U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
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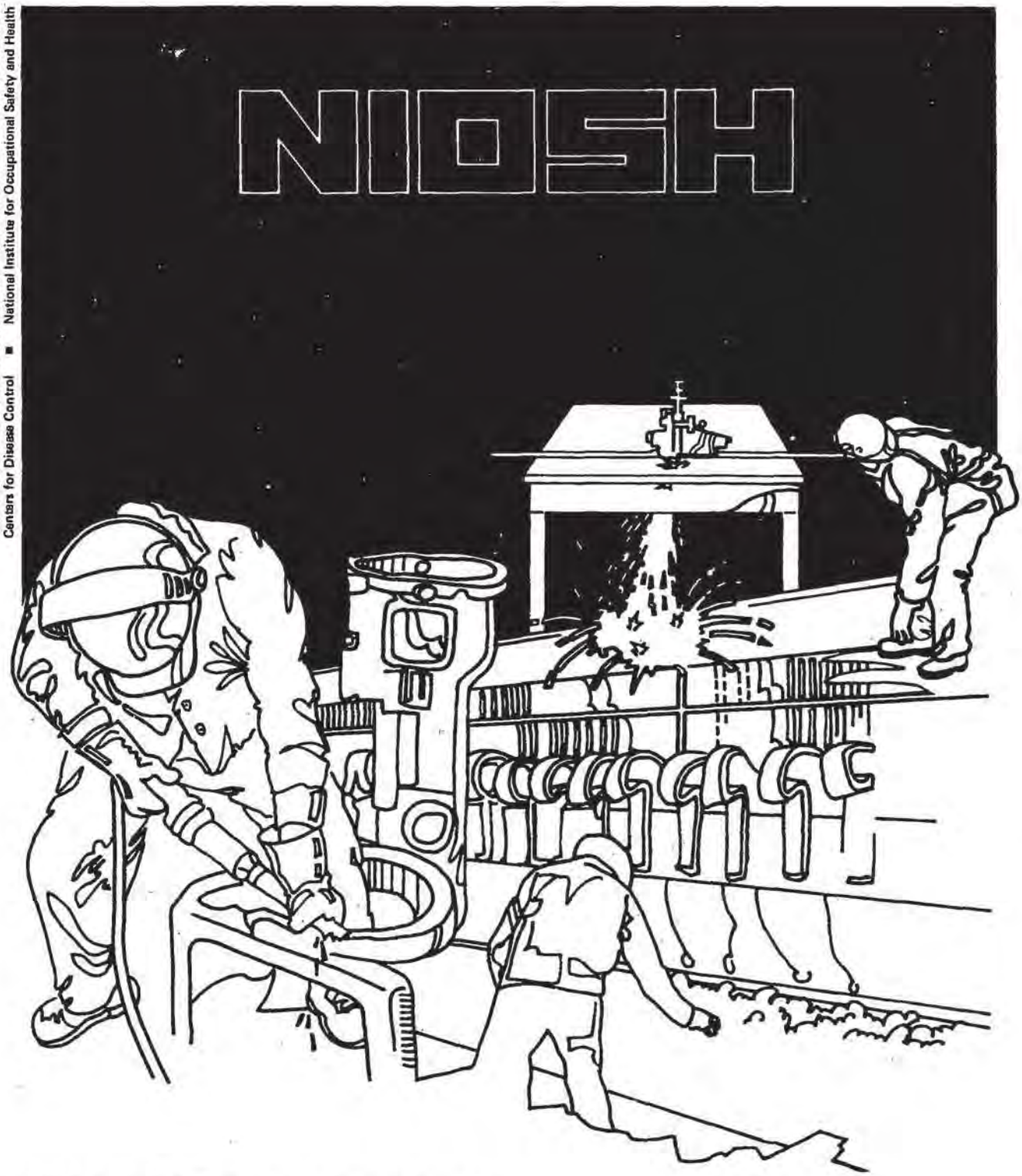
NIOSH



