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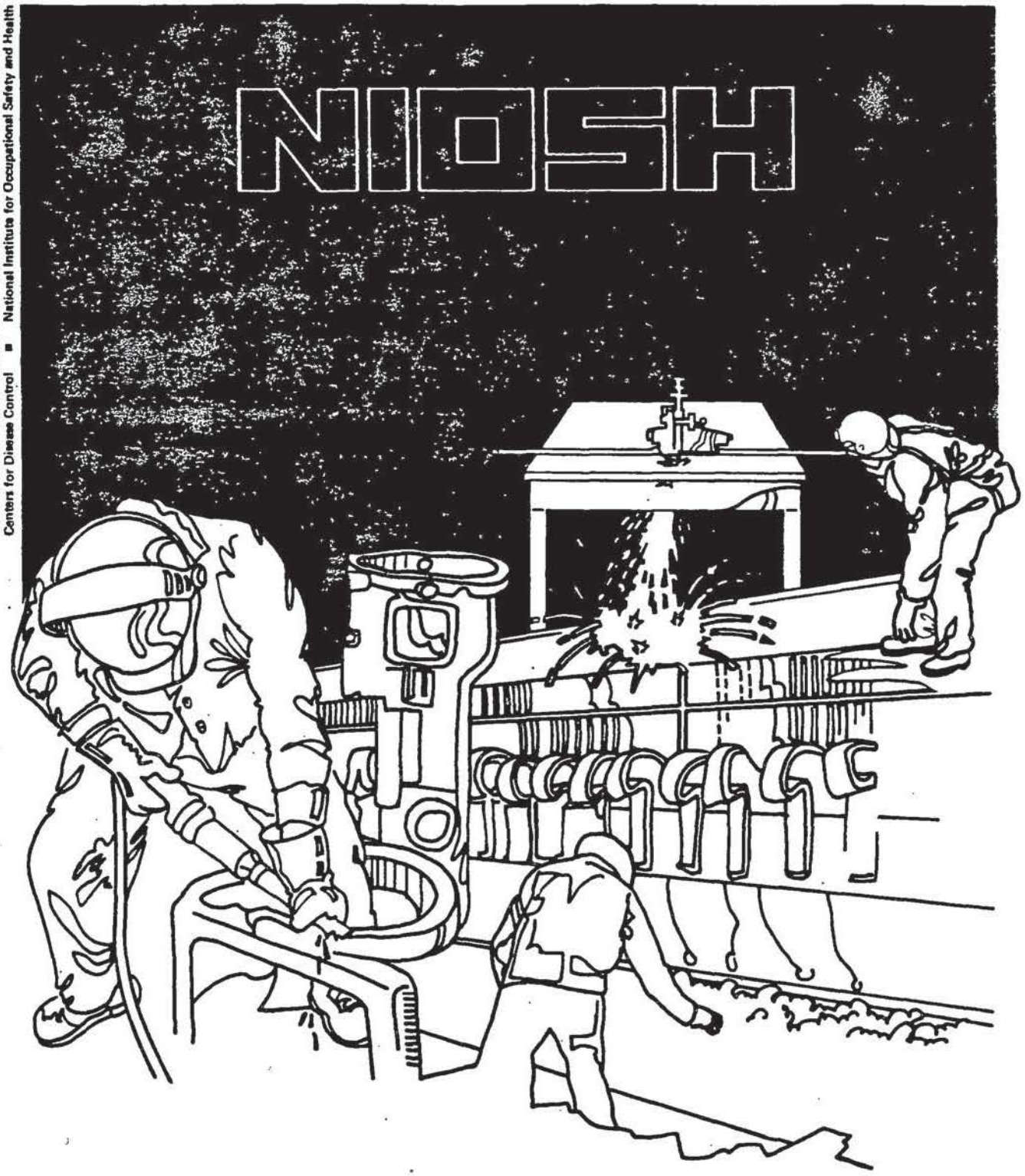

