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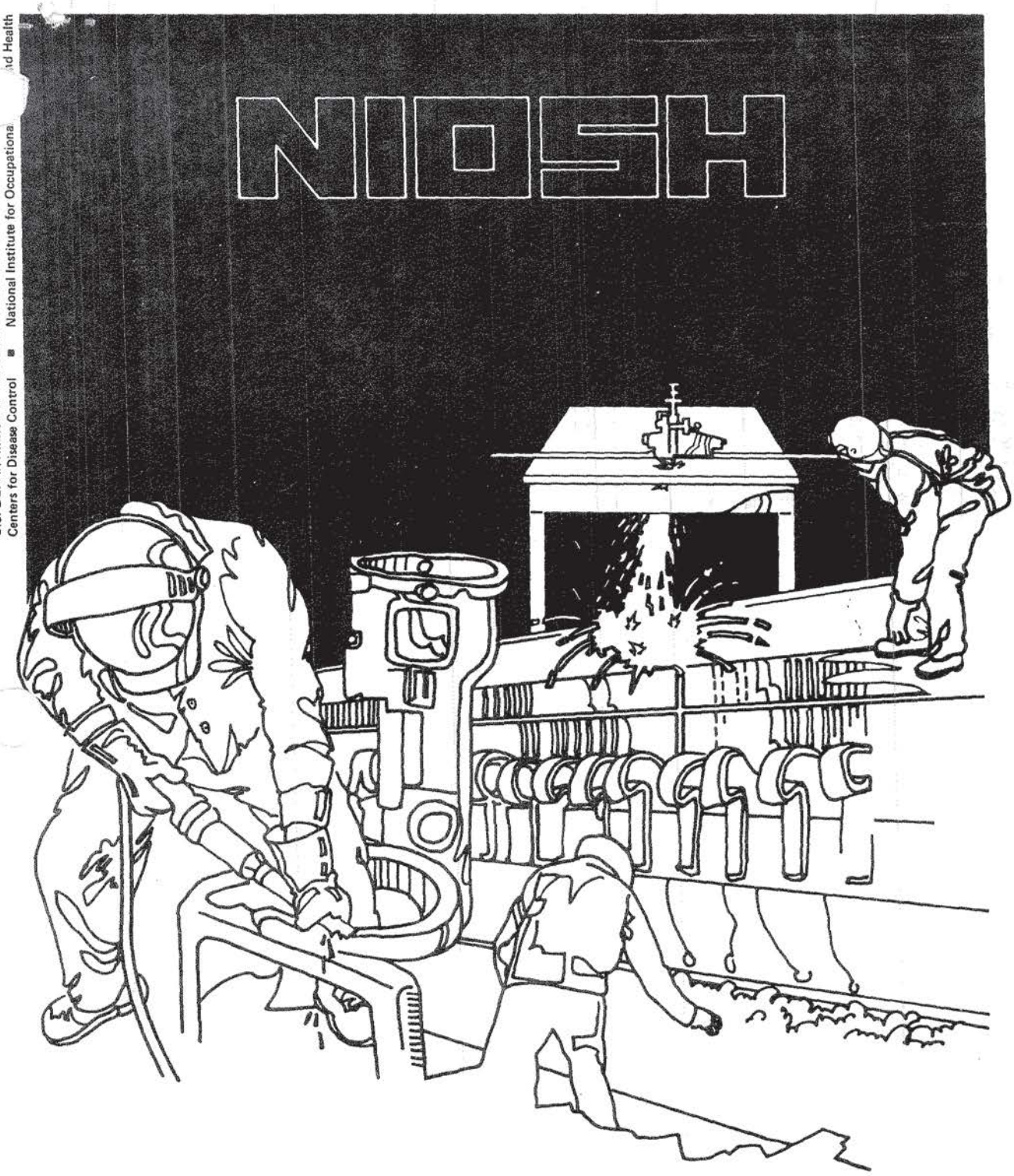

Health Hazard Evaluation Report

HETA 82-062-1077
BOISE MEDICAL ARTS CENTER
BOISE, IDAHO

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 82-062-1077
MARCH, 1982
BOISE MEDICAL ARTS CENTER
BOISE, IDAHO

NIOSH INVESTIGATOR
ARVIN G. APOL

I SUMMARY

In December 1981 the National Institute for Occupational Safety and Health (NIOSH) received a request from Commerical Management, the building management firm of the Boise Medical Arts Center, to determine the source of intermittent odors and the cause of headaches, nausea, and, on one occasion vomiting, being experienced by workers in the basement level of the Boise Medical Arts Center, Boise, Idaho.

An initial visit was conducted on December 30, 1981. The affected employees worked in the basement level of the 10 year old, 5 story medical building. They had been experiencing intermittent symptoms for the past 10 months. The odors were found to be coming up through cracks in the concrete floor, floor to foundation joints, and floor to support pillar joints. The odor, thought to be gasoline or other petroleum products, was confirmed by laboratory analysis. Limited environmental sampling was conducted on December 30, 1981. Additional samples were collected on January 4, 1982. The vapor concentrations at the cracks and inside one wall were above the lower explosive limit (14,000 ppm). The vapor concentrations in the rooms ranged up to 280 ppm.

