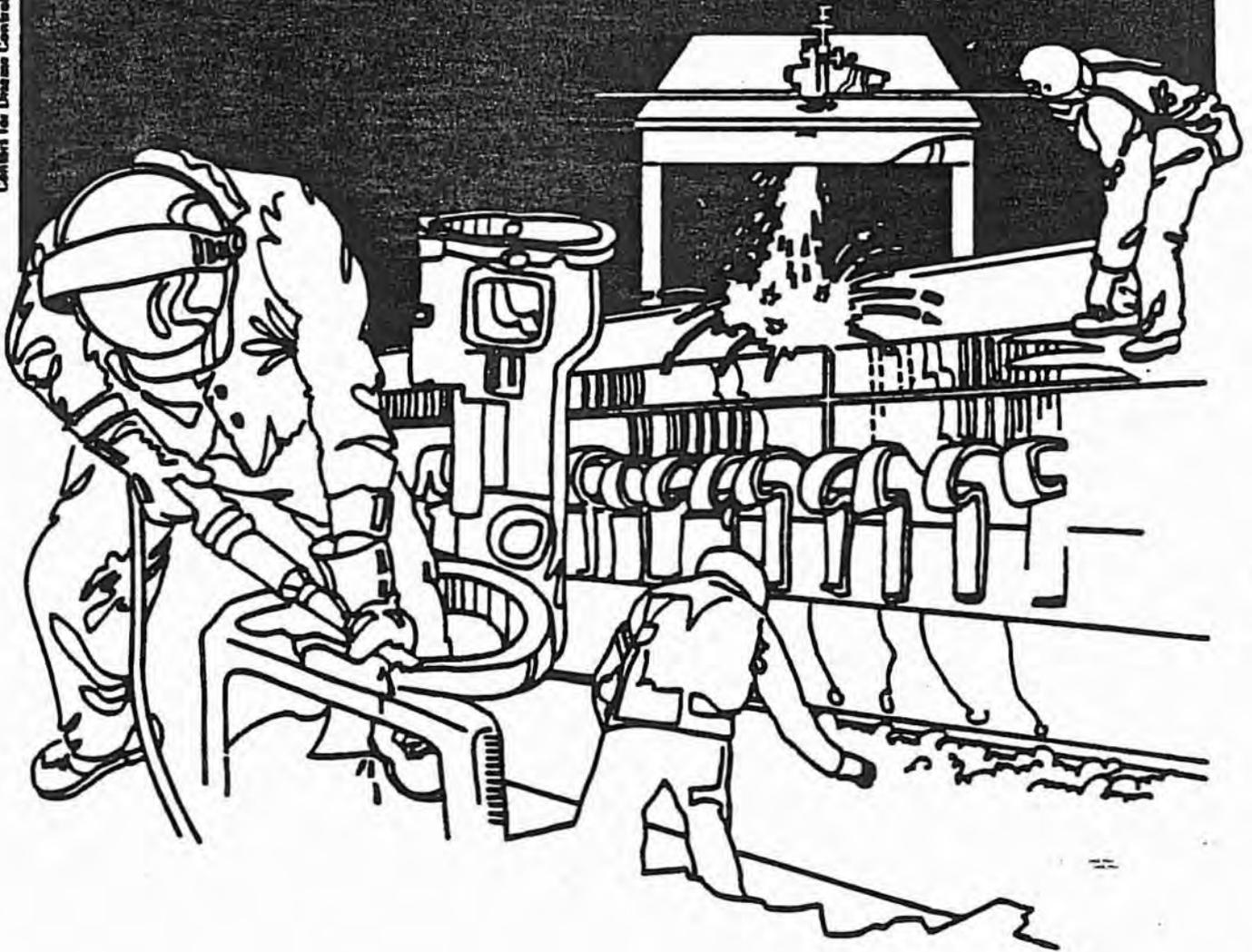


NIOSH



Health Hazard Evaluation Report

HETA 84-319-1649
PIONEER MINISTRIES
WHEATON, ILLINOIS

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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PIONEER MINISTRIES
WHEATON, ILLINOIS

NIOSH INVESTIGATOR:
Daniel Almaguer, L.H.

I. SUMMARY

On May 6, 1984, the National Institute for Occupational Safety and Health (NIOSH) received a request from the management to conduct a health hazard evaluation at Pioneer Ministries, Wheaton, Illinois. The request was prompted by a former employee's complaints of headaches and numbness in the hands which were believed to be related to solvents used in the print room.