Health Hazard Evaluation Report

HETA 81-174-962
SPORT CRAFT, INC.
PERRY, FLORIDA

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.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HETA 81-174-962
OCTOBER 1981
SPORT CRAFT, INC.
PERRY, FLORIDA

NIOSH INVESTIGATORS:
PATRICIA LYNNE MOODY, M.D.
RICHARD HARTLE, MSPH

I. SUMMARY

In March 1981, the National Institute for Occupational Safety and Health responded to a request for technical assistance from the Occupational Safety and Health Administration to investigate reports of respiratory and dermatological sensitization between the years of 1976 and 1978 in at least one former employee of the sewing room at Sport Craft, Inc., a manufacturer of recreational boats in Perry, Florida. During a visit to the plant and interviews with present employees, NIOSH found that major process and personnel changes had occurred since the last OSHA visit in 1977 and determined that no current health hazard existed in the sewing room. However, interviews with former employees suggested that a variety of health problems--including symptoms of headache, nausea, feelings of intoxication, rashes, transient difficulty breathing, and facial flushing--occurred intermittently in employees of the sewing room during the 1970's. The nature of the symptoms, the known toxic effects of several volatile solvents and carriers in the vinyl fabric (including methyl ethyl ketone, toluene, dimethyl formamide, and tetrahydrofuran) used in the sewing room, and the reports of frequently encountering "green" or uncured fabric make plausible the contention that a health hazard from volatile solvents and carriers may have existed in the past.

Four of 12 former employees reported the development of chronic respiratory symptoms during their years at Sport Craft (two cases of asthma, one of chronic cough, and one of shortness of breath and chronic cough). None of these employees was a cigarette smoker. Examination of the medical records of two of these employees verified a clinical diagnosis of "industrial asthma" and chronic productive cough, respectively. Epoxies, phthalates, and chromates among the non-volatile (at room temperature) constituents of the vinyl fabric have been previously associated with reports of respiratory and/or dermatologic sensitization. Lack of appropriate environmental data, of more specific medical evidence for sensitization, or of adequate epidemiologic evidence preclude any definite conclusion about the relationship between the pulmonary diseases and occupational exposures.

The results of this study indicate that although no current health hazard exists in the sewing room of Sport Craft, Inc., volatile solvents and "carriers" contained in uncured rolls of vinyl laminated fabric may in the past have been responsible for reports of central nervous system intoxication, contact dermatitis, difficulty breathing, and flushing. No certain determination of respiratory sensitization could be made, although the manufacturer's proprietary list of the fabric constituents in 1977 included epoxies and phthalates, both of which have been associated with respiratory sensitization in other occupational settings.

Keywords: SIC 3737; boat, furnishings (vinyl covered cushions); vinyl laminated fabric; seamstresses; solvents (methyl ethyl ketone, toluene dimethyl formamide, tetrahydrofuran) epoxies, phthalates, chromates.

I. INTRODUCTION

On February 2, 1981, the National Institute for Occupational Safety and Health received a request for technical assistance from the Occupational Safety and Health Administration (OSHA) for evaluation of an apparent allergic sensitization to polyvinyl chloride-laminated fabric at Sport Craft, Inc. in Perry, Florida, a manufacturer of fibrous glass-hulled recreational boats. A former employee of the sewing room reportedly developed respiratory and dermatological hypersensitivity between the years 1976 and 1978. OSHA requested NIOSH's assistance to determine (1) whether a present health hazard exists in the sewing room at Sport Craft, and (2) whether the employee's history of sensitization might have occurred because of an occupational exposure.

II. BACKGROUND

Since 1962, the Sport Craft company has manufactured recreational boats at their facility in Perry, Florida. Fibrous glass hulls are constructed and finished, interiors are assembled, and furnishings are either made at the plant or purchased pre-manufactured and then installed. Until 1977, the sewing department employed approximately 9 employees who cut, sewed, and upholstered seats and other portions of the interior requiring vinyl-covered cushions and upholstery. The plant declared bankruptcy and underwent reorganization in 1977. Shortly thereafter, the company cut the staff of the sewing room to approximately 3 employees and began buying cushions that had already been covered in vinyl fabric and required installation only.