Health Hazard Evaluation Report

HETA 83-009-1335
CUMBERLAND MANUFACTURING COMPANY
PRINCETON, KENTUCKY

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

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

HETA 83-009-1335
JULY 1983
CUMBERLAND MANUFACTURING COMPANY
PRINCETON, KENTUCKY

NIOSH INVESTIGATOR:
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I. SUMMARY

On October 18, 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Kentucky Department of Labor to assist in evaluating a reported outbreak of illness that included nausea, eye and throat irritation, dizziness, rapid heart beat, and fainting at the Cumberland Manufacturing Company, Princeton, Kentucky. The outbreak was suspected to be associated with exposure to an unidentified noxious gas. Environmental sampling conducted October 7-18 by the Kentucky State Fire Marshall and by the Division of Compliance, Occupational Safety and Health, Kentucky Department of Labor, had detected no carbon monoxide, Freon, or explosive gases.

On October 19 and 20, 1982, NIOSH conducted a medical survey at the factory. Questionnaire interviews to evaluate the clinical and epidemiological features of the illness were conducted with 113 employees who worked in the main garment assembly room on the first day of the outbreak, October 7, 1982. Medical records were reviewed for 36 of the 48 employees who received emergency medical care at a local hospital on October 7. Arterial blood gas data on three workers, including results of a specimen drawn at the factory, were also reviewed.

Eighty-nine (79%) of 113 garment assembly room employees reported one or more symptoms on October 7; the most frequent were headache in 69 (78%) of the symptomatic employees, lightheadedness in 50 (56%), sore or dry throat in 42 (47%), burning eyes in 41 (46%), weakness in 39 (44%), sleepiness in 36 (40%), nausea in 34 (38%), dizziness in 33 (37%), and difficulty breathing in 31 (35%). Employees who were affected tended to be the same age, had the same variability in work stations, and worked in the same areas of the assembly room as those who remained unaffected. Medical records, including examination of the lungs, chest X-rays, and electrocardiograms, revealed no findings suggestive of environmental chemical effects. Twenty of 24 recorded diagnoses were either anxiety or conversion reaction (anxiety expressed as physical effects). The arterial blood gas data indicated that hyperventilation contributed to the health effects experienced by two of the three workers sampled.

The pattern of health effects experienced by assembly room workers does not confirm or negate exposure to a hazardous substance at the Cumberland Manufacturing Company on October 7, 1982. There did not appear to be any process-related source of chemical exposure. Acute hyperventilation was likely responsible for many of the reported health effects.

KEYWORDS: SIC 2330 (Women's outerwear manufacturing), hyperventilation

II. INTRODUCTION

On October 18, 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Kentucky Department of Labor to assist in evaluating a reported outbreak of illness in employees of the Cumberland Manufacturing Company, a garment manufacturing company in Princeton, Kentucky. The initial reports included nausea, eye and throat irritation, dizziness, rapid heart beat, and fainting.

NIOSH conducted a medical survey at the factory on October 19 and 20, 1982. Initial findings of the investigation were sent to the Kentucky Department of Labor, company management, and Amalgamated Clothing Workers Union Local 65c on October 29, 1982.

III. BACKGROUND

A. Description Process

The Cumberland Manufacturing Company, located on the outskirts of Princeton, Kentucky, is a one-story structure built in 1939. The building contains a few offices and two large rooms, one for cutting fabric and one for garment assembly. From the cutting room, fabric pieces are stored temporarily along one wall of the assembly room before they are distributed to sewing machine stations in the center of the room. Finished garments are pressed at one end of the assembly room and loaded on carts for shipping. An air compressor located in the cutting room powers all sewing machines in the assembly room. Air is carried from the compressor through a galvanized steel pipe along one wall of the assembly room and then by several plastic hoses to individual machine stations.

The company sells cutting and assembly services on contract to brand-name apparel firms which, in turn, supply it with the fabrics to be used. At the time of the outbreak a shipment of pre-shrunk, non-permanently pressed, stonewashed denim had been in use at the factory for one week.

