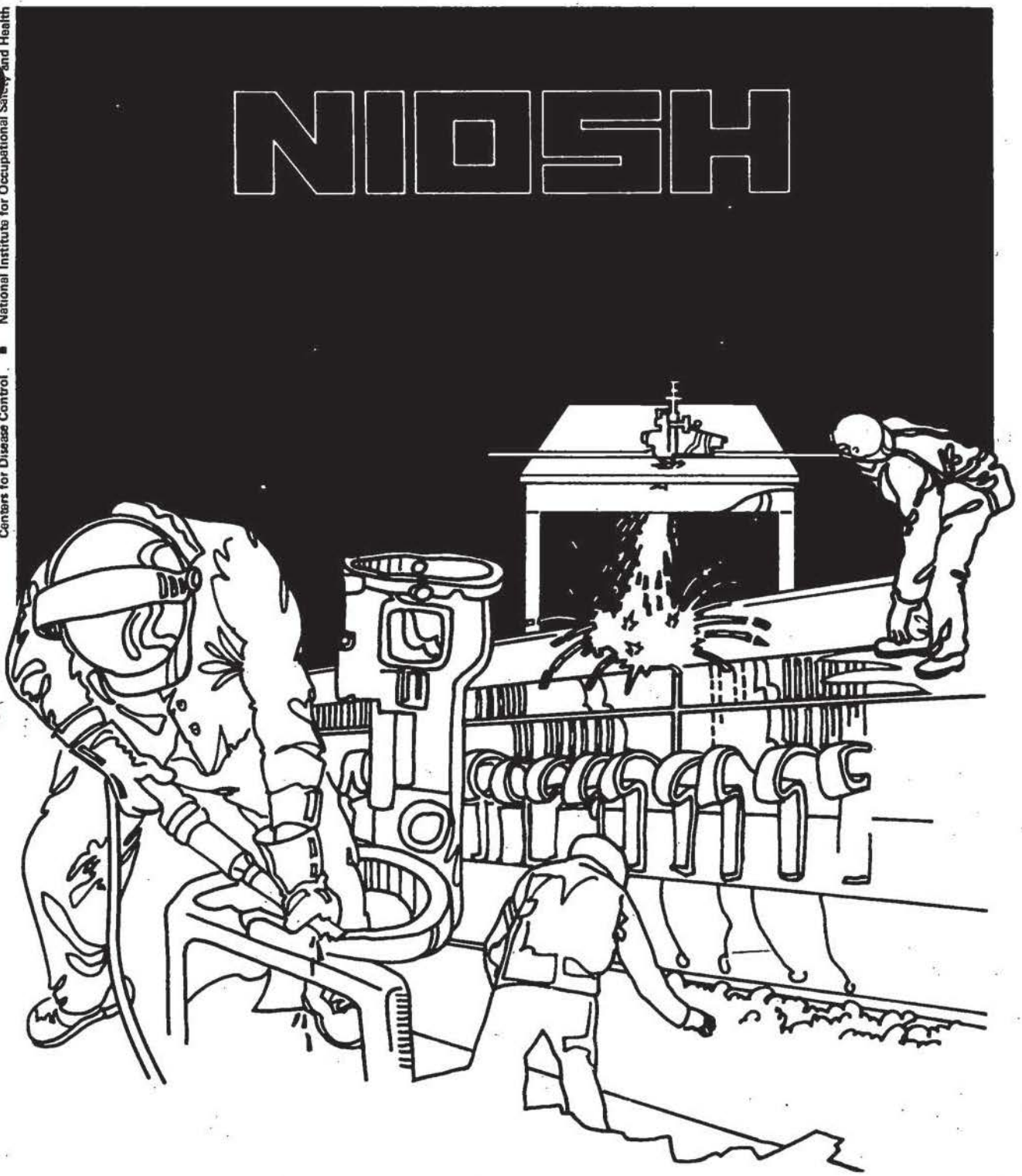
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 81-400-1242
SMEAD MANUFACTURING COMPANY
LOCUST GROVE, GEORGIA

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 81-400-1242
DECEMBER 1982
SMEAD MANUFACTURING COMPANY
LOCUST GROVE, GEORGIA

NIOSH INVESTIGATORS:
Paul Roper, C.I.H.
Stan Salisbury, C.I.H.

I. SUMMARY

On July 27, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request to conduct a Health Hazard Evaluation at the Smead Manufacturing Company, Locust Grove, Georgia. Several workers involved in the assembly of paper file folders on the "five piece line" and "bracket line" were experencing headache, throat irritation, and other symptoms which they attributed to exposure to certain animal collagen-based glues. The glues evaluated were water soluble semi-solid gelatins which are melted at 150° F and applied to the folders by machine. Workers reporting symptoms were completing the final folder assembly by hand.