In April 1977, OSHA responded to a confidential request to inspect the plant. During the course of that investigation, reports of illness among sewing room employees attributed to work with "green" or "uncured" rolls of the laminated vinyl fabric prompted the OSHA investigator to focus his investigation on the sewing room. He recorded reports of rashes and respiratory distress in 1976, and three incidents related to apparent intoxication or mucous membrane irritation due to "vapors" from the vinyl fabric in 1977. All reports apparently involved employees of the sewing room or (in one case) of the adjacent work area.

On the basis of confidential product information obtained from the manufacturer of the vinyl-based fabric, OSHA sampled for methyl ethyl ketone, toluene, benzene, tetrahydrofuran, xylene, and dimethyl formamide. Detector tube sampling in a closed roll of fabric gave levels of 500 ppm (parts per million) of MEK; 2 inches away, the level of MEK dropped to 100 ppm, and it ranged from 5 to 20 ppm in the breathing zone of a worker. Personal and area air monitoring for all of the above substances yielded non-detectable levels of every compound, a laboratory result which lead the OSHA inspector to comment in his report that these results could not be regarded as "representative", since "some exposure should have been indicated", suggesting a laboratory error.

III. EVALUATION: METHODS AND RESULTS

A. Initial Survey

NIOSH representatives visited the Sport Craft plant on March 17, 1981. After a brief opening conference with the plant manager, we conducted a walk-through investigation of the areas in which the vinyl laminate is currently used or stored: the sewing room and cutting area, the interiors section, and the warehouse. We detected no odor of solvents in the vicinity of the stored rolls, in interiors (where the pre-covered cushions are unpacked and installed), or in the cutting area or sewing room. Only two seamstresses currently work in the sewing room, rolls of uncut vinyl are no longer stored there, and both storing and cutting of new rolls take place out in the large room which surrounds the sewing room.

The NIOSH industrial hygienist took bulk air samples in the sewing room. Because of uncertainty about the type of contaminant which might exist at the present time, three samples were collected on charcoal and silica gel at a flow rate of 100 cubic centimeters (cc) per minute for approximately four hours. The charcoal tube samples were subsequently desorbed with carbon disulfide and the silica gel tube sample was desorbed with methanol. Gas chromatograph-mass spectrometer analysis showed only two peaks, identified as 1,1,1-trichloroethane and toluene in concentrations ranging from 1.1-1.5 mg/M^3 (milligrams per cubic meter of air) and 1.8-9.8 mg/M^3, respectively. 1,1,1-trichloroethane was not among the constituents listed by the fabric manufacturer in 1977. The current NIOSH recommended permissible exposure limit for toluene is 100 ppm (parts per million) or 375 mg/M^3, although the OSHA standard is 750 mg/M^3. The current NIOSH recommendation for 1,1,1-trichloroethane is a ceiling of 350 ppm (1900mg/M^3), not to be exceeded for more than a 15-minute period; OSHA recommends a permissible exposure limit of 350 ppm averaged over an 8-hour workday. However, since the levels measured in the sewing room are very small fractions of the standard, they should not represent a health hazard, assuming that these concentrations are representative of current environmental conditions in the sewing room.

Of the approximately 65 current production workers at the plant, we interviewed 16, including 9 potentially "exposed" persons from the sewing room, interiors area, and the warehouse, and 7 unexposed persons selected from clerical and "finishing" area staff. We asked employees if they had developed any of the following symptoms at work within the preceding month: difficulty breathing, wheezing, hives, skin rash they thought was related to work, vomiting, headache, or burning throat, skin, eyes, or nose.