In June 1984, NIOSH investigators conducted an initial survey of the facility. Ventilation measurements were taken and the print room employee and a former employee were interviewed.

In October 1984, an environmental survey was conducted to assess potential employee exposures to the various chemical substances used in the print room. Qualitative laboratory analyses of bulk samples showed that the fountain solution being used contained isopropanol, cellosolve, and butyl cellosolve as major components, plus smaller amounts of other organic compounds. The printing ink was shown to contain a series of unresolved aliphatic compounds, plus butylated hydroxytoluene (BHT). Qualitative analysis of the general area air sample collected in the center of the print room throughout the workday showed the presence of isopropanol, 1,1,1-trichloroethane, xylenes, various C₈-C₁₀ aliphatics and C₉H₁₂ aromatics.

Personal samples collected near the breathing zone of the print room employee were analyzed and quantitated for cellosolves, isopropanol, 1,1,1-trichloroethane, total hydrocarbons, and xylenes. These analyses showed no detectable concentrations of cellosolves, but did show trace quantities (less than 1% of applicable environmental criteria) of isopropanol, total hydrocarbons, 1,1,1-trichloroethane, and xylene. Short-term personal breathing zone air samples collected to assess potential employee exposures to cyclohexanone during the plate making process showed no detectable concentrations. ==

Ventilation measurements showed that 0.8 cubic feet of air per minute per square foot of floor space (cfm/ft²) were supplied to the print room. This is approximately 160% of the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) recommendation of 0.5 cfm/ft² for duplicating and printing rooms.

On the basis of the data obtained during this investigation, it was determined that airborne concentrations of the chemical substances measured during the survey did not present a health hazard to the print room employee. Recommendations are included in Section VIII of this report.

Key Words: SIC 8661 (Religious Organizations), printing press, solvents, cyclohexanone, cellosolves, isopropyl alcohol

II. INTRODUCTION

On May 6, 1984, the National Institute for Occupational Safety and Health (NIOSH) was requested by the management to conduct a health hazard evaluation at Pioneer Ministries, Wheaton, Illinois. The request was prompted by a former employee's complaints of headaches and numbness in the hands which were believed to be related to solvent usage in the print room.

On June 5, 1984, NIOSH investigators conducted an initial survey of the facility. Ventilation measurements were taken, an inventory of all chemicals used in the print room was conducted, material safety data sheets were collected, and the print room employee and a former print room employee were interviewed.

On October 30, 1984, an environmental survey of the facility was conducted and on February 26, 1984, a letter was sent to the management notifying them of the sample results.

III. BACKGROUND

A. Plant Production and Workforce

Pioneer Ministries is a non-denominational religious organization which provides week-day clubs and camping programs to churches throughout the United States and Canada. The facility was built approximately 11 years ago and at the time of these surveys Pioneer provides employment for approximately 40 persons; two production personnel, one maintenance worker, and the remaining personnel were involved in the administration of programs. The print room is located on the first floor in the northwest corner of the building and the room covers an area about 19 feet by 23 feet. At the time of these surveys only one employee worked in the print room. Prior to this survey a second print room employee quit due to health problems which he believed to be work related.

B. Process Description and Employee Duties

Plate making, printing, and assembly of printed materials are the major duties of the print room employee. The plate making process involves making a negative and transferring the image to a metal plate using various developers, fixers and lacquers. Most chemicals used in the process were transferred from containers to reservoirs and were not handled directly. Small quantities of the fixer and lacquer were applied to the metal plate by hand using a cotton cloth, a process which took less than five minutes to complete. On the day of the environmental survey more plates were made than normal and the process took about one hour to complete. Normally, about one half hour would be needed to prepare the plates.

Completed plates are mounted on the press for printing. When the press is activated, the plates are alternately dampened with water and charged with ink. This transfers the image to a rubber blanket mounted on an adjacent cylinder which in turn transfers the image to paper passing between the blanket cylinder and the impression cylinder. Rubber based inks and fountain wash are added to the press reservoirs as needed. Occasionally, other wash solutions are used for cleaning the blankets and rollers during a run and following the completion of a run and are applied by hand using a cotton cloth.

In addition to plate making and running the press, the print room employee spends most of the day doing a variety of tasks related to the assembling (collating, binding, etc.) of printed materials which do not require the use of any chemical formulations.

