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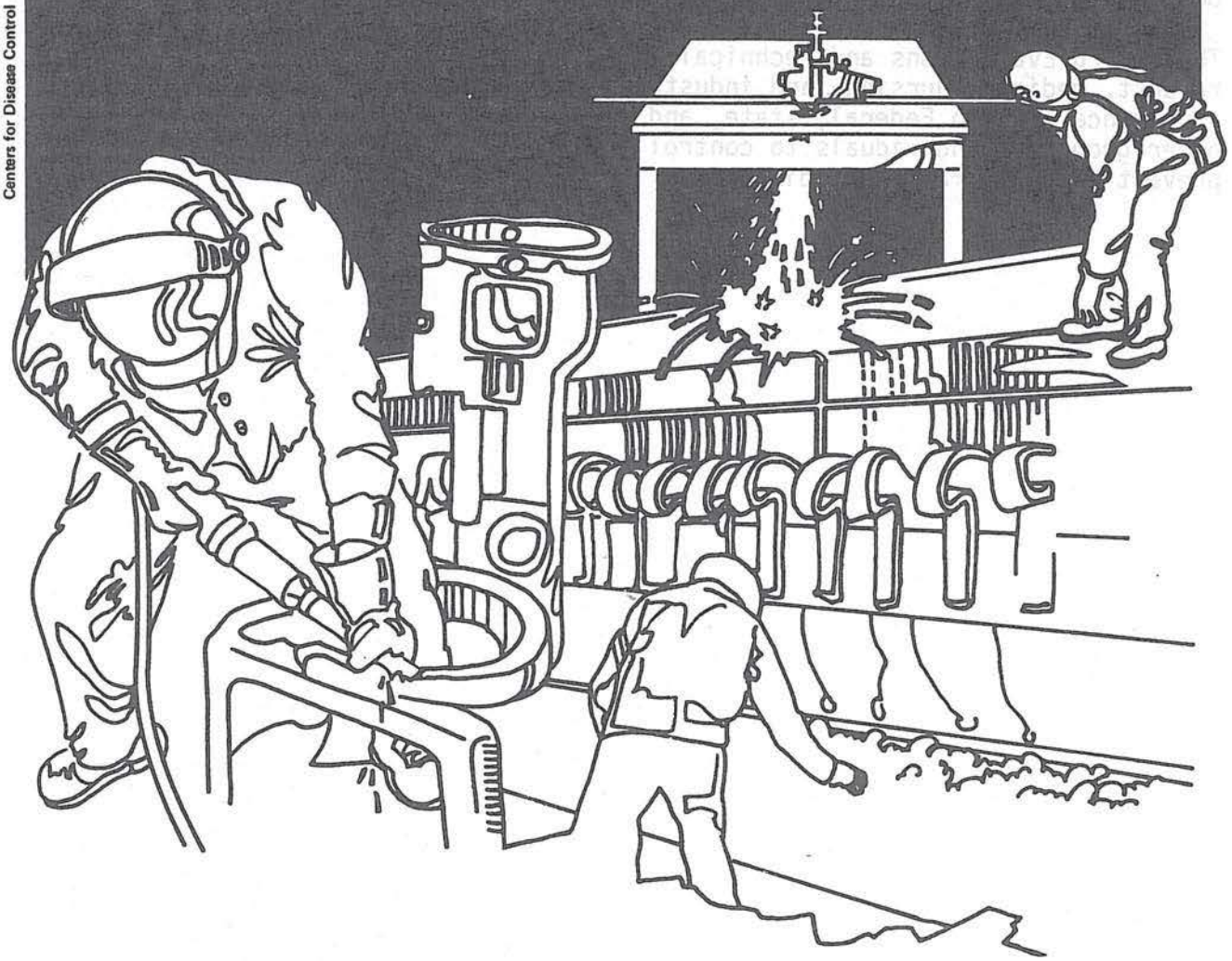

Health Hazard Evaluation Report

HETA 81-311-1139
REPORTER PRINTING COMPANY
FOND DU LAC, WISCONSIN

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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REPORTER PRINTING COMPANY
FOND DU LAC, WISCONSIN

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I. SUMMARY

In April 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Neenah-Menasha Printing Pressmen and Assistants Union, Local 298, to conduct a health hazard evaluation at the Reporter Printing Company, Fond du Lac, Wisconsin. The requestor was concerned with possible adverse health effects resulting from chemical exposures in the pressroom, particularly in the photographic plate burning area.

