	(33)	3/3	(100)
Runny Nose	4/12	(33)	1/3	(33)
Tearing of Eyes	4/12	(33)	1/3	(33)
Stuffy Nose	3/12	(25)	2/3	(67)
Chest Wheezing	3/12	(25)	2/2	(100)