On July 30, 1981, NIOSH investigators conducted an initial screening survey. Employees were interviewed and bulk samples of the glues were obtained. Air samples of heated glue vapors released from glue vats on each assembly line were also collected. The compositions of the glues were obtained from the manufacturer. The glue vapors were found to be a complex mixture of aliphatic and aromatic hydrocarbons. Specifically identified by gas chromatography/mass spectrometry analyses were: methyl salicylate (oil of wintergreen), o-phenylphenol, and several terpene or terpene derivative compounds, the most significant being camphene (a component of citronella oil).

On January 19, 1982, NIOSH investigators collected personal and general area air samples to determine actual employee exposures to these compounds in the glue vapors. The only substance consistently identified in the air samples was methyl salicylate, concentrations of which ranged from only 0.4 to 2.0 mg/M^3. The highest personal exposure to o-phenylphenol was 1.2 mg/M^3 measured on the bracket line. Camphene was not detected on any of the personal or general area samples. At the present time there are no established inhalation exposure criteria for methyl salicylate and o-phenylphenol. Sulfur dioxide was suspected as a possible decomposition product of the heated glue, but laboratory tests did not detect SO_2 in the vapor.

Although some of the workers had experienced symptoms of throat irritation and lightheadedness, and many had complained about the strong odor of the glues, based on the results of this survey, no adverse health effects would be expected from such low level exposures to the vapors released. Unfortunately, very little toxicity information is currently available concerning the effects of exposure, through inhalation, to the compounds identified in the glue vapors. Recommendations which should help to reduce employee complaints about glue odors are included in the body of the full report.

KEYWORDS: SIC 2645 (Mfg. filing folders), adhesive, headache, throat irritation, camphene (CAS # 79-92-5), methyl salicylate (CAS # 119-36-8), o-phenylphenol (CAS # 90-43-7), sulfur dioxide (CAS # 7446-09-5)

II. INTRODUCTION

On July 16, 1981, several employees of the Smead Manufacturing Company, Locust Grove, Georgia submitted a confidential request to the National Institute for Occupational Safety and Health (NIOSH) for a health hazard evaluation of their exposures to adhesives used in the assembly of paper file folders at this facility. Several employees working on the "bracket line" and "five piece line" had complained of headache, throat irritation, hoarseness, and various other symptoms which they suspected were caused by breathing vapors released when the glues were heated and applied to the file folders during assembly.

An initial industrial hygiene survey was conducted on July 30, 1981. During the survey NIOSH investigators met with the Plant Manager and with a representative of the employees, the President of the Upholsterers' International Union of North America, AFL-CIO, Local No. 672. After discussing the request and purpose of the investigation, a walk-through survey of the manufacturing operation was conducted in order to obtain information concerning work practices and schedules, production processes, and materials used during file folder assembly. Confidential interviews were conducted with 21 employees concerning possible symptoms or health problems believed to be work related. NIOSH investigators also inspected and discussed the operation of the plant's heating, ventilation and air-conditioning (HVAC) system with the Plant Maintenance Supervisor. During this survey, NIOSH collected bulk air samples of the vapors released from the heated glues for subsequent laboratory analysis to identify volatile and potentially toxic or irritating compounds present in the air. An interim report, summarizing the results of this initial investigation, was submitted to company and union representatives on September 2, 1981.

Based on the results of the analyses of the bulk air samples collected during the initial NIOSH investigation, a follow-up survey was conducted on January 19, 1982. The purpose of this follow-up visit was to determine if employees working on or near the bracket and five piece assembly lines were being exposed to vapors of camphene, methyl salicylate, and o-phenylphenol and at what concentrations these vapors were present in the employees' breathing zone. These substances appeared to be the major constituents of the glue vapor emitted into the air when the glue was heated or melted.

III. BACKGROUND

The Smead Manufacturing Company, at Locust Grove, Georgia, is a major manufacturer of paper file folders. The plant was opened November 1, 1978, and employs 130 production, 10 administrative, and 2 maintenance personnel. Animal collagen-based glues are used as adhesives for the types of folders assembled on the bracket line and five piece line. Both glues, Flexible Glue™ 50-184 and

50-226 are purchased from Swift Adhesives, Division of ESCHEM, Inc. At both the bracket line and five piece line the glue, which is normally a semi-solid gelatin, is heated to a liquid at approximately 150° F. At the bracket line, the melted glue is applied onto a tape which is then used by the workers in the assembly of folders, such as those used as report covers or computer printout binders. Approximately 6 to 7 employees work on or near the bracket line during each 8-hour shift. At the five piece line, approximately 10 to 12 employees per shift assemble and glue five piece expandable pocket folders. The plant operates two shifts per day from 7 a.m. to 3 p.m. and from 3 p.m. to 11 p.m.