The source of the petroleum products could be from the large gas and oil tank farm which is located two blocks from the medical center. Six test holes were drilled around the building. One water sample taken at the water table had 5/8 inch of petroleum products floating on the surface.

The recommendations made by NIOSH, which have since been accomplished, were to seal all accessible cracks and joints and to adjust the ventilation system to pressurize the building (it had been under negative pressure relative to the outside air). Since these corrections have been make the petroleum product vapors are no longer detectable in the building and the employees' symptoms have ceased. Long term corrections are now in progress.

On the basis of this investigation, NIOSH determined that a hazardous exposure existed to petroleum product vapors (gasoline) in the basement level of the medical building. This is based on (1) gasoline vapor concentrations up to 280 ppm in the rooms and which were above the lower explosive limit (14,000 ppm) at the cracks in the floor and in the restroom wall (on other days during the past 10 months the concentration in the room could have been much higher), and (2) the adverse health effects experienced in the past 10 months by the employees. Recommendations to prevent the vapors from entering the building are included in this report.

KEYWORDS: SIC 8001 (offices of Physicians) gasoline, gasoline and oil spills, buildings, offices.

II. INTRODUCTION

In December 1981 the National Institute for Occupational Safety and Health (NIOSH) received a request from Commerical Management, the building management firm of the Boise Medical Arts Center, to determine the source of intermittent odors and the cause of headaches, nausea, and, on one occasion vomiting, being experienced by office workers in the basement level of the Boise Medical Arts Center, Boise, Idaho.

An initial survey was conducted on December 30, 1981. Additional environmental sampling was conducted on January 4, 1982. An interim report including the findings and recommendations was sent to the requester on January 8, 1982. In addition, the Idaho Department of Health and Welfare, the Idaho Environmental Protection Agency, and the Boise Fire Department were notified of the problem.

III. BACKGROUND AND INVESTIGATIVE FINDINGS

The Boise Medical Arts Center is a 5-story, plus basement level, 10 year old medical building. The basement level is 10-12 feet below ground level. The employees who worked in several of the basement offices would smell odors that resulted in headaches, nausea and, on one occasion, vomiting. These odors were intermitent and varied in intensity.

Several state and local agencies had been called in to investigate but had not found the cause of the problem. Just prior to the request for help from NIOSH, OSHA was contacted. The OSHA industrial hygienist identified several locations where the odors were present (eg. the restrooms, the Boise Retina Lab darkroom, the stairwell and several other rooms). Vapors were also found inside the wall of the restroom which exited the wall via the electrical outlet. Using this information a common denominator was sought. The common denominator was that all rooms with odors were on an outside wall or had a support pillar in the room. Floor to wall and floor to pillar joints (floor cracks) were the only items in common. Two cracks were found in the uncarpeted stairwell. Smoke tube tests showed an air stream coming up through the cracks. The investigators smelled the air near the cracks and found the same gasoline type vapors. Air samples from these cracks were then measured with a Wilks MIRAN Infrared Analyzer. The vapor concentrations were higher than the instrument could measure (over 2000 ppm). Tests with a MSA Model 40 Combustible Gas Indicator showed the vapors were in the explosive range (above 14,000 ppm). Further sampling and analytical tests confirmed that the vapors were gasoline and other petroleum products. The source of the gasoline vapors was from under the building. As the vapors exit the small cracks they are immediately diluted with the room air which reduces concentrations down to 300 ppm or less.

The retina laboratory darkroom had a high odor concentration. One of the affected employees spent considerable time in this room. A hole had been cut through the concrete floor below the sink to connect the drain to a sewer line which ran under the floor. This hole had not been covered and resealed. The gasoline vapors in this hole were also in the explosive range. This room and the restrooms have exhaust fans which result in negative pressure in the rooms. Smoke tube tests showed that there was a strong air flow from the stairwells into the basement level indicating

that the entire basement level was under negative pressure relative to outside air. This negative pressure was sucking air up through the floor into the basement

Two blocks from the medical building is a large bulk gas and oil tank farm and an 8 inch petroleum product line from Salt Lake City. There are approximately 50 above ground storage tanks (up to 350,000 gallon capacity) and a number of underground storage tanks. There are a number of oil companies that use this tank farm. They are members of the Idaho Petroleum Council which is working on finding the source of the petroleum products. Petroleum products leaking from the storage tanks, the pipe line or other pipes connecting the tanks could seep through the ground down to the water table. The medical center is located between the tank farm and the Boise River so once at the water table the petroleum products can migrate to the area under the medical center Six holes have been drilled around the medical building. One water sample taken at the water table (currently at 24 feet) had 5/8 inch of petroleum products floating on the surface. The soil in the test holds also contained the petroleum products. Additional holes are to be drilled until the source is found.

At the recommendation of NIOSH the cracks in the basement were sealed and the building ventilation system was adjusted to pressurize the building relative to the outside air and air pressure under the basement.

