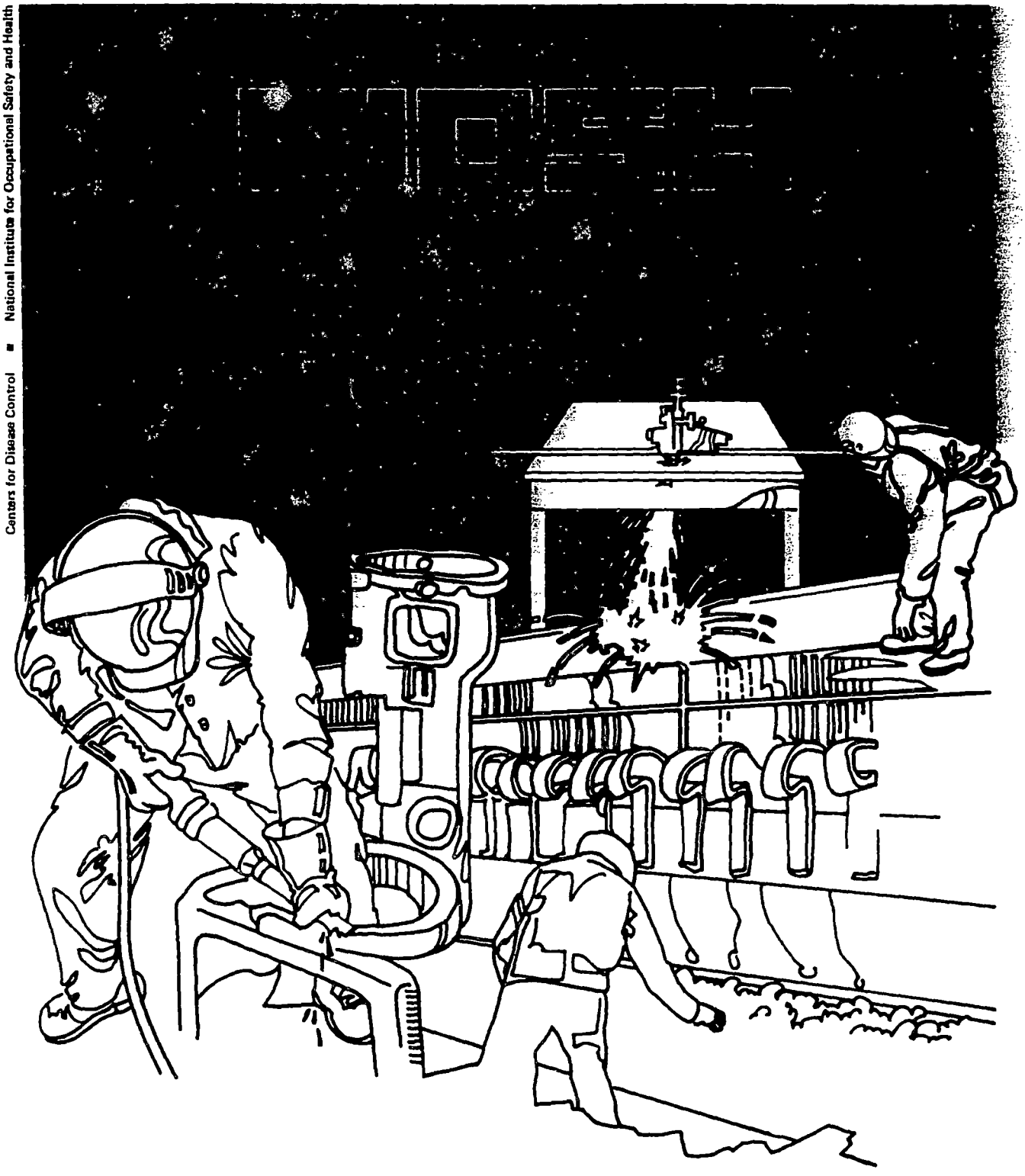
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health



Health Hazard Evaluation Report

HHE 80-106-963
UNION CARBIDE
SISTERSVILLE, WEST VIRGINIA

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.

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Union Carbide
Sistersville, West Virginia

NIOSH INVESTIGATORS:
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I. SUMMARY

On April 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request to evaluate five (possibly more) cases of subcutaneous masses ("lumps") in employees working in the Polymer II area of the Union Carbide, Sistersville Plant. There was concern that the medical conditions may have been the result of occupational exposure to chemicals.

The NIOSH investigation included employee interviews and a review of medical records, death certificates, a recent company-sponsored morbidity/mortality study of silicone workers, and company environmental exposure data (Polymer II area) for the last five years. The plant was visited on June 23-24, 1980.

