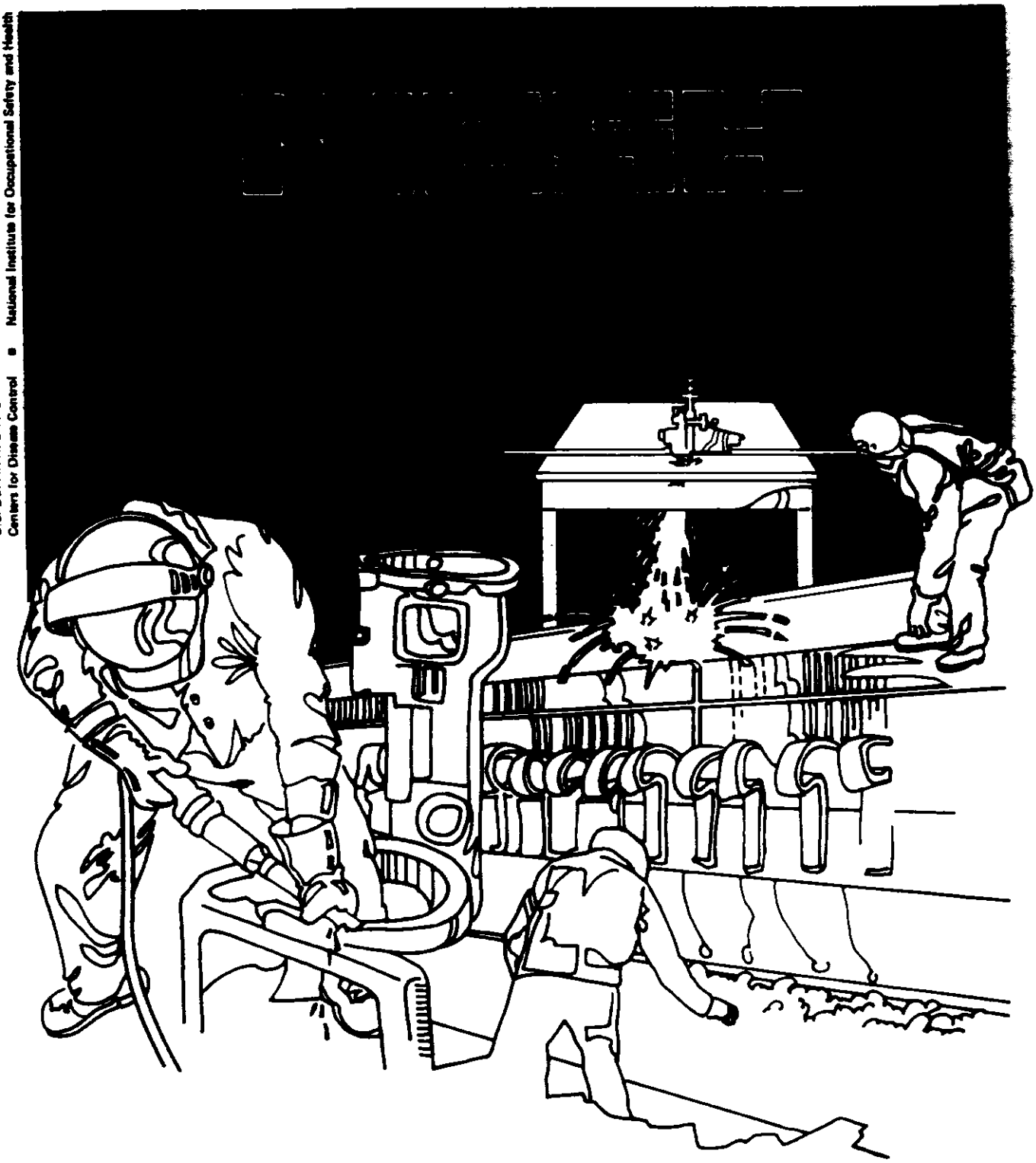
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health



Health Hazard Evaluation Report

HETA 88-236-2090
BOSTON GLOBE
BOSTON, MASSACHUSETTS

The Health Evaluations and Technical Assistance Branch of NIOSH conducts health 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.