IV. EVALUATION DESIGN AND METHODS

A. Initial Survey (July 30, 1981)

Before visiting the plant, NIOSH learned that employees reported the odor of the glues used on the five piece line and bracket line had been much stronger and irritating for the last several months. The Plant Manager confirmed the perfumes in the glues had been changed early in 1981. Because the animal based glues have a naturally foul odor, perfumes are added to give the glue a more pleasant smell. One of the perfumes previously used for this purpose was no longer available, and the supplier was currently using oil of wintergreen. The plant manager stated that other Smead plants had been using glues containing wintergreen for several years and that he was not aware of any employee complaints at these plants.

On July 30, 1981, NIOSH industrial hygienists visited the plant in order to conduct confidential interviews with employees and to observe the production processes where these glues were used. Bulk air samples of the vapors released from the melted glues and bulk samples of the glues as received from the supplier were also collected for subsequent laboratory analyses.

The 21 employees selected for interviews were first asked to complete a one page questionnaire asking employees if they had experienced any symptoms of health related problems since working at their present jobs. Those who had, were asked to check from a list, the symptoms they had experienced constantly, frequently, seldom, or never. Each employee was then interviewed privately by a NIOSH investigator to learn of any additional symptoms or health problems and whether any of these symptoms were related to any particular task, production process, or material (Appendix A). The 21 employees interviewed were selected as indicated below:

	Bracket Line	Five Piece Line	Totals
1st shift (7am-3pm)	4	6	10
2nd shift (3pm-11pm)	6	5	11
Totals	10	11	21

Bulk samples of glue 50-184 and 50-226 were taken at the Smead plant from their shipping containers and submitted to the NIOSH laboratory for analysis. In the laboratory, portions of the two glue samples were put into separate sealed vials and heated to normal process temperature in a hot wax bath between 70-80° C (158-176° F) for at least an hour. A 30-50 microliter head space sample was taken from each vial using a gas tight syringe and analyzed directly for volatiles by gas chromatography/mass spectrometry (GC/MS). The bulk samples were also analyzed by the NIOSH laboratory for sulfur dioxide (SO_2), a possible decomposition product of the glues. Weighed portions of each bulk sample were placed in an impinger and heated in a water bath to 57-68° C (135-154° F). Air was pulled through each impinger at 1 liter per minute (Lpm) for 35 minutes, then passed through a treated Whatman filter to collect any SO_2 evolved. The samples were analyzed by ion chromatography for SO_2 using NIOSH Method P & CAM 268.[1]

At the plant, bulk air samples of glue vapors were collected on activated charcoal tubes connected to small battery powered pumps which pulled an air stream through the tube at approximately 1 Lpm. In this way, any vapors could be adsorbed and concentrated on the tubes and later analyzed in the NIOSH laboratory to identify the compounds contained in the melted glue vapors. Glue vapors were sampled on the bracket line and five piece line by placing a charcoal tube as close as possible to the melted glue directly in the path of any vapors released. Analysis of the charcoal tubes was performed in the NIOSH laboratory by desorbing the collected vapors with carbon disulfide and analyzing the compounds desorbed from the tubes by GC/MS.

To aid in the analysis of these samples, the basic composition of the glues was provided to NIOSH by the manufacturer.

Glue 50-184 (used on bracket line)

Primary Base Component - animal glue
Composition - Animal collagen (protein) derived from hides, bones, tendons, and ligaments (synonyms: collagen, gelatin, bone glue)

Additives:	
triethylene glycol	<20.0%
o-phenylphenol	0.5%
sodium bisulfite	0.4%
Perfumes:	
oil of citronella	<0.1%
oil of wintergreen (methyl salicylate)	<0.1%
Other Additives:	
corn dextrine	
sugars (i.e., glucose & sucrose)	

Glue 50-226 (used on five piece line)

Primary Base Component - animal glue
Composition - Animal collagen (protein) derived from hides, bones, tendons, and ligaments (synonyms: collagen, gelatin, bone glue)

Additives:	
o-phenylphenol	0.5%
sodium bisulfite	0.3%
sodium hydrosulfite	<0.1%
diethanolamine	
citric acid	
Perfumes:	
oil of citronella	<0.1%
oil of wintergreen (methyl salicylate)	<0.1%
Other Additives:	
corn dextrine	
sugars (i.e., glucose & sucrose)	

B. Follow-up Environmental Survey (January 19, 1982)

On January 19, 1982, NIOSH industrial hygienists returned to the plant to measure actual employee exposures to vapors of citronella oil (terpenes), methyl salicylate (wintergreen) and o-phenylphenol. These chemicals were the major compounds identified in the glue vapor samples and headspace analyses of bulk glue samples collected during the initial NIOSH survey. Since citronella oil contains many terpene compounds and accurate quantitation of all compounds was not possible, camphene, the major terpene found in the samples, was selected for quantitation.