In June 1981, NIOSH investigators conducted an initial survey of the facility. In September 1981, an environmental survey was conducted during which personal breathing zone and area air samples for acetic acid, cyclohexanone and butyl cellosolve and bulk material samples for polynuclear aromatic hydrocarbons (PNA's) and benzene were collected from the pressroom. In addition, medical questionnaires were administered to the pressroom employees.

Results of the environmental samples indicated that employee exposures in the plate burning area were below the environmental criteria for acetic acid and cyclohexanone. Short term concentrations for acetic acid in personal samples were 0.85 and 0.68 parts per million (ppm), and 8-hour time weighted average (TWA) concentrations were 0.12 and 0.04 ppm (ACGIH Short Term Exposure Limit 15 ppm; OSHA 8-Hour TWA 10 ppm). Short term concentrations for cyclohexanone in personal samples were 1.10 and 0.89 ppm, and 8-hour TWA concentrations were 0.15 and 0.05 ppm (ACGIH Short Term Exposure Limit 100 ppm; NIOSH 10-hour TWA 10 ppm).

Analysis of bulk material samples indicated that no PNA's were present in the black printing ink, and that no benzene was present in the solvent mixture used in press cleaning operations.

Medical interviews with the employees did not identify any health problems which could be associated with current workplace exposures.

On the basis of the data obtained in this investigation, NIOSH has determined that no hazard to pressroom employees existed due to exposures in the plate burning area or pressroom at the time of this survey. To reduce the possibility of future exposures, recommendations are included in Section VIII of this report.

KEY WORDS: photographic plate processing, printing, pressmen, PNA's, SIC 2711

II. INTRODUCTION

On April 23, 1981 a representative of the Neenah-Menasha Printing Pressmen and Assistants Union, Local 298, requested a NIOSH health hazard evaluation at the Reporter Printing Company, Fond du Lac, Wisconsin. The requestor was concerned with possible adverse health effects from exposure to the various substances used in the pressroom. A particular concern was expressed with substances used in the photographic plate burning area.

On June 16, 1981 NIOSH investigators conducted an initial survey visit to the facility. An opening conference was held with representatives of management and the local union, followed by a walk-through inspection of the printing press area. Work practices were observed and data was collected relating to the use of various substances in the pressroom. On September 14-15, 1981 an environmental survey was conducted during which personal and area air samples, and bulk material samples were collected. Results of the environmental survey were transmitted by letter to union and management representatives in February 1982.

III. BACKGROUND

The Reporter Printing Company is a newspaper publishing company with an estimated circulation of 22,500. The company has been at its present location since 1977. At the time of the survey, the company employed approximately 100 workers, 5 of whom were pressmen involved in the operation of the company's offset printing press. Pressroom operations are conducted on a one shift per day basis, 6 days per week, with each employee working approximately 6 and 1/2 hour work days. The age of the pressroom employees ranged from 40-60 years, with an average length of service of 26.5 years.

A. Plate Preparation

Pressroom operations begin with the preparation of the press cylinder plates. In this process, several aluminum plates are coated with a thin film of a light sensitive diazo solution. Each plate, along with a photographic negative of the material which is to be printed, is mounted in a ultraviolet (UV) light etching machine. Once the machine is activated, UV light passes through the transparent areas of the negative and causes the diazo coating on the plate to harden. This results in a transfer of the image from the negative onto the aluminum plate. The plate is then placed in an adjacent machine were it is treated with a solution containing cyclohexanone, 2-butoxyethanol, and acetic acid. Following removal of the unreacted chemicals with a water spray, the plate is removed from the machine. Since the process is mechanical, the operator does not come into direct contact with the chemicals except when initially loading the machine's reservoirs. The entire plate burning process takes approximately 1 hour for a normal run of newsprint and is routinely conducted by one of the pressmen.

B. Offset Press Operation

The prepared plates are next mounted on the press cylinders. 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 it to a web of paper passing between the blanket cylinder and an impression cylinder.

The primary substance used in this process is a black oxidizing offset ink. This ink is composed of petroleum ink oil (containing carbon black), mineral oil, and hydrocarbon resin, with small amounts of asphaltic residue and modified rosins. A variety of other colored inks are used on a limited basis for advertisements or special features, and the color and composition of these inks may vary greatly.

Each operation of the press usually requires 4 employees. The pressroom foreman operates the main press controls located adjacent to the presses. The remaining employees are stationed alongside the automated paper cutting and folding machine located in the center of the presses, to monitor the outcoming newspapers for printing defects. Periodically, these employees make minor adjustment on particular press units as necessary. In addition, these employees are required to reload the press with rolls of paper as necessary, during which time the presses are turned off. On the average, the operation of the press usually takes between 1.5 and 2 hours. Occasionally, more than one press run may occur on a single day in order to print special supplements or editions.