Review of environmental exposure data provided by Union Carbide indicated that exposure to seven substances had been evaluated in the Polymer II area. The substances and the concentration ranges found (reported in ppm) are: allyl chloride (0.1-0.11), methyl chloride (0.1-15.0), toluene (0.3-67.0), formaldehyde (0 5-4.0), benzaldehyde (0.01-0.04), dimethylamine (0.2-32.8), and trimethylamine (0.03-0.09). Exposures were generally of short duration (5 minutes or less). Exposures to the substances measured would not be expected to exceed current health standard when short exposure times are considered; however, a more thorough evaluation of formaldehyde is warranted.

The majority of the 31 workers interviewed recalled instances when they experienced symptoms such as light-headedness and mucous membrane irritation. Review of six medical records of those reported as having "lumps" revealed that the term "lumps" covered various conditions: lymphoma cutis, thyroid cancer, mastopathia cysto-fibrotica, "clogged pore" cyst, enlargement of regional lymph node accompanying stomatitis, a presternal tissue thickening following a car accident, and, in one person, a tender inflammatory swelling of the right side of the neck. Only the first two of these conditions are cancers and none of the seven conditions appear to be related. There was no evidence of a cause-specific disease cluster in the 34 death certificates reviewed. The morbidity/mortality study of silicone workers was not useful in this evaluation because the reliability of the study results are questionable because of a suspiciously low standard mortality ratio (23.6) and the fact that "lumps" or lymphomas were not evaluated.

There is no evidence of a lymphoma-cancer cluster among the employees in the Polymer II area. Potential exposure to formaldehyde should be further evaluated by Union Carbide.

KEYWORDS: SIC 2818 (Industrial Organic Chemicals, Manufacturing), silicone oils, toluene, formaldehyde, benzaldehyde, dimethylamine, trimethylamine, methyl chloride, allyl chloride.

II. INTRODUCTION

In April 1980, a representative of the International Chemical Workers Union requested a health hazard evaluation at Union Carbide Corporation, Chemical and Plastics Division, Sistersville, West Virginia. The request indicated that five or more employees in the Polymer II Department have developed tumors and there was concern that these "lumps" may have resulted from occupational exposure to one or more chemicals.

III. BACKGROUND

Union Carbide is one of the four major producers of silicon oils. More than 150 products are made in the Polymer II area of the Sistersville Plant. These products are antifoaming agents, emulsifiers, high viscosity oils, and gums.

The base material for the operations in the Polymer II area is silicon (97% pure) obtained from the cracking of silicon oxide sand. Catalyst and other additives vary in type and/or quantity from product to product. Ingredients are gravity fed, pumped, poured from drums or hand-fed into the reaction vessels (kettles). After the contents are reacted under specific temperature and pressure for a prescribed period of time, the product is pumped or drained from the kettle and the process is repeated until the desired product volume has been produced. The equipment is usually cleaned before a new product is made. Solvents such as toluene and mineral spirits, or emulsifiers such as "NP10", are used for this purpose, depending on the chemical characteristics of the product residue.

Polymer II operations are housed in four different buildings: K-51, 8-inch mill/K-56, emulsion, and surfactant kettle house. These were the only areas visited during this survey.

There are four shifts responsible for the Polymer II operations. Each shift has eight operators.

IV. METHODS

In response to this request a NIOSH medical officer and an industrial hygienist visited the plant on June 23 and 24, 1980. Following an opening conference, where the purpose and scope of the health hazard evaluation were discussed with representatives of management and Local #698, ICWU, a walk-through of the Polymer II areas was conducted. Other activities during this field trip are described below.

A. Medical

Medical activities included:

1. Interviews with the operators and maintenance personnel who were currently assigned to the Polymer II area or who had spent a considerable amount of time in this area in the past.

2. Review of available medical information on six of the eight employees reported as having tumors or "lumps".

3. Review of a recent company-sponsored morbidity/mortality study of silicone workers by the Industrial Health Foundation Inc.

4. Review of death certificates of past employees.

B. Environmental

Due to the nature of the request, this evaluation was primarily involved with collection and review of medical information. Environmental activities in support of this evaluation included:

1. An evaluation of the Polymer II area from the standpoint of chemical usage and ventilation systems. Informal discussions with employees were accomplished to identify particular exposure situations of concern.

2. Review of the Respiratory Protection Program and Confined Space Entry Procedures.

3. Review of the environmental exposure data that Union Carbide had collected over the pass 5 years in the Polymer II area.