C. Engineering, Administrative, and Personal Protective Controls

Ventilation for the print room is supplied by the building's heating, ventilating, and air-conditioning (HVAC) system. Gloves supplied by the ink manufacturer were available but were not required by the employer or used by the press operator when running the press or when using the fountain wash. Most chemicals used in the printing process are transferred from containers to reservoirs, therefore, the print room employee has very limited skin contact with the chemicals used in the process.

IV. EVALUATION DESIGN AND METHOD

During the initial survey, ventilation measurements were taken to determine the amount of make-up air being supplied to the printing room and the amount of air being exhausted. Additionally, an inventory of all chemical substances used in the print room was conducted and material safety data sheets were collected for all these substances.

During the environmental survey bulk samples of the fountain solution and the printing ink were collected for qualitative analysis, a general area air sample was collected for qualitative analysis, and personal samples were collected near the breathing zone of the print room employee. General area and personal samples were collected using battery powered sampling pumps attached via tygoné tubing to charcoal tubes which served as the collection media. The general area air sample was placed in the center of the print room and sampled at a flow rate of 200 cubic centimeters per minute (cc/minute) throughout the work shift. This sample was analyzed qualitatively via gas chromatography/mass spectrometry for identifiable organic compounds. Two personal samples were collected near the breathing zone of the print room employee for approximately four hours each at a flow rate of 50 cc/minute and were analyzed via gas chromatography for organic substances identified on the general area air sample and in the bulk samples. Two short term

(15-minute) personal samples were also collected to assess the potential for exposure to cyclohexanone during the plate making process. Additionally, direct reading detector tubes were used to screen for acetic acid, carbon dioxide, carbon monoxide, hydrocarbons, and toluene.

V. EVALUATION CRITERIA

A. Environmental Criteria

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. These criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, a pre-existing medical condition, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are often not considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor/Occupational Safety and Health Administration (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is required by the Occupational Safety and Health Act of 1970 (29 USC 651, et seq.) to meet those levels specified by an OSHA standard.

A time weighted average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8 to 10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high, short-term exposures.

B. Toxicity

A summary of the potential adverse health effects and the applicable evaluation criteria for substances for which air samples were collected are provided in Table 1.

VI. RESULTS AND DISCUSSION

Ventilation measurements showed that 0.8 cubic feet of air per minute per square foot of floor space (cfm/ft²) were supplied to the print room. This is approximately 160% of the American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) recommendation of 0.5 cfm/ft² for duplicating and printing rooms.¹

Qualitative laboratory analysis of bulk samples showed that the fountain solution being used contained isopropanol, cellosolve, and butyl cellosolve as major components, plus smaller amounts of other glycols or glycol ethers, an adipate, and a phthalate. The bulk sample of the rubber based printing ink showed that it contained a series of unresolved aliphatic compounds, plus butylated hydroxytoluene (BHT). Qualitative analysis of the general area air samples collected in the print room throughout the day showed the presence of isopropanol, 1,1,1-trichloroethane, xylenes, various C₈-C₁₀ aliphatics, and C₉H₁₂ aromatics.

Based on the results of these analyses, personal samples collected near the breathing zone of the print room employee were analyzed and quantitated for isopropanol, 1,1,1-trichloroethane, xylenes, cellosolves, and total hydrocarbons. This analysis showed no cellosolves above the analytical limit of detection of 5 micrograms (ug) per sample while trace quantities (less than 1% of applicable environmental criteria) of 1,1,1-trichloroethane, xylene, isopropanol, and total hydrocarbons were detected. Short-term (15-minute) personal breathing zone air samples collected to assess potential employee exposures during the plate making process showed no cyclohexanone above the analytical limit of detection of 5 ug/sample.

There is no evidence in the available medical literature which suggest that the airborne contaminants detected, during these surveys, could produce the symptoms complained of by this former employee.

VII. CONCLUSION

Based on the environmental sample results, the ventilation measurements, and available toxicological information collected during these surveys, it was concluded that a health hazard did not exist from exposure to the various chemical substances used in the printing process at Pioneer Ministries.

The airborne contaminants measured in the print room were below any existing exposure criteria and would not be expected to result in a significant health risk nor would they account for the symptoms exhibited by the former employee. A few products used in this printing process do contain chemicals which are absorbed through skin contact and therefore, appropriate measures should be taken to prevent skin contact when using these products.