Personal exposures to camphene, methyl salicylate, and o-phenylphenol were determined by collecting air samples on activated charcoal tubes which were attached to the worker's shirt collar. A measured air volume was pulled through the tubes using battery powered air sampling pumps set at a calibrated flow rate of 150 cubic centimeters (cc) of air per minute. Smead personnel sampled (first shift only) included three workers from the bracket line, one "bone and press" operator, and five workers on the five piece line. The samples were analyzed quantitatively in the NIOSH laboratory for camphene, methyl salicylate, and o-phenylphenol by desorbing the collected vapors from the charcoal with 1.0 milliliter of carbon disulfide, containing 2% ethanol, and analyzing the desorbing solvent by gas chromatography using flame ionization detection.

Bulk air samples of the glue vapors on the bracket line and five piece line were also collected using the same sample locations and sampling methods as used during the initial survey. The samples were analyzed by NIOSH using GC/MS to identify volatiles released.

V. EVALUATION CRITERIA

A. Environmental Criteria

The primary sources of environmental evaluation criteria normally used for NIOSH health hazard evaluations include: 1) NIOSH criteria documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's),[2] and 3) the U.S. Department of Labor (OSHA) federal occupational health standards.[3] These criteria are intended to represent the maximum airborne concentrations of substances to which most workers may be exposed for eight hours a day, 40 hours per week (or other durations where indicated) without adverse health effects. Because of wide variation in individual susceptibility, a small percentage of workers may experience discomfort from some substances at concentrations at or below the recommended criteria.[2] A smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by a hypersensitivity reaction.

For those compounds with established occupational exposure limits, the various criteria proposed by OSHA, ACGIH, and NIOSH for airborne concentrations of the chemical substances known to be contained in the glues used on the bracket and five piece lines are listed in Table 1 of this report. Table 1 also lists the major health effects or sites of action of those chemicals. At the present time there are no established criteria for triethylene glycol, camphene, methyl salicylate, and o-phenylphenol.

B. Toxic Properties

A review of the literature on the toxicity of the known chemical components of the glues used on the bracket and five piece lines revealed the following information:

1. Animal Glue

This is the primary base component of both the 50-184 glue, used on the bracket line, and the 50-226 glue, used on the five piece line. It is composed of animal collagen (protein) derived from hides, bones, tendons, and ligaments (synonyms: collagen, gelatin, bone glue). These glues may have a slightly allergenic property and for susceptable persons, direct skin contact should be avoided.[4]

2. Additives

SODIUM BISULFITE--is used as a bleach and preservative. Sodium bisulfite ($NaHSO_3$) can decompose when heated to release sulfur dioxide (SO_2). It has a relatively low oral toxicity, but is irritating to the eyes, skin, and mucous membranes. Occupational exposure to sodium bisulfite dust has produced mild eye and

respiratory responses. SO_2 is considered to be the active ingredient in sodium bisulfite. The ACGIH has adopted a TLV of 5 mg/M3.2,5

SULFUR DIOXIDE--is a colorless gas with a strong pungent odor. It is a severe irritant of the eyes and upper respiratory tract. Chronic exposure can cause rhinitis (runny nose), dryness of the throat, fatigue, inflammation of sinus passages, cough, and shortness of breath.[6] Sulfur dioxide rapidly forms sulfurous acid on contact with mucous membranes. This accounts for its severe irritant effects. It is estimated that 10 to 20% of the young healthy adult population are hypersensitive to the effects of SO_2 exposure. Recent studies have shown some chronic effects, such as chronic bronchitis and reduced pulmonary function at chronic exposures below the current federal (OSHA) standard of 5 ppm. NIOSH has recommended lowering the current standard to 0.5 ppm.[7] Persons with a history of asthma have reported that their condition is worsened just from drinking soft drinks containing only trace amounts of SO_2.[8]