V. RESULTS/DISCUSSION

An interim report was sent to the management and union at the Sistersville plant and to the requester (ICWU Industrial Hygienist) in August, 1980. A review of the medical interviews and walk-through data collected during the June 23-24, 1980 field trip were presented. Much of the information contained in Interim Report #1 is also presented in this final report.

A. Medical

1. During our visit, 23 of 32 operators and eight maintenance workers, all of them serving the Polymer II Department, were interviewed by questionnaire that asked about occupational history, health history, and specific work-related health and exposure complaints. Questionnaires were also distributed to the nine operators who could not be reached during this visit. However, no replies were received.

Eight workers were pointed out to us as having "lumps". The age range for these persons is 29-41 years. Their plant seniority ranged from 4-15 years, and their department seniority from 2-10 years. We talked to six of the eight, and obtained private medical records on one of these and an additional seventh person.

The majority of the workers interviewed had one or more complaints such as exposure to fumes; minor central nervous system-related symptoms (apparently caused by toluene or biocides used in the past); mucous membrane irritation due to hydrogen chloride, sulfuric acid or trifluoroacetic acid exposure; or breathing problems caused by exposure to Cab-o-sil dust. Three of the 31 persons interviewed had been treated for kidney stones, while two others had a history of prostatitis (inflammation of the prostate gland).

The term "lump" covers various conditions: lymphoma cutis, thyroid cancer, mastopathia cysto-fibrotica, "clogged pore" cyst, enlargement of regional lymph node accompanying stomatitis, a presternal tissue thickening caused by a car accident, and, in one person, a tender inflammatory swelling of the right side of the neck (for which we advised medical evaluation). Only the first two of these conditions are cancers, and none of the seven conditions appear to be related.

2. Review of the medical records of six of the employees identified as having "lumps" enabled us to confirm medical diagnoses.

3. A morbidity/mortality survey of silicon workers at Union Carbide facilities was conducted by the Industrial Health Foundation Inc. for the Union Carbide Company. The Sistersville plant was one of the facilities included in the survey. The report was not useful in our evaluation for two reasons. First, the reliability of the mortality study results themselves are questionable, since the overall SMR is suspiciously low (23.6). This may have been due to some imcompleteness of the record system used, or to the study definition. Second, the morbidity report does not include an evaluation of "lumps" or lymphoma.

4. Review of 34 available death certificates of former Union Carbide employees of the Sistersville plant revealed no evidence of a cause specific disease cluster. However, too few deaths occurred to make a definitive statement about mortality, and in any event, only in those diseases that are lethal would death certificate review be of value.

B. Environmental

The safety and health department of the Sistersville Union Carbide Plant is a well staffed unit consisting of a director, two industrial hygienist, one industrial hygiene technician, a safety supervisor, a safety technician and two hourly workers to assist the safety supervisor. There are also two nurses (one full-time and one part-time) and an optometrist and physician who visit the plant on a weekly basis.

Each product made has an operating instruction pamphlet which includes an internal safety and health data sheet, information on safety and health precautions, and specific operating procedures.

Chemical exposures during routine Polymer II operations appear to be intermittent in nature and occur primarily during charging and cleaning of the production equipment (reactions occur in closed systems). Some products are made via a batch process while others are continually produced. Many are produced only two or three times per year for days or weeks at a time. Although there are over 150 products made in the Polymer II area, many are similar in composition, differing only in the relative quantities of ingredients; therefore, the spectrum of exposures is not as diverse as the total number of products may indicate.

1. Although no environmental sampling was done as part of this evaluation, information collected during informal discussions with employees on duty during our walk-through of the Polymer II area indicated that employees are concerned about exposure to certain chemicals. The following information is presented to alert management as to the chemical of concern and the health effect that the employees associated with that exposure.

Toluene Vapors	Predominantly associated with the cleaning of production equipment. Exposure has resulted in occasional episodes of light-headedness and nausea.
Acid Fumes/Mists	Upper respiratory irritation.
Amine Vapors	Primarily associated with the production of L-9300 and T29 and with the use of V6607 additive. Primary complaint was the sickening odor, except for the V6607 where there was additional concern over the upgrading of the internal health hazard rating to a 4, which is the most hazardous plant classification.
Cab-o-sil Dust	Upper respiratory system irritation.

2. There were no significant deficiences noted in the Respiratory Protection Program and Confined Space Entry Procedures, which are both part of the Sistersville Plant Safety Procedures Manual.

3. Environmental data collected by Union Carbide at the Sistersville Plant has been computerized. The following information was presented on a printout: contaminant name, threshold limit value, air concentration, sampling time (where applicable), sampling method, analytical reference, sampling comments, 8-hour TWA concentration (where applicable), exposure time per day and respiratory usage comments.