Solvents and inks are the primary chemicals to which the print room employee would be exposed. The employee may be exposed to solvents and inks during transfer of materials from larger containers to smaller containers or reservoirs. Solvents continuously evaporate from the ink and fountain troughs or when container covers are not in place. Manual cleaning of blankets and rollers with solvent soaked rags would also be a significant source of exposures.

VIII. RECOMMENDATIONS

1. The print room employee should be advised of the potential health implications of exposure to the various chemical formulations used in the area and the correct handling procedures (e.g. wear gloves and safety glasses).
2. Cleaning solvents should be used in a manner so as to avoid unnecessary inhalation or skin contact. Protective gloves should be worn when handling solvents, to prevent the possibility of skin contact.
3. Solvent soaked rags should be disposed of properly in covered containers to reduce the escape of solvent vapors to the general workroom area.
4. Safety glasses should be worn in the print room when transferring chemicals from containers to reservoirs to prevent splashes in the eye.
5. Good personal hygiene should be practiced by the print room employee(s). Hands should be washed thoroughly prior to eating or smoking in order to minimize the possibility of ingestion of any materials.
6. Prior to purchasing press room chemical formulations, suppliers should be required to furnish factual and accurate information (material safety data sheets) about the ingredients and their potential toxic effects.

IX. REFERENCES

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X. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report Prepared by: Daniel Almaguer
Industrial Hygienist
NIOSH - Region V
Chicago, Illinois

Environmental Assistance: Richard S. Kramkowski, P.E.
Regional Consultant for OSH
NIOSH - Region V
Chicago, Illinois

Originating Office: Division of Surveillance, Hazard
Evaluations & Field Studies
Hazard Evaluation and
Technical Assistance Branch
Cincinnati, Ohio

Laboratory Analysis: Utah Biomedical Laboratory
Salt Lake City, Utah

XI. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Resources and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Services (NTIS), Port Royal Road, 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 the following:

- A. Pioneer Ministries
- B. U.S. Department of Labor, OSHA - Region V
- C. NIOSH, Region V

For the purposes of informing the affected employees, copies of the report should be posted in a prominent place accessible to the employees, for a period of 30 calendar days.

Table 1
Evaluation Criteria and Health Effects Summary §

Pioneer Ministries
Wheaton, Minnesota
HETA 84-319

Substance	NIOSH	OSHA	ACGIH	Health Effects
Acetic acid	--	10	10 1ft	Vapor may produce irritation of eyes, nose, throat, and lungs. ²
Aromatic hydrocarbons (e.g. xylene)	100 200*	100	100 1ft	There is a wide spectrum of acute and chronic health effects from these compounds, including mucous membrane irritation, dermatitis secondary to defatting of the skin, central nervous system depression and in some cases liver dysfunction. Most commonly used aromatic solvents such as toluene and xylene do not seem to produce any serious long-term health effects. ³
Cyclohexanone - skin	25	300	25 1ft	Vapor may cause eye, nose, and throat irritation; repeated or prolonged skin contact may cause irritation or dermatitis. Animal studies have shown the ability of cyclohexanone to produce liver and kidney damage in rabbits on prolonged exposure. ⁴
2-butoxyethanol (2-BE) (butyl cellosolve) - skin	LFL	50	25 7ft	See health effects for 2-EE

(continued on next page)

Table 1
(Continued)

Substance	NIOSH	OSHA	ACGIH	Health Effects
2-ethoxyethanol (2-EE) (cellosolve) - skin	LFL	200	5	2-EE has caused significant increases of adverse reproductive effects in experimental animals of both sexes. The cellosolves may cause upper respiratory tract irritation and has been shown to cause lung and kidney injury in laboratory animals. ⁵
Isopropyl alcohol	400	400	400 500†	Short-term exposure to high concentrations may cause mild irritation of the eyes, nose, and throat. Drowsiness, headache, and incoordination may also occur. Dermatitis may result from repeated or prolonged skin contact. ⁶
1,1,1-trichloroethane	350	350	350 400*	Short-term exposure may cause eye irritation and central nervous system depression. Dermatitis may result from repeated or prolonged skin contact. ⁶

Skin - indicates the potential for skin absorption.

LFL - lowest feasible level

† - Short-term exposure limit for a 15 minute period.

* - Ceiling limit for 10 minute period.