Following the press run, the employees are required to clean the residual ink from the blankets and cylinders. This is accomplished using rags soaked with a blanket and roller wash. The entire cleaning process usually takes approximately 30 minutes.

Ventilation to the area is supplied by the building's general air-conditioning system. Personal protective equipment available to the employees consists of safety glasses and protective gloves.

IV. MATERIALS AND METHODS

An environmental evaluation was conducted in the plate burning room to determine employee exposures to the substances used in this area. Personal samples were collected near the breathing zone of the machine operator, and area samples were collected near the operators work station to assess airborne concentrations of cyclohexanone and 2-butoxyethanol. Samples were collected using battery powered sampling pumps operating at 100 cubic centimeters of air per minute (cc/min) attached via tygon tubing to charcoal tubes which served as the collection media. These samples were analyzed using NIOSH method S-19.[1] Samples for acetic acid were collected in the same manner except that a flow rate of approximately 1.0 liters per minute was used. These samples were analyzed using NIOSH method No. S-169.[2] The dates, locations, and duration of the samples collected are given in Tables 1 and 2.

Due to the relatively short duration of press operation (1.5 to 2 hours), the small amount of time spent by the employees at the operating presses, and the lack of ink mist noted by visual observations, air samples for ink mist were not collected during press operation. Instead, a qualitative

analysis of the materials used in the pressroom was conducted, with emphasis on identification of potential carcinogenic materials or other materials which could present a hazard during the pressroom operations. Bulk samples of two substances most regularly used in the pressroom were collected in order to assess the possible presence of carcinogenic contaminants. A sample of the black oxidizing offset printing ink was analyzed for the presence of 16 EPA priority PNA's (Specific compounds listed in Appendix 1). A bulk sample of the blanket and roller wash was collected and analyzed by gas chromatography/mass spectrometry to characterize its hydrocarbon components and detect the possible presence of benzene.

To assess the possibility of existing work related health problems, medical questionnaires were administered to the employees working in the pressroom. These included questions on the employees work and medical histories.

V. EVALUATION CRITERIA

A. Environmental Criteria

The environmental criteria described below are intended to represent airborne concentrations of substances to which workers may be exposed for eight hours a day, 40 hours per week for a working lifetime 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.[3] A smaller percentage may be more seriously affected by aggravation of a pre-existing condition or by a hypersensitivity reaction. The time-weighted average (TWA) exposure refers to the average concentration during a normal 8-hour workday. The Short-Term Exposure Limit (STEL) is the maximum allowable concentration, or ceiling, to which workers can be exposed during a period of up to 15 minutes, provided that no more than four excursions per day are permitted, with at least 60 minutes between exposure periods.

The primary sources of environmental evaluation criteria considered for this study were: 1) NIOSH criteria documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's),[3] and 3) the U.S. Department of Labor (OSHA) federal occupational health standards.[4] The criteria judged most appropriate for the substances quantitatively evaluated are marked by an *.

Substance	Short Term Exposure Limits	Source	8 - 10 Hour Time Weighted Average	Source
Acetic Acid	15 ppm*	ACGIH	10 ppm*	OSHA
Cyclohexanone	100 ppm*	ACGIH	25 ppm* 50 ppm	NIOSH[5] OSHA
2-Butoxyethanol (Butyl Cellosolve)	75 ppm*	ACGIH	25 ppm* 50 ppm	ACGIH OSHA

(Note: ppm = parts of contaminant per million parts of air)

B. Toxicity

The adverse health effects from excess exposure (exposures to airborne concentrations above the evaluation criteria) are summarized below. In addition to those substances listed above for which air samples were collected, a brief discussion is provided for other substances which have been commonly associated with newspaper pressroom operations:

1) Acetic Acid - Short term exposure to these vapors can cause irritation of the eyes, nose, throat, and lungs. Repeated or prolonged exposure may cause darkening or irritation of the skin and chronic inflammation of the nose, throat, and bronchial tubes.[6]

2) Cyclohexanone - Short term exposure to concentrations ranging from 50 - 75 ppm have been shown to cause irritation of the throat, eyes, and nose. Long term exposure has been shown to produce liver and kidney damage in tests on laboratory animals.[7]

3) 2-Butoxyethanol - Short term exposure may cause irritation of the skin and upper respiratory tract. Long term exposure can lead to narcosis, pulmonary edema, and severe kidney and liver damage.[6]

4) Carbon Black - Exposure may cause both transient and permanent lung damage and skin irritation. Carbon black may often contain significant amounts of PNA's.[8]