The overall "exposed" group had been employed longer (5.4 vs 2.8 years), contained a higher proportion of males (67% vs. 43%), and reported no recent health symptoms, compared with 4 of 7 persons in the unexposed group who reported at least one symptom at work within the preceding month. Employees currently working with the vinyl fabric on a daily basis denied that it caused any problems for them at the present time, although several persons recalled problems in the sewing room a few years earlier.

B. Retrospective Survey

In addition to interviews with current employees, NIOSH was able to contact 12 of 21 former employees whose names had been supplied by several sources: the employee who initiated the hazard evaluation, the OSHA report, and each contacted employee in turn. The company had been unable to supply us with employment records of former employees. Although we asked for the names of all employees our sources could recall, we recognize that they might have been more likely to recall persons with medical problems, and that we may therefore have contacted an epidemiologically biased sample. Nonetheless, since our interest was not in defining precise rates of illness among former employees but in attempting to determine whether a health hazard may have existed in the past, we feel that the presentation of this information is legitimate.

During the telephone interviews, we asked former employees for demographic information, job information, whether they had ever had to leave work or their work station because of a medical problem (with further information on what the problem was, when it occurred, its duration, and whether they had seen a doctor), whether they smoked, and any comments they might have. In addition, we asked whether they had developed any "medical problems" at Sport Craft, and the frequency with which they had experienced any of the following while at work: difficulty breathing, wheezing, hives, skin rashes, vomiting, headaches, burning skin, eyes, nose, or throat,.

All twelve of the contacted employees were women, with a mean age of 49 and a range from 29 to 69. They had been employed at Sport Craft in the interval between the years 1962 and 1981, and their mean duration of employment was 7.4 years, with a range of 2 to 17.5 years. In this group, there were 8 seamstresses, 3 upholsterers, and one cutter. Eleven of twelve indicated that they had had to leave their work station at least once because of a medical problem, 9 employees (75%) attributed this to a workplace exposure, and seven of these employees (58%) reported having gone to the emergency room from work at least once. The described conditions for which they left the workplace and/or went to the emergency room included: symptoms of intoxication (giddiness, dizziness, weakness, incoordination, crying), headache, nausea, difficulty breathing, skin rashes, and numbness of hands and lips (possible hyperventilation syndrome). Symptoms experienced occasionally or frequently at work by this group included headache (75%), irritated nose and throat and burning eyes (each 67%), difficulty breathing (58%), burning skin (50%), vomiting and skin rashes (each 33%), and wheezing (25%). None reported hives. Three persons also reported developing "blisters" on the conjunctivae, and on the mucous membranes of nose and throat, and three workers described flushing of the face when working with the material. Three persons described the odor of the cloth as that of "formaldehyde", one as "bitter", one as being "like kerosene", and one as "smelling like glue". Several employees referred to "hot" spots in the fabric which had a tacky consistency and which, in addition to the odor, characterized what they meant by "green" or "uncured" material.

Four of the twelve former employees (25%)--all of them non-smokers--reported that they developed persistent respiratory symptoms (chronic bronchitis, shortness of breath and cough, and two cases of asthma with onset during work at Sport Craft). Of the four persons who reported the development of chronic respiratory disease during their employment at Sport Craft, two employees agreed to release their medical records to NIOSH. The medical records of both persons confirm that the individuals developed their pulmonary problems during the time they worked at Sport Craft, and in one case a diagnosis of "industrial asthma/industrial bronchitis" was made. A third individual has not sought medical attention for her cough and shortness of breath, and the fourth person--who reported developing asthma--declined to release her medical records.

NIOSH also reviewed the report of the OSHA investigation of 1977. In addition to the substances contained in the fabric which have already been mentioned and for which OSHA sampled, the fabric contained a variety of compounds, including epoxies, phthalates, fungicides, and dyes containing chromates.