TRIETHYLENE GLYCOL--is used as a plasticizer in glue 50-184. Occupational handling and use of triethylene glycol has presented no significant problems from ingestion, skin contact, or vapor inhalation. Triethylene glycol is very low both in acute and chronic oral toxicity and has not caused irritation to the eyes or skin. No significant adverse effects were observed for persons exposed by inhalation of vapors. No occupational exposure standard has been established due to its low toxicity.[9]

DIETHANOLAMINE--combined with citric acid is used as a plastizer in glue 50-226. Diethanolamine is characterized as having a low oral toxicity. Direct contact with diethanolamine may impair vision and denature skin, but it produces only mild skin and eye irritation.[5,6]

O-PHENYLPHENOL--is used as a preservative in both 50-184 and 50-226 glues. Animal studies indicate o-phenylphenol has a relatively low acute oral toxicity. 0.1% aqueous solutions of the sodium salt of o-phenylphenol caused neither primary skin irritation or skin sensitization.[10] To date there are no reports of serious occupational health hazards resulting from handling of o-phenylphenol. However, moderate irritation can occur to the eyes as a result of direct contact.[11]. Adverse health effects from inhalation of o-phenylphenol vapor have not been reported in the literature.

CITRIC ACID--is an intermediate in normal metabolism. It occurs in many foods and is considered to be largely innocuous. Man's daily consumption of citric acid from natural sources may exceed 500 mg/kg of body weight.[9]

3. Perfumes

OIL OF CITRONELLA--is a natural substance derived from the steam distillation of various grasses and has a pungent citrus like odor. Its main constituents are geraniol, citronellol, camphene, and dipentene. Oil of citronella has a low oral toxicity but may cause skin and eye irritation from direct contact.[12] Camphene, the only component of citronella oil detected in the bulk air samples collected at Smead, is similar chemically to pinene, the principle component of turpentine. Pinene is easily absorbed through the pulmonary system, the skin, and the intestine. Inhalation of pinene may increase heart rate, cause dizziness, nervous disturbances, chest pain, bronchitis, and nephritis (inflammation of the kidney).[13]

METHYL SALICYLATE (oil of wintergreen)--The only known toxic effects for methyl salicylate are by ingestion. Chronic salicylate intoxication is termed "Salicylism". The syndrome consists chiefly in headache, dizziness, ringing in the ears, diffuculty in hearing, dimness of vision, mental confusion, fatigue, drowsiness, sweating, thirst, hyperventilation, nausea, vomiting, and occassional diarrhea.[14] There are no reports in the literature concerning the effects of methyl salicylate exposure by inhalation. Methyl salicylate has been classified as a moderate to severe skin and eye irritant.[12]

4. Other components

Other components of the glues considered non-toxic include corn dextrine and sugars, such as glucose and sucrose.

VI. RESULTS AND DISCUSSION

A. Initial Survey (July 30, 1981)

1. Environmental Findings

Analyses of the air samples collected during the initial survey on July 30, 1981, revealed the glue vapors are a complex mixture of aliphatic and aromatic hydrocarbons. Specifically identified in the 50-226 glue used on the five piece line were: methyl salicylate, o-phenylphenol, and several terpene or terpene derivative compounds. Vapors from the 50-184 glue, sampled on the bracket line, were mostly a complex mixture of various alkanes and aromatic hydrocarbons similar to that found in the vapor of a mineral spirits type solvent. The major single constituent of this vapor was a terpene compound. Methyl salicylate was a minor component in the mixture and o-phenylphenol was not detected.

The only compounds identified by the NIOSH laboratory in the head space analysis of the vapors released from the heated (158-176° F) bulk glue samples were small amounts of o-phenylphenol and methyl salicylate. Portions of each glue sample were also heated

(135-154° F) and analyzed for SO_2. No SO_2 was detected in the vapors from the 50-184 glue and less than 0.9 ppm SO_2 was detected in the 50-226 glue vapor. The amount detected in the 50-226 glue was barely above the detection limit for the analytical method used.[1] Using this method, NIOSH has frequently detected trace amounts of SO_2, even in blank samples. Therefore, the presence of SO_2 in the sample was not confirmed.

2. Employee Interviews

Eight of the 21 workers interviewed reported they had experienced symptoms of health related problems for one year or more, and believed these symptoms to be job related. When asked whether they had any health related problems or symptoms associated with any process or material, the most common complaint was headache (6 employees). Several employees mentioned throat irritation (3 employees) and leg pain (3 employees).

Ten of the 21 workers had experienced symptoms only within the past 6 months but 3 of the 10 had only been with Smead for less than 6 months. Eight of the 10 reported headaches, while 3 of the 10 reported throat irritation, dizziness, and eye irritation. One employee reported chronic health problems not thought to be work related, and 2 employees had no health problems they considered to be related to glue vapor exposure.