BOSTON GLOBE
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I. SUMMARY

In February 1988, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Boston Globe Safety and Health Committee No. 3 to conduct health hazard evaluations at the Boston Globe's Dorchester and Billerica, Massachusetts, newspaper printing plants. The request identified exposures to solvents and inks, and reported the following health concerns: hematuria, bladder cancer, and respiratory, skin, and neuropsychological complaints among pressmen and paper handlers.

In response to this request, a team of NIOSH industrial hygienists conducted initial and follow-up field evaluations in June, August, and November 1988, to assess worker exposures to paper dust, ink mist, and organic solvents. These evaluations were performed during the newspaper production shift and the "make-ready" shift where workers are involved in cleaning, maintenance, and preparation activities for subsequent production shifts.

Results of the personal exposure monitoring for total dust, indicated concentrations ranging from none detected to 0.58 mg/m^3 for employees working primarily on the first and second decks (pressmen, color men, plate handlers), with the exception of one air sample which had a concentration of 9.93 mg/m^3. For employees working below deck (tension men and paper handlers), personal breathing-zone (PBZ) air concentrations of total dust ranged from none detected to 6.60 mg/m^3. All air sampling results for total particulates were below the existing evaluation criteria established by OSHA and ACGIH for total particulates not otherwise classified or regulated. NIOSH has not recommended evaluation criteria for total particulates. Ink mist was not detected on any of the PBZ air samples obtained on five pressroom workers, to a limit of detection of 0.08 mg/m^3.

PBZ concentrations of total naphthas (components of cleaning agents and products used in the pressroom) were higher in air samples obtained during the make-ready shift as expected, as pressroom workers have limited contact with cleaning agents during the production shift. PBZ concentrations of naphthas ranged from 0.5 to 15 mg/m^3 during the production shifts, and from 15 to 105 mg/m^3 during the make-ready shifts. All PBZ results were below the evaluation criteria for naphthas established by NIOSH, OSHA, and ACGIH.

PBZ concentrations of glycol ethers including butoxypropanol, diethylene glycol monobutyl ether (DEGMBE), butoxyethoxypropanol (BEP), dipropylene glycol monomethyl ether (DPGME), and ethylene

below guidelines established by OSHA and ACGIH, where applicable. While NIOSH has not developed specific criteria for the glycol ethers evaluated in this survey, NIOSH recommends that those glycol ethers such as EGMBE which are structurally related to 2-ethoxyethanol or 2-methoxyethanol be reduced to the lowest extent possible.

While overexposures to organic solvents were not documented during the NIOSH surveys, the potential for significant dermal exposure to organic solvents, particularly glycol ethers, was identified. Recommendations regarding local exhaust ventilation, work practices, and the use of personal protective equipment are included in the Recommendations Section of this report to further reduce airborne and dermal exposures to naphthas and glycol ethers. Additional recommendations are offered concerning general work place safety issues.

KEYWORDS: SIC 2711 (Newspapers: publishing and printing), 2752 (Offset printing), ink, naphtha, glycol ethers, paper dust.

II. INTRODUCTION

In response to a request received from a joint union-management committee at The Boston Globe, NIOSH conducted health hazard evaluations at the Globe's Dorchester and Billerica, Massachusetts, newspaper printing plants. The health hazard evaluation request was initiated as a result of a union-based questionnaire survey which indicated several cases of hematuria, a case of squamous cell cancer of the bladder, as well as skin, respiratory, and neurological complaints among pressman and paper handlers. NIOSH was asked to provide an industrial hygiene characterization of the workplace, and to coordinate the environmental evaluation with medical evaluations performed by investigators at the Harvard School of Public Health (HSPH) and Mt. Sinai.

In June 1988, an initial walk-through survey was conducted at the Dorchester and Billerica newspaper printing plants. On August 4-8, 1988, a site visit was made to the two plants to conduct environmental monitoring for total and respirable particulates and volatile organic compounds. A follow-up evaluation was conducted in November 1988, to further evaluate worker exposures to particulates, volatile organic compounds (primarily naphthas), oil mist, and glycol ethers. The follow-up exposure assessment was performed in conjunction with the cross-sectional health survey of pressroom workers.