IV. DISCUSSION AND COMMENT

None of the substances for which OSHA sampled during the 1977 visit--MEK, xylene, toluene, benzene, tetrahydrofuran, or dimethyl formamide--has been associated with true allergic (sensitizing) phenomena. Overexposure to the aromatic solvents is associated with central nervous system effects (symptoms of intoxication, nausea, and headache), dermatitis secondary to defatting and drying, mucous membrane irritation, and blood dyscrasias. Tetrahydrofuran is a known skin and mucous membrane irritant, and dimethyl formamide has been associated with hepatic (liver) injury. An Antabuse (disulfiram)-like effect of dimethyl formamide exposure has also been described, with flushing, tachycardia, and headache, especially after ingestion of alcohol. Dimethyl formamide was used in the manufacture of the fabric until February 1977.

In "uncured" or "green" fabric, in which OSHA measured 500 ppm of MEK, it is plausible that other solvent "carriers" such as tetrahydrofuran and dimethyl formamide might have been liberated in concentrations sufficient to evoke skin irritation (contact dermatitis), flushing, and mucous membrane irritation, and that the formaldehyde-like or "bitter fishy" smell may be presumed to have been due to the dimethyl formamide. All of the symptoms described by the former employees may be plausibly reconciled with described effects of volatile elements of the fabric, with the exception of the chronic respiratory symptoms, especially asthma.

No volatile (solvent) constituent of the fabric and no other substances independent of the fabric in the sewing area are known to be associated with an asthma-like syndrome. Epoxies are an identified constituent of the vinyl fabric, and uncured epoxy resins and their curing agents (amines and phthalic anhydrides) have been associated with both skin and respiratory sensitization--in the latter case, creating an asthma-like picture. Phthalate plasticizers are also a constituent of the fabric, and they have also been associated with the development of asthma.

However, we have no current method of determining whether partially cured epoxies or reactive phthalates were present in the "green" rolls of fabric described by former employees, and current employees deny that "hot" spots or "green" rolls are still a problem. Chromate dyes are well-known skin sensitizers, but they are not known to be associated with respiratory problems.

Thus, while no current health hazard exists in the sewing room at Sport Craft, it appears that past exposures to volatile solvents and carriers in incompletely "cured" or dried vinyl fabric may have resulted in episodes of central nervous system intoxication, contact dermatitis, mucous membrane irritation, difficulty breathing, and facial flushing. In addition, several non-smoking employees reportedly developed chronic respiratory problems which may have been related to workplace exposures, although the evidence for this is indirect and tenuous.

V. RECOMMENDATIONS

1. The current practices of the sewing and cutting areas, which include the storage, airing, and cutting of vinyl fabric in the large room outside the sewing room, and the use of pre-covered cushions in the boats should be continued, since this appears to have resulted in the eradication of work-related symptoms among sewing room employees.

2. If sewing room employees detect "uncured" areas in any fabric rolls in the future, those rolls should be carefully and fully aired and dried in a well-ventilated space before employees undertake further sewing or cutting.

3. Employees and management should seriously consider the formation of an employee-management health and safety committee.

4. We encourage the management of Sport Craft to provide employees of the sewing room and of other areas in the plant with information about the potential hazards of the materials with which they work. Such a practice promotes the safe handling of materials and decreases the likelihood that workers will inadvertently be harmed by toxic substances.

VI. AUTHORSHIP AND ACKNOWLEDGEMENTS

Investigation performed
and report prepared by:

Patricia Lynne Moody, M.D.
Medical Officer, HETAB

Richard Hartle, MSH.
Industrial Hygienist, HETAB

Originating office	Hazard Evaluations and Technical Assistance Branch Division of Surveillance, Hazard Evaluations and Field Studies
Report typed by	Patricia Lynne Moody, M.D. and Terry R. O'Neal, Clerk Typist

VII. REFERENCES

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VIII. DISTRIBUTION AND AVAILABILITY

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 through the National Technical Information Service (NTIS), Springfield, Virginia 22216.

Copies of this report have been sent to:

1. Congressman, U.S. House of Representatives
2. Sport Craft, Inc.
3. Two former employees
4. OSHA, Region IV
5. NIOSH, Region IV

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