Other symptoms mentioned less frequently were peeling of skin on the hands, skin irritation (redness, rash, or itching), feeling "high", backache, and nasal irritation. The full range of symptoms considered to be job related by the 21 employees interviewed were:

Symptom	No. Reporting Symptom
Frequent headaches	14
Throat irritation, (sore, swollen, or hoarse)	6
Dizziness	4
Eye irritation	4
Feeling "high"	3
Peeling skin where the glue sticks	3
Leg pain	3
Backache	2
Nose irritation (itching or burning)	2
Skin redness or rash	2
Nausea	1
Lingering taste in mouth	1
Sharp momentary pain in chest	1

While headaches were the frequent symptom, some of the employees thought the headaches might be due to stress and tension associated with machine paced work. Other employees thought the

glue might be responsible. Most of the employees who experienced throat irritation, dizziness, and feeling "high" thought breathing the glue vapors might be responsible. The leg pain and backache were usually attributed to standing long hours on the job.

B. Follow-up Environmental Survey (January 19, 1982)

Based on the results of the analysis of glue vapors collected during the initial survey, NIOSH investigators returned to the plant on January 19, 1982, to determine actual employee exposures to vapors of methyl salicylate, o-phenylphenol, and oil of citronella. Since the major terpene compound found in oil of citronella was camphene, this compound was selected for air monitoring in order to quantitate employee exposures. The results of the analyses of the air samples are presented in Table 2.

Neither camphene nor o-phenylphenol was detected on any personal or area sample taken from the five piece line. Camphene was not detected on the bracket line, but one personal sample measured a concentration of 1.1 mg/M^3 of o-phenylphenol. An area sample, taken directly above the glue coated file binder tape on the bracket line, detected 4.2 mg/M^3. These results are not consistent with the initial survey results in which bulk air samples, collected from the bracket line, did not contain o-phenylphenol. The only compound consistently identified in the air samples was methyl salicylate, but concentrations ranged from only 0.4 to 2.0 mg/M^3. The highest personal exposure to methyl salicylate was 1.2 mg/M^3, measured on the bracket line.

Analyses of the bulk air samples of glue vapors collected on the five piece line and bracket line detected a complex mixture of aromatic and aliphatic hydrocarbons, including trace amounts of 1,1,1-trichloroethane, toluene, perchloroethylene, methyl salicylate, and terpenes. However, no o-phenylphenol was detected in these samples.

In summary the results of the sampling both during the initial and follow-up surveys indicate the principal component specifically identified in the vapors from the glues used on the five piece and bracket lines is methyl salicylate. Turpenes (which includes camphene) and o-phenylphenol were detected during the initial survey but were not found as major components of the vapors in the samples collected during the follow-up survey. Sulfur dioxide was not detected in the head space of any of the heated bulk glue samples.

VII. CONCLUSIONS

Based on the results of this survey, no adverse health effects would be expected due to the very low level of personal exposures to glue vapors that employees would encounter while working on the five piece line and bracket line. Unfortunately, very little

toxicity information is available concerning the effects of exposure, through inhalation, to the compounds identified in the glue vapors. Those substances which were specifically identified in air samples, such as methyl salicylate (oil of wintergreen), were at extremely low concentrations (i.e. less than 2 mg/M^3). Effects from exposure to turpentine vapors (containing terpenes similar chemically to camphene) are mainly nose and throat irritation, but these effects generally occur at concentrations above 560 mg/M^3 (100 ppm).[5]

One case of asthmatic bronchitis was reported by an employee of this plant. There are reports in the literature of asthmatic conditions arising from occupational exposures to the following substances: (1) isocyanates, (2) phthalic anhydride, (3) platinum, (4) cobalt, (5) vanadium, (6) sulfur dioxide, and (7) formaldehyde.

None of these substances were reported to be constituents of the glues. The glues did contain a sulfite compound which, according to the glue manufacturer's material safety data sheet, could release SO_2 as a thermal decomposition product. However, when the glues were heated to normal process temperatures in the NIOSH laboratory, no detectable amounts of sulfur dioxide or any other known asthma-associated substances were found to be released or produced.

The worker who developed asthmatic bronchitis also had other risk factors which could lead to asthmatic bronchitis. The presence of these factors compound the difficulty in trying to ascertain a cause for the illness.

The appearance of a single case of asthmatic bronchitis in a worker group is not sufficient to establish a pattern. Therefore, NIOSH could not determine whether this single case was related to glue vapor exposure. Neither the NIOSH laboratory tests nor the results of air sampling in the workplace documented the presence of any air contaminant presently known to induce asthma.