This report includes the data and observations from the environmental surveys and constitutes the final report of NIOSH activities. Recommendations for improving working conditions at these facilities, and for minimizing exposure to various chemical agents and safety hazards, are made in the Recommendation Section of this report. Many of the findings and recommendations discussed in this report have been previously made, in both written and verbal communications. A final report of the descriptive health survey of pressroom workers conducted by the HSPH and Mt. Sinai team was submitted to the health and safety committee on March 22, 1990.

III. BACKGROUND

The main printing plant located in Dorchester has been in operation since 1955, and the Billerica satellite plant since 1984. Prior to 1976, the Dorchester facility used the letterpress printing process. Letterpress involves the use of lead plates with raised-surface letters that pick up the ink and transfer the print directly to the page. Workers were exposed to ink and ink mist generated by the rollers, as well as to clean-up solvents, such as kerosene. After 1976, the presses were converted for use in the dilitho (direct lithography) printing process. Dilithographic printing involves the

use of a chemically treated plate which allows the ink to adhere only to the print image. A wider variety of solvents was needed in this process, for both operation and clean-up of the presses. Between 1979 and 1987 the dilithographic operation was phased out and replaced by offset printing. The Billerica plant has used offset printing since its inception.

Like dilithography, offset printing is a lithographic process; however, it is not a direct printing process. The printed image is transferred to a blanket roller which then transfers the image to an impression cylinder through which continuous sheets of paper are fed. Separate inking and dampening systems are incorporated which allow only the printed image to pick-up ink for transfer to the rollers. The dampening system consists of a water-based fountain solution containing small amounts of glycol ethers. The inking system supplies either black ink, which contains carbon black, or colored inks containing various pigments. Printing inks are composed of pigments dispersed in an oil vehicle and various additives such as resins, drying oils and solvents.

Approximately 500,000 newspapers are printed for the weekday edition and over 750,000 for the Sunday edition of the Boston Globe. At the time of this survey, there were 284 pressroom workers employed at the Boston Globe, 203 at the main facility and 81 at the Billerica facility.

Pressroom workers progress through a series of positions, from entry level positions such as paper handlers and plate handlers, to pressmen. Paper handlers feed paper to the press and plate handlers deliver and remove plates. Tension men are responsible for keeping the press supplied with paper and for leading sheets after a "web" break occurs. Pressmen apprentices are involved in lubricating the presses, plating-up the presses, and splicing new paper rolls to old, while pressmen are responsible for the overall operation of the presses and quality of print. The day crew generally "make-ready" the presses by performing clean-up and maintenance, changing blankets and rollers, and setting up the paper. The night crew are responsible for newspaper production.

IV. INDUSTRIAL HYGIENE EVALUATION

Environmental monitoring was conducted to assess worker exposures to particulates (paper dust), ink (oil) mist, organic vapors (primarily naphthas), and glycol ethers. Sampling was conducted at both plants, during both the production and make-ready shifts.

Particulates

Full-shift personal and area air sampling was conducted to assess particulate exposures during the newspaper production shifts, at both plants. Five micron (um) pore size polyvinyl chloride (PVC) filters and calibrated, battery-operated sampling pumps operating at flowrates of 2 liters per minute (lpm) and 1.7 lpm were used to collect total and respirable particulates, respectively. Sampling and analysis were performed in accordance with NIOSH Method 0500 for total particulates and NIOSH Method 0600 for respirable particulates.[1] A total of 68 air samples were collected on November 20-22, 1988 at the Dorchester plant and on November 25, 1988 at the Billerica plant, including 38 personal breathing zone air samples and 30 general area air samples.