Data was available for the following substances: allyl chloride, methyl chloride, toluene, formaldehyde, benzaldehyde, dimethylamine, and trimethylamine. Results are summarized in Table 1. The majority of samples were short-term and obtained using either a detector tube or a badge (passive dosimeter).

Only two substances (dimethylamine and formaldehyde) were found in significant concentrations. Dimethylamine, an eye and mucous membrane irritant, concentrations ranged from 0.2 to 32.8 ppm using a silica gel sampling method. Dimethylamine exposures appear that they may be hazardous in some instances (OSHA standard is 10 ppm); but, exposure occurs infrequently (during charging cycle) and for short period of time (usually less than 5 minutes). Therefore, the 8-hour, time-weighted average exposure would not be expected to approach the 10 ppm standard.

Formaldehyde concentrations ranged from 0.5-4.0 ppm using a detector tube sampling method. Considering that the current OSHA standard for this substance includes a 5 ppm ceiling level and that NIOSH recommends that it be handled as a potential occupational carcinogen, a more thorough evaluation of employee exposure is warranted. The formaldehyde detector tube method has not been certified by NIOSH. Due to the short exposure times (less than 5 minutes)

an impinger or a direct reading method such as the CEA 555 Air Monitor would be the preferred sampling method. The newer solid sorbent methods do not have the sensitivity necessary to evaluate a 5-10 minute exposure. If exposure times are very much less than 5 minutes then the direct reading air monitor would be the only feasible sampling method.

VI. RECOMMENDATION

1. The exposure situations of concern to the operators and maintenance personnel should be discussed at the Health and Safety Subcommittee meeting and ways of alleviating these concerns determined.

2. The ventilation systems in the kettle house and the V6607 storage drum area of the gum building should be evaluated for their effectiveness. The windows and doors or both of these buildings were wide open during the survey. Any cross-drafts would adversely affect the capture efficiencies of the existing exhaust systems. Reports of isolated episodes of light-headedness and nausea, particularly when working on the upper platform during the dropping and cleaning of the filters in the kettle house, suggest that exposures to toluene vapors may have, on occasion, exceeded safe levels. Mental confusion or drowsiness caused by even short-term exposure to such levels could cause a fall and result in serious injury.

3. Considering the quantity of toluene used, all new batches received should be tested for the presence of benzene, which may be a contaminant, or the supplier of the toluene should provide such information.

4. Formaldehyde exposures should be more thoroughly evaluated using a sampling technique suitable for short (5 minute) exposures.

VII. AUTHORSHIP/ACKNOWLEDGEMENTS

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VIII. DISTRIBUTION/AVAILABILITY OF REPORT

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

This report (copies) has been sent to:

1. Union Carbide, Sistersville, West Virginia
2. ICWU Industrial Hygienist
3. President, Local 698
4. OSHA, Region III
5. NIOSH, Region III

For purposes of informing the "affected employees" the employer shall promptly post for a period of 30 calendar days, this report in a prominent place(s) near where the exposed employees work.

TABLE I
SUMMARY
Company Environmental Data
Union Carbide Sistersville Plant
Polymer II Area
1976-1980

SUBSTANCE	SAMPLING METHOD	CONCENTRATION RANGE (ppm)	OSHA STANDARD (ppm)	NIOSH RECOMMENDED STANDARD (ppm)
Allyl Chloride	Charcoal Tube	0.1-0.11	1.0	*
Methyl Chloride	Charcoal Tube	1.0-15.0	100 (1)	*
	Badge	0.1		
Toluene	Charcoal Tube	1.8-4.6	200 (2)	100 (2)
	Badge	0.3-67.3		
Formaldehyde	Detector Tube	0.5-4.0	3 (3)	note (3)
Benzaldehyde	Charcoal Tube	0.01-0.04	*	*
Dimethylamine	Silica Gel	0.16-32.8	10	*
	Detector Tube	1.0-20.0		
Trimethylamine	Silica Gel	0.03-0.09	*	*

(1) Acceptable ceiling concentration: 200 ppm; acceptable maximum peak for five minutes during any 3 hour period: 300 ppm.
(2) Acceptable ceiling: 300 ppm; acceptable maximum peak for a 10 minute period: 500 ppm. NIOSH has recommended this standard be reduced to 100 ppm TWA with a 200 ppm 10 minute ceiling.
(3) Acceptable ceiling concentration: 5 ppm; acceptable maximum peak for 30 minutes: 10 ppm. NIOSH considers formaldehyde a potential carcinogen, and therefore recommends that exposure be kept as low as possible.
*There is no standard or recommended standard for this substance.