The company operates on a single daily shift (7:00 a.m. to 3:30 p.m.) on weekdays and an occasional shift on Saturday mornings.

The plant has an air-conditioning system, but at the time of the outbreak and the NIOSH investigation the system was not in use. Rather, the plant's opened windows and doors provided ventilation.

B. History of Reported Health Problems

On October 7, 1982, some of the employees in the assembly room noticed a strange smell and reported feeling faint shortly after coming to work. The air compressor running that morning was back in use for the first time after having been overhauled recently. Concern developed that the air compressor could be the source of the strange smell, which some employees described variably as sweet, bitter, or insecticide-like.

The suspect air compressor was turned off and an alternate used. Employees continued to report feeling ill. One employee fainted at approximately 9:45 a.m. and more faintings followed. The factory closed at 10:00 a.m. Approximately 50% of the assembly room employees were taken to a local hospital for medical evaluation of possible exposure to noxious gas. One employee was hospitalized overnight for observation. Environmental sampling conducted by the Kentucky State Fire Marshall at the factory on October 7 was negative for carbon monoxide, Freon, and explosive gases, including natural gas and sewage gases.

On October 8, normal factory production resumed and no employees reported feeling ill. Over the next ten days, however, sporadic reports of employee illness continued and two more faintings occurred. The suspect air compressor was not used after initial disconnection on October 7. The insurance company representing the air compressor manufacturer employed a private laboratory to evaluate air samples from the suspect compressor. Analysis of samples taken on October 11 reportedly showed an acidic condensate. The Kentucky Department of Labor, Occupational Safety and Health Division of Compliance inspected the factory at various times during October 11 to 18. Repeated samplings for carbon monoxide were negative. Concern over the continuing health problems prompted the request to NIOSH.

IV. EVALUATION DESIGN AND METHODS

The study was designed to determine if the pattern of reported health effects suggested exposure to a hazardous substance. A NIOSH medical investigator administered a questionnaire to all employees who worked in the assembly room in order to: (1) record observations made on October 7, 1982; (2) assess health problems which began on October 7, 1982; and (3) identify employees according to location of work station. Hospital emergency room records and medical records from private physicians were reviewed.

V. RESULTS

One hundred thirteen employees worked in the assembly room on October 7, including 80 machine operators, 14 garment inspectors, six bundle distributors, four mechanics, three shipment preparers, and one manager. Four employees provided no job description. The mean age was 35 years for machine operators and 39 years for all other identified job groups. The mean job duration was 4.6 years for machine operators and 9.1 years for the others. All machine operators were female; 22 (75%) of the other employees who identified jobs were female.

Thirty-four employees noticed a strange smell on October 7. Of 22 who described the smell, eight said it resembled natural gas. The other 14 descriptions were variable, including "sulfur", "ether", and unfamiliar "chemical" odors.

Eight employees fainted on October 7. These employees and 81 others reported experiencing at least one of the following health effects on October 7: headache - 69 (78%), lightheadedness - 50 (56%), sore or dry throat - 42 (47%), burning eyes - 41 (46%), weakness - 39 (44%), sleepiness - 36 (40%), nausea - 34 (38%), dizziness - 33 (37%), difficulty breathing - 31 (35%), chest pain - 19 (21%), and fatigue - 8 (9%). Without prompting, 10 (11%) employees also reported experiencing a coated tongue or a bad taste; five (6%) tingling or numbness in the feet, legs, or face; five chills; and two (2%) difficulty in concentrating. No employee reported experiencing a rapid heart beat. Employees whose health problems continued over the next 12 days included: 45 (65%) of those with headaches, 24 (57%) with sore or dry throat, 19 (56%) with nausea, 17 (52%) with dizziness, 25 (50%) with lightheadedness, 18 (50%) with sleepiness, nine (47%) with chest pain, 14 (45%) with difficulty breathing, 16 (39%) with burning eyes, and 14 (36%) with weakness; none had persistent fatigue. Persistence of other health effects was less than fifty percent. Eight additional employees reported similar health effects which began after October 7.