Ink (Oil) Mist

Seventeen of the particulate samples described above were further analyzed for mineral oil content, as mineral oil is a major component of newspaper printing inks. Previous studies have shown that ink misting can occur in newspaper printing plants as a result of the high speeds attained during printing (50,000 to 60,000 impressions per hour). Following a gravimetric analysis to determine the total mass of particulates collected, filter samples were analyzed for mineral oil content using NIOSH Method 5026.[1] Filter samples were extracted with freon-113 and the extracts analyzed by infrared spectroscopy. Bulk samples of the black inks in current use at the two plants were used as standards. The bulk ink samples were extracted with freon-113 and filtered, to obtain the mineral oil fraction. Samples which appeared to have a black color, indicating the possible presence of black ink, were selected for analysis along with area air samples collected adjacent to the ink rollers which were expected to have the highest ink mist concentrations.

Organic Vapors

A variety of organic solvents are used as cleaning agents and wash solutions in the press room, including Auto Wash Globe B, Cleansall, Solvent Type 1, and kerosene. These substances all contain naphthas. Preliminary air sampling was conducted in the pressroom area and in the "slop" and ink rooms at the two plants to identify components which were present. Area air samples were collected on activated charcoal tubes using low-flow personal air sampling pumps. Qualitative analysis of these samples using a gas chromatograph equipped with a mass selective detector (GC-MSD) indicated that the air samples contained primarily aliphatic hydrocarbons in the C_9 to C_{14} range, with small amounts of C_9 to C_{10} aromatics, toluene, and xylene. Limonene and alpha-terpineol (components of Cleansall) were

also found on some air samples, particularly those collected in the slop room. Based on the results from this preliminary work, personal breathing zone and general area air samples were quantitatively analyzed for total naphthas. Full-shift air samples were collected at both plants, during the production and make-ready shifts. These air samples were also collected on activated charcoal tubes using calibrated, personal sampling pumps operating at flowrates of 50 milliliters per minute (ml/min) or 100 ml/min.

Twelve air samples, 10 personal breathing zone and two general area air samples were obtained on August 5, 1988, at the Dorchester plant during the make-ready shift. Activities performed during this shift include cleaning rollers, cleaning "chips" (removing the accumulated sludge from within the presses), washing the surfaces of the presses, and "sucking pans" (vacuuming waste ink from the trays). Exposure monitoring was also conducted for naphthas at the Billerica plant during the make-ready shift on November 28, 1988. A bulk sample of stoddard solvent was used as a standard for these analyses, as results from preliminary GC-MSD analyses indicated that this sample was representative of the naphthas present on the air samples. Of the 14 air samples analyzed, 12 were personal breathing-zone air samples and two were general area air samples. On November 20-21, at the Dorchester plant, and November 25, at the Billerica plant, a total of 39 air samples were collected for naphthas during the production shifts. This included 32 personal breathing-zone and seven area air samples.

Glycol Ethers

Glycol ethers are present in small amounts (<10%) in some fountain solutions and cleaning agents used at the Boston Globe, including All Purpose Cleaner, Alkaline Fountain Solution, LPC Plate Cleaner, and Autowash Globe B. The following glycol ethers were identified in bulk samples, and were later quantified in air samples obtained at the two plants: butyl cellosolve, butoxypropanol, diethylene glycol monobutyl ether, butoxyethoxypropanol, and dipropylene glycol monomethyl ether. Preliminary air sampling indicated that the presence of naphthas interfered with the analysis of glycol ethers by gas chromatography using conventional flame ionization detection (GC-FID). To minimize these interferences and maximize selectivity, an experimental multidimensional GC-MSD-SIM technique was used. SIM (selective ion monitoring) is a technique in mass spectrometry whereby only a few selective ions known to be present in the compounds of interest are scanned and all other ions present are not measured. Air samples were collected on activated charcoal tubes, using personal sampling pumps calibrated at 50 to 100 ml/min. Nine samples, including four personal breathing-zone and five general area air samples were obtained on

August 5 and 8, 1988, at the Dorchester plant. Air sampling also was conducted on the follow-up survey during both production and make-ready shifts. Eight air samples were collected including seven area samples and one personal breathing-zone air sample.