Since the above corrections have been made the petroleum product vapors are no longer detectable in the building and the employees adverse health effects have ceased. The additional NIOSH recommendation of using a vacuum pump to draw air from under the building through the existing french drain system will be accomplished in the near future.

The long term corrections being undertaken by the oil companies are to find the source of the petroleum products, installation of a vacuum pump to draw air from under the building and the drilling of an 8 inch well to the 45 foot level and to raise and lower the water table in order to flush the petroleum products from the ground under the building.

IV. EVALUATION DESIGN AND METHOD

A. Environmental -- Breathing zone and area samples were collected for petroleum product vapors on charcoal tubes with subsequent analysis using gas chromatography and mass spectrometry.

B. Medical -- The affected employees were interviewed during which time they stated the adverse health effects they experienced.

V. EVALUATION CRITERIA

A. Environmental -- OSHA currently does not have an occupational standard for exposure to gasoline due to the wide variety of components in the products. The American Conference of Governmental Hygienists has recommended an 8 hour time weighted average exposure level of 300 ppm and a short term exposure level of 7500 ppm. This criteria is used in this evaluation.

B. Toxicology -- The 1981 edition of "Documentation of the Threshold Limit Values" by the American Conference of Governmental Industrial Hygienists lists the following information for gasoline.

"Gasoline is a complex mixture of paraffins, olefins and aromatic hydrocarbons ranging from C-3 to C-11 hydrocarbons."

"Acute toxicity is similar for all gasolines. They act generally as an anesthetic and are mucous membrane irritants. The hazard is high because of the ease in which harmful concentration may develop. Inhalation is the most important route of occupational entry. Acute symptoms of intoxication, headaches, blurred vision, dizziness and nausea are most common symptoms of excessive vapors. Reported responses to gasoline vapors are: 160-270 ppm causes eye and throat irritation in several hours; 500-900 ppm causes eye, nose, and throat irritation and dizziness in 1 hour; and 2000 ppm produces mild anesthesia in 30 minutes. Higher concentrations are intoxicating in 4-10 minutes. The threshold for immediate mild toxic effect is 900-1000 ppm."

"A TLV of 300 ppm is recommended, based on calculations on hydrocarbon content of gasoline vapor. A STEL of 500 ppm is also recommended."

VI. RESULTS AND DISCUSSION

The air samples collected on charcoal tubes contained substituted butanes, pentanes, hexanes, heptanes, hexanes, cyclopentanes, cyclopentenanes, cyclohexanes, and cycloheptanes. These compounds are found in gasoline and other petroleum products. The results of the samples collected on January 4, 1982 are shown below.

Location	Sample Time Minutes	Gasoline Vapor Concentration PPM
(BZ) retina lab darkroom	18	212
(BZ) retina lab darkroom (some time spent out of room)	120	170
(BZ) office area	70	41
" "	51	25
(area) retina lab darkroom	51	283
" " "	67	156
" " "	82	152
" " "	67	121
" " "	52	102
(area) mens restroom	60	169
" "	67	164
" "	71	119
inside of wall space in the mens restroom	69	330
" "	52	314

The concentrations measured were taken on one day only. The employee in the retina lab darkroom stated the odor varied from day to day as did the severity of the symptoms experienced. How high the concentrations were on days that the employee went home sick cannot be determined or estimated. Measurements taken at the crack in the floor and in the wall were above the lower explosive limit of 14,000 ppm. Since corrective measures have been made the petroleum product (gasoline) vapors are no longer detectable in the building.

VII. CONCLUSION

On the basis of this investigation, NIOSH determined that a hazardous exposure existed to petroleum product vapors (gasoline) in the basement level of the medical building. This is based on (1) gasoline vapor concentrations up to 280 ppm in the rooms and which were above the lower explosive limit (14,000 ppm) at the cracks in the floor and in the restroom wall (on other days during the past 10 months the concentration in the room could have been much higher) and (2) adverse health effects experienced in the past 10 months by the employees.

VIII. RECOMMENDATIONS

1. Seal all cracks in the floor, floor to wall and floor to support pillar joints.

2. Pressurize the basement level relative to the air under the building and outside atmosphere. This can be done by making adjustments in the heating and air conditioning systems.

3. Pull a vacuum from under the building. To accomplish this connect an explosion proof fan to the stand pipe that connects to the french drain system under the building.

4. The ultimate solution is to find the source of the gasoline and stop the flow under the building. Idaho Petroleum Council is currently conducting this work.

IX. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this complete Determination Report are currntly available upon request from NIOSH, Division of Standards Development and Technology Transfer, Information Resources and 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. 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. Commercial Management (Manager of Boise Medical Arts Center), Boise, Idaho

2. U.S. Department of Labor, Occupational Safety and Health Administration, Region X, Seattle, Washington

3. Idaho Department of Labor and Industrial Services

For the purpose of informing the affected employees, the employer shall promptly post this Determination Report in a prominent place(s) near the work area of the affected employees for a period of thirty (30) calendar days.

XI. ACKNOWLEDGEMENTS

Report prepared and survey conducted by:

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