Among the employees whose health was affected, 54 (64%) considered the effects to be work-related, 13 (15%) considered them not work-related, and 17 (20%) were unsure. Five employees gave no opinion. No significant difference existed between the mean ages of employees with health effects (36 years) and those without health effects (38 years) ($t=1.0347$, $d.f.=111$, $P>0.30$). Sixty-eight (81%) of 84 employees who worked at only one work station reported one or more symptoms, compared to 21 (72%) of 29 employees who worked at more than one place, a statistically insignificant difference (Chi-square = 0.498, $P>0.10$).

Seven of the eight employees who fainted on October 7 worked in area A of the assembly room, as shown in Appendix 1. The first employee who fainted on October 7 was one of the two who fainted on later dates, and both of these employees worked in area A. No overall difference existed, however, between the proportion of employees who experienced health effects while working in area A (25 [81%] of 31) as compared to elsewhere in the assembly room (64 [78%] of 82) (Chi-square = 0.0899, P>0.75).

Permission was obtained to review emergency room records for 36 of the 48 employees seen at a local hospital on October 7, 1982. In none of the 15 cases where an examination of the lungs was recorded were any abnormalities found. Chest X-rays taken of ten employees revealed no active disease in seven and localized "slight accentuation of bronchovesicular markings" in the other three. No findings were suggestive of pulmonary edema, a change which might be most commonly noted a short time after exposure to various acidic vapors and noxious gases. Four employees had an electrocardiogram; three showed no abnormalities, and changes in the fourth were "consistent with normal aging". In 20 cases, the diagnosis was anxiety or conversion reaction (anxiety expressed as physical effects). In three cases, the diagnosis was "reaction to noxious odor" and in one case "? chemical bronchitis" (no lung examination was recorded in this last case). In the other cases, no diagnosis was made.

Three employees had arterial blood gas analyses. In two cases (employees 1 and 2, Table 1), the results suggest slight respiratory alkalosis consistent with acute hyperventilation. No chronic hyperventilation was present, as indicated by the undiminished bicarbonate levels.

VI. DISCUSSION AND CONCLUSIONS

The epidemiological pattern obtained by interviews and review of medical records does not confirm or negate exposure to a hazardous substance at the factory on October 7, 1982. Employees who were affected tended to (1) be the same age, (2) have the same degree of mobility while at work, and (3) work in the same areas of the assembly room as those who remained unaffected.

While headache was the most frequently reported symptom at any time during the outbreak, the health effects typically experienced on the first day of the outbreak differed, in order of prevalence, from those which persisted twelve days later. One of the most frequent initial symptoms, burning eyes, was less frequently reported as a persisting problem. Although nausea, dizziness, and chest pain were less frequently reported initially, they ranked among the most persistent symptoms. Continuing exposure to a given hazardous substance would be expected to produce the same array of health effects, although fewer workers may be affected if lower levels exist.

In conclusion, no specific hazardous substance nor any continuing common source of exposure was identified by this NIOSH investigation. The symptoms reported are common to a variety of conditions and may reflect several different factors, not necessarily all job-related. Acute hyperventilation is likely to have contributed significantly to the health effects of both workers with documented respiratory alkalosis and the majority of the other employees. Hyperventilation, often associated with anxiety[1], describes breathing which is too rapid and/or too deep to maintain normal levels of oxygen and carbon dioxide in the bloodstream[2]. This imbalance produces diverse symptoms and may affect the cardiovascular, respiratory, neurologic, gastrointestinal, and musculoskeletal systems. The most common effects experienced, however, are lightheadedness, dizziness, and a vague "out-of-touch" feeling. In serious cases of hyperventilation, such as those with acute onset, people experience paresthesias, which are abnormal skin sensations such as tingling. Anxiety-induced hyperventilation can lead to somatic (physical) illness. An outbreak of this nature usually reflects employee stress arising from a complex interaction of environmental, physiological, psychological, and social variables. If employees again become ill with symptoms similar to those experienced in the October 1982 outbreak, management may wish to consider hiring outside consultants to evaluate ergonomic factors, lighting conditions and work station adjustment, for example, since such factors may contribute to employee stress.