V. EVALUATION CRITERIA

A. General

As a guide to the evaluation of the hazards posed by work place exposures, NIOSH field staff employ environmental evaluation criteria for the 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 work place exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled to the level set by the evaluation criterion. These combined effects are not often considered by 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 work place are: 1) NIOSH Criteria Documents and Recommended Exposure Limits (RELs), 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLVs), and 3) the U.S. Department of Labor (OSHA) Permissible Exposure Limits (PELs). The OSHA PELs may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH-recommended exposure limits, by contrast, are based primarily on concerns relating to the prevention of occupational disease. When considering the exposure levels and the recommendations for reducing the levels found in this report, it should be noted that industry is legally required to meet those levels specified by an OSHA PEL.

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. Substance Specific Evaluation Criteria

Evaluation criteria for specific substances evaluated in this survey are listed below along with a discussion of primary health effects.

Paper Dust

Cellulose (paper) dust is considered a nuisance dust. The current OSHA PEL for nuisance dust (particulates not otherwise regulated) is 15 mg/m^3 for total dust and 5 mg/m^3 for respirable dust. These criteria were established to minimize mechanical irritation of the eyes and nasal passages, and to prevent visual difficulties. NIOSH has not developed specific criteria for total and respirable particulates.

Newsprint Inks

Over the years, many changes have been made in newsprint ink formulations in an effort to achieve quicker drying, less misting, and better print quality. However, the major components still include an oil vehicle (generally mineral oil although soybean-based inks are now being introduced), carbon black or colored pigments, varnishes, and wetting agents. Concerns regarding pressroom worker exposures have focused on ink mists, as some epidemiological studies have suggested an excess mortality among pressmen from cancers of the respiratory tract.[2-5] Of concern, were the mineral oil and carbon black components, as well as various pigments that may be present in colored inks.

Mineral oils can contain a complex mixture of aromatic, naphthenic, and straight- or branched-chain paraffinic hydrocarbons. The composition of a given oil is dependent on the type and degree of processing of the oil. In general, the more extensive the processing of the oils the better the removal of the aromatic fraction, which contain polycyclic aromatic hydrocarbons (PAHs), substances which are considered potential carcinogens. Unfortunately, there is little information reported concerning the type of oil, carbon black, or additives used at the printing plants where previous epidemiological studies were conducted. Carbon

black has been shown to adsorb PAHs, and extracts of carbon black have shown carcinogenic activity. The type of production method used is thought to affect the PAH content of the carbon black. The significance of the mineral oil component of newsprint inks in converting the carbon black-associated PAHS into solution is not known at this time.

Environmental evaluation criteria for mineral oil mist have been established by OSHA and ACGIH, at 5 mg/m^3 as 8-hour TWAs. These criteria were established to minimize respiratory irritation and pulmonary effects. NIOSH has not established a REL for oil mist. The current NIOSH REL for carbon black is 3.5 mg/m^3 as a 10-hour TWA and, where PAHs are present, 0.1 mg/m^3. The OSHA PEL for carbon black is 3.5 mg/m^3 as an 8-hour TWA. Worker exposures to carbon black were not directly evaluated during this survey.

Naphtha-Based Solvents

As previous mentioned, several of the wash solutions and cleaning agents used at the Boston Globe contain naphthas as a major component. Naphtha is a general term which refers to a non-uniform blend of petroleum hydrocarbons containing aliphatic and aromatic components. The solvents used at the Globe vary in their aromatic content as well as in the predominant hydrocarbon species. Overexposure to naphthas can result in dizziness, drowsiness, headache, and nausea. Naphthas can also cause irritation of the eyes, throat, and skin.[6] Prolonged skin exposure also may result in drying and cracking of the skin as a result of the defatting action of these substances.

Environmental evaluation criteria have been established by OSHA and ACGIH for stoddard solvent, which contains predominantly C_9 to C_{12} hydrocarbons, and for VM&P naphtha which contains predominantly C_7 to C_{11} hydrocarbons, both having an aromatic content less than 20%. The OSHA PELs and ACGIH TLVs are 525 mg/m^3 and 1350 mg/m^3 as 8-hour TWAs, for stoddard solvent and VM&P naphtha, respectively. NIOSH has established an REL for petroleum distillates (VM&P naphthas, mineral spirits, and stoddard solvent, having an aromatic content less than 20%) of 350 mg/m^3 as a TWA for up to a 10-hour workshift. NIOSH recommends that exposures to kerosene, which contains predominantly C_9 to C_{16} hydrocarbons, not exceed a TWA of 100 mg/m^3 for up to a 10-hour workshift.