5) Polynuclear Aromatic Hydrocarbons (PNA's) - PNA's or Polycyclic Aromatic Hydrocarbons (PAH's) are terms used to refer to a class of aromatic hydrocarbon products found in crude petroleum, coal tars, and the combustion products of most organic materials. Many PNA's have been shown to be carcinogenic. The formation of PNA's can occur during the manufacture of carbon black. PNA's may then adhere to the carbon black and subsequent occupational exposure to the carbon black may pose a significant carcinogenic risk.[8,9]

6) Mineral Oil Mist - Many studies have shown pure mineral oil mist to be relatively nontoxic. However, in some instances mineral oil has been shown to contain certain carcinogenic impurities, and the current ACGIH TLV of 5 milligrams per cubic meter may not adequately protect against these effects.[7]

7) Aromatic Hydrocarbon Solvents - In general, the vapors from aromatic hydrocarbons can cause central nervous system depression and irritation of the mucous membranes, usually to a degree proportional to their molecular weight. In addition, repeated or prolonged skin contact may cause a defatting of the skin, which leads to dermatitis. Benzene, however, possesses a toxicity quite different from that of the other members of the aromatic hydrocarbon family. Chronic exposure to benzene has been shown to cause aplastic anemia and leukemia. NIOSH recommends that benzene should be considered a human carcinogen and emphasis should be placed on prohibiting its use as a solvent in open type operations.[7,9,10]

VI. RESULTS

A. Plate Burning Room

Results of the environmental samples collected during the plate burning process indicated that employee exposure was below the environmental criteria used for this study. Short term concentrations for acetic acid were 0.85 and 0.68 ppm for personal samples, and 0.73 and 0.74 ppm for area samples. Eight-hour TWA concentrations for acetic acid were 0.12 and 0.04 ppm for personal samples, and 0.10 and 0.05 ppm for area samples. Short term concentrations for cyclohexanone were 1.10 and 0.89 ppm for personal samples, and 0.82 and 0.96 ppm for area samples. Eight-hour TWA concentrations for acetic acid were 0.15 and 0.05 ppm for personal samples, and 0.11 and 0.06 ppm for area samples. No 2-butoxyethanol was detected in the samples above the limit of detection of 0.01 milligram per sample. A complete listing of the results is provided in Tables 1 and 2.

B. Pressroom

No PNA's were found above the limit of detection of about 0.1 ppm for the 16 PNA's for which the bulk sample of the printing ink was analyzed.

Analysis of the blanket and roller wash revealed the composition of the solvent to be primarily aromatic compounds with a molecular weight of 120 (trimethyl benzenes, methyl ethyl benzenes, etc.). Small amounts of 2-butoxyethanol, toluene, xylene, a few C_9-C_{12} alkanes and aromatic compounds of a molecular weight of 134 (tetramethyl benzenes, diethyl benzenes, etc.) were also detected. No benzene was detected in the sample.

C. Medical Interviews

The results of the employee questionnaires revealed no health problems which could be directly related to current workplace exposures, although some general health problems were noted.

VII. DISCUSSION AND CONCLUSIONS

Several epidemiological studies have indicated that there may be an increased risk of certain forms of cancer among pressroom workers in the printing trades.[11] A brief summary of some of the major studies and findings follows:

A study of the printing trades workers in Manchester and London, England by Moss, Scott, and Atherly found the percentages of excess deaths from cancer of the lung and bronchus to be 103% for pressroom workers at the Manchester newspapers, and 24% for pressmen at the London newspapers.[12]

A separate study of workers at a London newspaper which had been included in the aforementioned study was conducted by the British Department of Productivity and Unemployment. Their findings included a 20% increase in cancer mortality and a 33% increase in deaths from bronchogenic carcinoma in printing workers.[13]

A study of United States newspaper workers by Lloyd, Decoufle and Salvin found increases in cancer mortality, especially from cancer of the oral cavities of pressmen under the age of 55. In addition, small increases were seen in cancer of the lung and bronchus.[14]

A study of Los Angeles pressmen by Pagnanini-Hill, Glazer, Henderson, and Ross showed elevated risks of death from leukemia and cancer of the kidney, lung, and trachea.[15]

Although limitations based on study design and the amount of information available in these epidemiological studies do not allow for definitive conclusion to be made regarding the degree of cancer risk to pressmen, there does appear to be consistent findings of certain forms of cancer in almost all of the studies, e.g. lung cancer and cancer of the buccal cavity and pharnyx.[11] In addition, the presence of a number of potentially carcinogenic substances have been identified in printing pressrooms. These include the mineral oil-carbon black ink mists (possibly containing PNA's), solvents used in a variety of operations (i.e. benzene), and a number of dyes and pigments used in printing inks (i.e. chromates). In order to identify the specific etiologic factors responsible for the possible increase in certain forms of cancer among pressmen, further in-depth environmental, medical, and epidemiological studies must be conducted.[14]