VIII. RECOMMENDATIONS

Although employee exposures to glue vapors have not been found by NIOSH to be a health hazard, the results from employee interviews indicate many of the workers were bothered by the odor. Since little toxicity information is currently available concerning the effects of inhalation of these vapors and since current methods of quantitating exposures can not account for the complex mixture of compounds found in these vapors, the following recommendations are offered to hopefully reduce employee complaints about the glue odors:

1. Continue the practice of leaving open the drums of glue to air out the glue prior to use. This may allow some of the more volatile and irritating organic vapors to escape.

2. Heat the glue only as hot as necessary to keep it liquid. Excessive heating may cause increased vapor emission and release toxic thermal decomposition products, such as sulfur dioxide.

3. Insure all HVAC systems are configured to circulate air as long as the building is occupied. Thermostats should be set to the "fan on" position, not to "auto". In this way, air will circulate even when air conditioning compressors or furnaces are not operated.

4. Outside air dampers on HVAC units should be set to prevent full closing of the vent when outdoor air is not used for cooling. In accordance with recommendation by the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE), as found in ASHRAE Standard 62-1981, at least 35 cubic feet of outdoor air per minute per person should be provided to the building occupants at all times.[15]

5. Since the workers are experiencing dry hands and a slight dermatitis, hand cream should be provided to the employees for use after washing hands.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

Evaluation Conducted by:	Paul Roper, CIH Regional Consultant NIOSH Region IV Atlanta, Georgia
Report Prepared by:	Stanley A. Salisbury, CIH Regional Industrial Hygienist NIOSH Region IV Atlanta, Georgia
Environmental Assistance:	Andrea V. Kidd Industrial Hygienist Trainee NIOSH, Region IV Atlanta, Georgia
Originating Office:	Hazard Evaluations and Technical Assistance Branch Division of Surveillance, Hazard Evaluations, and Field Studies NIOSH Cincinnati, Ohio
Laboratory Analyses:	Staff Measurements Research Support Branch, NIOSH Cincinnati, Ohio

X. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Publications 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 the NIOSH Publications Office at the Cincinnati, Ohio address.

Copies of this report have been sent to:

1. Plant Manager, Smead Manufacturing Company
2. Upholsterers' Int'l Union of North America, Local 672
3. Upholsterers' Int'l Union, North America, Philadelphia, PA
4. Employee Requester (Confidential)
5. U.S. Department of Labor, OSHA, Region IV
6. NIOSH, Region IV
7. Designated State Agencies

For the purpose of informing the approximately 40 "affected employees", the employer will promptly "post" this report for a period of thirty (30) calendar days in a prominent place(s) near where the affected employees work.

XI. REFERENCES

1. National Institute for Occupational Safety and Health. NIOSH manual of analytical methods. Vol 6, 2nd ed. Cincinnati, OH: National Institute for Occupational Safety and Health, 1980. (DHHS (NIOSH) publication no. 80-125).

2. American Conference of Governmental Industrial Hygienists (ACGIH). Threshold limit values for chemical substances and physical agents in the workroom environment with intended changes for 1982. Cincinnati, Ohio: ACGIH, 1982.

3. Occupational Safety and Health Administration (OSHA). OSHA safety and health standards. 29 CFR 1910.1000. Occupational Safety and Health Administration, revised 1980.

4. International Labour Office. Encyclopaedia of occupational health and safety. Vol I/a-k. Geneva: International Labour Office, 1971.

5. American Conference of Governmental Industrial Hygienists. Documentation of the threshold limit values. 4th. ed., with supplemental documentation for 1981. Cincinnati, Ohio: ACGIH, 1980.

6. National Institute for Occupational Safety and Health. Occupational diseases: a guide to their recognition. Revised ed. Cincinnati, OH: National Institute for Occupational Safety and Health, 1977. (DHEW (NIOSH) publication no. 77-181).

7. Testimony before the Department of Labor, Occupational Safety and Health Administration (OSHA), Public Hearing on the Occupational Standard for Sulfur Dioxide, May 1977.

8. Freedman BJ. Sulphur dioxide in foods and beverages: its use as a preservative and its effects on asthma. British Journal for Diseases of the Chest; 74(2):128-134, 1980.

9. Patty FA. Patty's industrial hygiene and toxicology. Vol 2C--toxicology, 3rd revised ed. New York: John Wiley & Sons, 1982.

10. Hodge HC, E Maynard, H Blanchet Jr, H Spencer, V Rowe. Toxicological studies of o-phenylphenol (Dowicide 1). Journal of Pharmacology and Experimental Therapeutics; 104:202-210, 1952.