Glycol Ethers

Airborne exposures to several glycol ethers were measured during this survey as a result of their presence in fountain solutions and cleaning agents used at the Globe. The glycol ethers evaluated

include butyl cellosolve, also known as ethylene glycol monobutyl ether (EGMBE), dipropylene glycol monomethyl ether (DPGME), butoxypropanol, butoxyethoxypropanol, and diethylene glycol monobutyl ether (DEGMBE). These substances are commonly used in offset printing since they are soluble in water and organic solvents.

Of the glycol ethers listed above, environmental evaluation criteria are only available for EGMBE and DPGME. EGMBE is an eye and mucous membrane irritant and has resulted in hematuria and kidney damage in animals.[7] Exposure can occur through inhalation, as well as skin absorption. The current OSHA PEL and ACGIH TLV for EGMBE is 120 mg/m^3 as an 8-hour TWA. Overexposure to DPGME can also result in irritation of the eyes, nose and throat, and high concentrations (6000 mg/m^3) have resulted in central nervous system impairment.[8] The OSHA PEL and ACGIH TLV for DPGME are both set at 600 mg/m^3 as 8-hour TWAs. NIOSH has not established environmental evaluation criteria for these glycol ethers. However, in the 1983 Current Intelligence Bulletin on glycol ethers, NIOSH recommends that concentrations of glycol ethers such as EGMBE, which are structurally related to 2-methoxyethanol and 2-ethoxyethanol, be reduced to the lowest extent possible as their potential for causing reproductive effects has not been adequately evaluated.[9]

VI. RESULTS AND DISCUSSION

Personal breathing zone air sampling results for total particulates are shown in Table 1. Particulate concentrations ranged from none detected to 6.60 mg/m^3 for employees working below deck, which includes tension men and paper handlers. The highest concentrations were obtained on tension men at 6.60 mg/m^3, 4.60 mg/m^3, and 3.91 mg/m^3. These workers are responsible for keeping the press supplied with paper and for leading sheets after a web (paper) break occurs. Not surprisingly, the concentration of total particulates in air samples obtained on the paper handlers, who work away from the presses, were all less than 0.4 mg/m^3. Total particulate concentrations obtained on employees working primarily on the first and second decks (pressmen, colormen, plate handlers, packer men) ranged from none detected to 0.58 mg/m^3, averaging 0.13 mg/m^3, with the exception of a single air sample which had a concentration of 9.93 mg/m^3. This air sample was obtained on a packer man. Packer men are responsible for watching the folders and for leading sheets after the web breaks.

Area air sampling results for total and respirable particulates are shown in Table 2. The concentration of total particulates ranged from 0.18 mg/m^3 to 6.12 mg/m^3 on the first deck, with the highest

concentrations (4.95 mg/m^3 and 6.12 mg/m^3) obtained near the folders, directly beneath the paper cutters. The amount of time that pressroom employees spend in this area is generally limited to start-up and shut-down of the presses, making adjustments/repairs on the presses, and when obtaining copies of the newspaper for inspection. The presence of the new fully-enclosed quiet rooms, which contain the press control panels, has substantially reduced the amount of time that pressmen must spend near the presses. Area air samples obtained in the reel room ranged from 0.10 mg/m^3 to 0.55 mg/m^3, with the highest concentration obtained beneath a folder. Respirable particulate air samples obtained near the folders had concentrations less than 0.1 mg/m^3, representing less than 10 percent of the total particulate mass collected on side-by-side total particulate samples. The particulate air sampling results obtained during this survey were all below the environmental evaluation criteria for nuisance dust, which includes cellulose (paper) fiber.