VIII. REFERENCES

1. Hyperventilation Syndrome. The Lancet. 1982; Vol II: 1438-1439.

2. Missri, JC and Alexander, S. Hyperventialtion Syndrome. JAMA. 1978; 240: 2093-2096.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

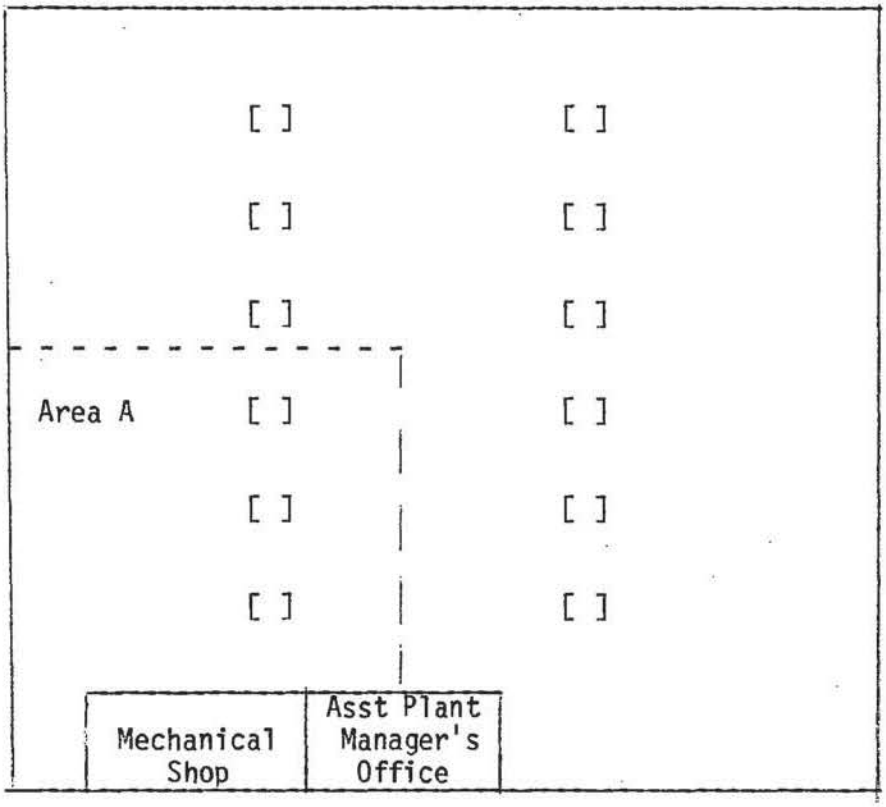
Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield,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

1. Kentucky Department of Labor
2. Cumberland Manufacturing Company
3. ACWU, Local 65c, Princeton, Kentucky
4. Caldwell County Memorial Hospital
5. NIOSH, Region IV

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

APPENDIX 1

Map of Garment Assembly Room
Cumberland Manufacturing Company, Princeton, Kentucky



Key: [ ] = structural support column

TABLE 1

Arterial Blood Gas Data*
Cumberland Manufacturing Company Employees
October, 1982

	Employee 1	Employee 2	Employee 3	Normal Range**
pH	7.51	7.48	7.47	7.35 - 7.45
pCO_2(torr)	29.4	31.6	40.3	35 - 45
pO_2(torr)	105.5	118.1	117.3	80 - 90
HCO_3 (mEq/L)	24.5	23.7	29.0	22 - 26
Total CO_2 (mEq/L)	23.6	24.7	30.0	23 - 27
Base Excess (mEq/L)	2.7	2.0	5.6	0 $\pm$ 2.0

*All data are pre-treatment.
**As reported by laboratory performing the tests.