11. Patty FA. Patty's industrial hygiene and toxicology. Vol 2A--toxicology, 3rd revised ed. New York: John Wiley & Sons, 1981.

12. Lewis RJ, T Rodger, eds. Registry of toxic effects of chemical substances: from RTECS Quarterly Microfiche. National Institute for Occupational Safety and Health, July, 1982.

13. Patty FA. Patty's industrial hygiene and toxicology. Vol 2B--toxicology, 3rd revised ed. New York: John Wiley & Sons, 1981.

14. Toxicology Data Bank: from National Library of Medicine Data Base.

15. American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. Ventilation for acceptable indoor air quality. ASHRAE Standard 62-1981. Atlanta, Georgia: ASHRAE, 1981.

TABLE 1

SUMMARY OF EXPOSURE LIMITS* and HEALTH EFFECTS
for SUBSTANCES CONTAINED IN GLUES USED ON
BRACKET LINE and FIVE PIECE LINE
SMEAD MANUFACTURING COMPANY
LOCUST GROVE, GEORGIA
HETA 81-400

SUBSTANCE	OSHA PEL**	ACGIH TLV***	NIOSH RECOMMENDATION	HEALTH EFFECTS CONSIDERED	REFERENCE
Sodium bisulfite	---	5 mg/M^3	---	Eye, skin and upper respiratory irritant; decomposes to release sulfur dioxide	5
Sulfur dioxide	5 ppm	2 ppm (5mg/M^3) 5 ppm STEL	0.5 ppm	Respiratory effects	7
Triethylene glycol	---	---	---	Very low toxicity; Not irritating to skin or eyes; no known respiratory effect	9
Diethanolamine	---	3 ppm	---	Low oral toxicity: direct contact may irritate skin or eyes	5
o-phenylphenol	---	---	---	Eye and upper respiratory irritation	11
Oil of citronella (contains camphene)	---	---	---	Possible skin and upper-respiratory irritant in excess concentrations	13
Methyl salicylate (oil of wintergreen)	---	---	---	Toxic by ingestion; Inhalation effects unknown.	14

* Limits are 8-hour time-weighted averages (TWA) unless otherwise stated.
** For OSHA standards, see Reference No. 2
*** For ACGIH TLV's, see Reference No. 1
ppm = parts per million parts of air; mg/M^3 = milligrams per cubic meter of air
STEL = Short Term Exposure Limit (15 minutes duration)

TABLE 2

SMEAD MANUFACTURING COMPANY
LOCUST GROVE, GEORGIA
HETA 81-400

AIR SAMPLING RESULTS
January 19, 1982

Job Classification	Type of Sample	Sampling Time	Concentration in mg/M^3 Camphene	Methyl Salicylate	o-phenyl phenol*
5 Piece Line					
Operator	personal	8:00am-10:00am	ND	1.1	ND
"	"	11:00am-2:08pm	ND	ND	ND
Assembly-#1 Pos. Rt.	personal	8:12am-2:09pm	ND	0.4	ND
Assembly-#1 Pos. Lft.	personal	8:21am-11:00am	ND	ND	ND
Assembly-#3 Pos. Rt.	personal	8:14am-2:10pm	ND	0.4	ND
Press and Inspect	personal	8:17am-1:00pm	ND	ND	ND
Above glue vat	area	8:18am-11:02am	ND	2.0	ND
" " "	"	11:03am-2:08pm	ND	0.7	ND
Bracket Line					
Tape Assembly	personal	7:46am-2:03pm	ND	1.2	ND
Tape Assembly	personal	7:48am-2:03pm	ND	0.4	1.1
Tape Assembly	personal	7:50am-2:03pm	ND	0.5	ND
Above Moving Tape	area	7:58am-11:08pm	ND	ND	4.2
" " "	"	11:08am-2:04pm	ND	ND	ND
Bone and Press Operator	personal	7:56am-2:04pm	ND	0.4	ND

Analytical Sensitivity (mg/sample)			
Limit of Detection	0.01	0.02	0.06
Limit of Quantitation	0.05	0.09	

* Charcoal tube desorption efficiency for o-phenylphenol was only 20%. The values reported should be considered as approximations. Phenylphenol was not detected in bulk air samples.

Note: ND = Not Detected
mg/M^3 = milligrams of substance per cubic meter of air sampled.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
PUBLIC HEALTH SERVICE
CENTERS FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
ROBERT A. TAFT LABORATORIES
4676 COLUMBIA PARKWAY, CINCINNATI, OHIO 45226

OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE. $300

Third Class Mail

POSTAGE AND FEES PAID
U.S. DEPARTMENT OF HHS
HHS 396