Because the particulate air samples may have contained ink mist in addition to paper dust, some of the particulate samples were further quantitated for mineral oil content, as mineral oil is one of the major components of newsprint inks. These samples are listed in Table 1. No mineral oil was present on the five personal breathing zone air samples analyzed, to a limit of detection of 40 to 60 micrograms per sample. This corresponds with airborne concentrations of mineral oil mist less than 0.08 mg/m^3. Of the 12 area air samples analyzed, only 6 had detectable levels of mineral oil mist, however, the concentrations were all quite low (0.07 mg/m^3 to 0.10 mg/m^3), with all values falling between the limit of detection and the limit of quantitation. In an effort to obtain samples indicative of worst-case exposures, area air samples were collected within a few feet from the presses. The results indicate that the inks in current use generate very little ink mist at the current operating conditions of the presses. Due to the limited amount of time that the pressmen currently spend in this area, potential exposure to ink mist is considered minimal. All results were well below the OSHA PEL and ACGIH TLV for mineral oil mist, both set at 5 mg/m^3.

During the make-ready shifts, personal breathing zone concentrations of naphthas ranged from 15 mg/m^3 to 105 mg/m^3, with the highest concentrations (105 mg/m^3 and 75 mg/m^3) obtained on employees who were vacuuming waste ink from the presses. Because the employees generally performed several different jobs during the shift, it is difficult to attribute a given exposure level to a specific task, particularly since short-term exposure monitoring was not conducted. Area air samples obtained in the slop room near the Solvent Type 1 cleaning tank had concentrations of 67 mg/m^3 and 88 mg/m^3.

During the production shifts, the concentrations of naphthas in personal breathing zone air samples ranged from 0.5 mg/m^3 to 15 mg/m^3 (averaging 1.5 mg/m^3). The highest concentration was obtained on a tension man. The concentration of naphthas in the remaining air samples were all less than 2 mg/m^3. Area air samples for naphthas ranged from 0.5 mg/m^3 near the auto wash unit, to 27 mg/m^3 in the ink room. The concentration of naphthas in a general area air sample obtained near the drinking water fountain in the reel room was very low, at 0.7 mg/m^3.

The air sampling results for total naphthas obtained during this survey were all below 100 mg/m^3, the most protective environmental evaluation criteria (for kerosene), with the exception of one personal breathing zone air sample obtained during the maintenance and make-ready shift at the Dorchester plant, which had a concentration of 105 mg/m^3.

On the initial survey, none of the glycol ethers analyzed were present in the personal air samples obtained on a pressman and plate handler during the production shift, or on the slop room attendant and pressman during the make-ready shift. The limit of detection for the glycol ethers ranged from two to seven micrograms per sample. Of the five area air samples obtained, all individual glycol ether concentrations were less than 1 mg/m^3. The concentration of individual glycol ethers on air samples obtained on the follow-up survey was low, ranging from none detected to 13.0 mg/m^3. The highest concentration found (13.0 mg/m^3) was obtained for butyl cellosolve, which was detected in the Dorchester slop room. Environmental monitoring performed on the employee working in this area gave a concentration of 2.6 mg/m^3 butyl cellosolve, with no other glycol ethers detected. The presence of other glycol ethers on the area air samples collected in the pressroom, slop room, and ink room were all less than 4 mg/m^3. All air sampling results for glycol ethers obtained during this survey were well below the existing evaluation criteria.

VII. SUMMARY

Worker exposures to particulate material were quite low for pressman and other press room employees working on the first deck, with PBZ concentrations falling below 1 mg/m^3, with the exception on one air sample obtained on a packerman which had concentration of 9.93 mg/m^3. As expected, the areas by the folder where the paper is cut have the highest particulate concentrations. The installation of quiet rooms which house the press control panels has minimized the amount of time that pressroom workers must spend in the general plant area, thereby

reducing exposures to chemical agents as well as to noise. Activities which were observed to result in potentially significant particulate exposures include blowing down the folders to remove accumulated paper dust, and leading sheets after a web break occurs. The latter activity results in the resuspension of settled dust which has accumulated on the print machines. Worker exposures to particulates were generally higher below deck as a result of continuous handling of rolls of paper which are fed to the presses. All PBZ air sampling results were below existing guidelines.