Based on the environmental samples collected during this survey, no substances were identified in the pressroom or plate burning operations which would pose a health hazard to employees under the conditions observed during this survey. In view of the long length of pressroom employment, it is possible that in the past, some employees may have been exposed to excessive concentrations of a variety of substances utilized in previous pressroom operations, some which may have been potentially carcinogenic. However, due to the relatively short duration of press operation, the low levels of mist generated by an offset press compared to presses used in the past, and the absence of identifiable PNA's in the carbon black containing printing ink, further risk of exposure to carcinogenic agents appears to have been greatly reduced.

VIII. RECOMMENDATIONS

1) Since a variety of colored printing inks containing various pigments are utilized on occasion, workers should exercise caution in handling these substances to avoid inhalation, skin contact, and possible inadvertent ingestion of the ink or its mist; particularly when working with inks which may contain lead or chromates.

2) Cleaning solvents should be used in a manner so as to avoid unnecessary inhalation or skin contact. Protective gloves or barrier creams should be utilized when possible to prevent the possibility of dermatitis. However, extreme care should be taken when using gloves around any moving machinery, e.g. when jogging presses. Solvent rags should be disposed of properly in covered containers to reduce the escape of solvent vapor into the work area.

3) Good personal hygiene should be encouraged among pressroom employees. Hands should be washed thoroughly prior to eating or smoking in order to minimize the possibility of ingestion of any materials.

4) Company plans to increase ventilation supply to the plate making room should be carried out. This should serve to further reduce the possiblility of mucous membrane irritation to the employee working in this area.

5) The company should continue to purchase pressroom materials which are free of recognized carcinogenic agents such as PNA's or benzene.

IX. REFERENCES

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X. AUTHORSHIP AND ACKNOWLEDGEMENTS

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XI. DISTRIBUTION AND AVAILABILITY

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Copies of this report have been sent to:

1. Reporter Printing Company

2. Neenah/Menash Printing Pressmen and Assistants Union, Local #298

3. OSHA, Region V

4. NIOSH, Region V

For the purpose of informing the 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.

APPENDIX 1

List of EPA Priority Pollutants as Detailed in EPA Method 610

Naphthalene*
Acenaphthalene
Acenaphthene
Fluorene
Anthracene*
Phenanthrene*
Fluoranthene
Pyrene*
Chrysene*
Benz(a)anthracene*
Benzo(a)pyrene*
Dibenz(a,h)anthracene
Indeno(1,2,3-cd)pyrene*
Benzo(g,h,i)perylene
Benzo(b)fluoranthene
Benzo(k)fluoranthene

* Suggested as having some cancer-causing potential

TABLE 1
RESULTS OF ENVIRONMENTAL SAMPLES COLLECTED FOR ACETIC ACID
AT THE REPORTER PRINTING COMPANY
(8/20-21/81)

Sample Date (1981)	Sample Type/ Location	Sample Duration (Minutes)	Sample Volume (Liters)	Short Term Exposure* (ppm)	8-Hour TWA** (ppm)
8/20	Personal/Operator	67	67.0	0.85	0.12
8/20	Area/Plate Room	66	72.6	0.73	0.10
8/21	Personal/Operator	30	30.0	0.68	0.04
8/21	Area/Plate Room	30	33.0	0.74	0.05

TABLE 2
RESULTS OF ENVIRONMENTAL SAMPLES COLLECTED FOR CYCLOHEXANONE
AT THE REPORTER PRINTING COMPANY
(8/20-21/81)

Sample Date (1981)	Sample Type/ Location	Sample Duration (Minutes)	Sample Volume (Liters)	Short Term Exposure* (ppm)	8-Hour TWA** (ppm)
8/20	Personal/Operator	67	6.8	1.10	0.15
8/20	Area/Plate Room	66	6.1	0.82	0.11
8/21	Personal/Operator	30	2.8	0.89	0.05
8/21	Area/Plate Room	30	2.6	0.96	0.06

*Short Term Exposure = This represents the exposure for the duration of the specific operation. Since the conditions affecting employee exposure were constant during the entire sampling period, this value is used to reflect short term or ceiling exposure.

**8-Hour TWA Exposure - This value represents the total exposure to the employee averaged over an 8-hour workday.

ppm - Parts of contaminant per million parts of air.

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