Particulate samples appeared to consist primarily of paper dust, rather than ink mist, as only trace quantities of mineral oil were detected on the area air samples obtained near the presses, and no mineral oil was detected on any of the PBZ air samples. While exposure to ink mist does not currently represent a significant exposure for pressroom workers, dermal exposure from contact with inks on the unprotected skin still presents a potential hazard.

PBZ concentrations of total naphthas were higher in air samples obtained during the make-ready shift, as expected, because pressroom workers have limited contact with cleaning solvents such as kerosene, blanket wash, and All Purpose Cleaner during the newspaper production shift. While all personal exposures to total naphthas were below the applicable environmental evaluation criteria established by NIOSH, OSHA, and ACGIH, the potential for high and varied short-term exposures to naphthas was observed during clean-up of the presses. During the make-ready shift, workers would clean the presses by placing themselves in a confined area beneath the press rollers, using solvents to clean parts. The potential for building-up high local solvent concentrations exists during this work. Reportedly, one employee had passed out and was taken to the hospital emergency room following this activity. The use of protective equipment and proper work practices are important in minimizing airborne and dermal exposures, as discussed below in the recommendations section.

PBZ concentrations of glycol ethers were non-detectable or very low, well below existing guidelines established by OSHA and ACGIH. However, the potential for considerable dermal exposure to these solvents was noted. The lack of glove use by some workers, as well as the use of improper glove materials are important factors in increasing the potential for dermal exposure. For glycol ethers in particular, skin absorption may be a more important route of exposure than inhalation.[10] In addition, at the time of this study there was a high prevalence of solvent-related dermatitis in this group of workers.[11]

VIII. RECOMMENDATIONS

Based on observations and data obtained during this survey, the following recommendations are offered. These recommendations concern safety issues as well as the use of protective equipment and safe work practices to minimize potential dermal and inhalation exposure to substances used in the pressroom.

1. Nitrile or neoprene gloves should be made available to the employees when handling solvents used in the pressroom. The latex gloves which were provided to employees do not provide adequate protection against petroleum or oil-based solvents. In addition, employees stated that the latex gloves swell when using solvents such as kerosene. The use of protective gloves and tyvek suits should be enforced during the make-ready shift, to prevent direct skin contact with inks, cleaning solvents, and fountain solutions during cleaning and maintenance activities.

2. When cleaning the presses during the make-ready shift, the trays and pans should be emptied before employees begin work beneath the rollers to minimize the build-up of vapors from the accumulated ink/fountain solution waste. These parts should then be replaced to collect debris and solvent rinses during cleaning. Consideration also should be given to the use of portable exhaust units which exhaust contaminants to the outside, in an effort to reduce employee exposure to solvent vapors. (Depending on local regulations, this may require additional air pollution controls to trap the organic vapors before releasing them to the outside).

3. As discussed during the initial site visit, a formal respiratory protection program is required whenever respirators are worn or offered to employees. This program should comply with the minimum requirements of CFR Title 29 Part 1910.134, the OSHA regulations governing the use of respirators.

4. No eating, drinking, or smoking should be allowed in the production areas. These activities pose an added health risk, as the solvents, wash solutions, and inks, may be transferred to the mouth. Additionally, smoking represents a potential fire hazard. These activities should be restricted to designated areas away from production.

5. The practice of blowing down the folders at the end of the shift to remove paper dust from the cutters, should be replaced with vacuuming to minimize reentrainment of particulates within the employees' breathing zones.

6. General housekeeping and work practices during the make-ready shift should be improved at both plants, to reduce potential exposures to substances used in the pressroom, and to minimize fire hazards. Spills of Type I Solvent, a combustible liquid, were observed on the floor areas in the slop room and were not promptly cleaned up. Combustible waste materials and residues were not stored in covered metal receptacles. Open containers of kerosene and Type I Solvent were observed in the ink room, and bung holes for many solvent drums were left open, allowing solvent vapors to escape into the general work room environment. There were also numerous incidents where ink, solvent, water, and greasy rags were on the floor creating slipping hazards.

7. The location of the ceiling-mounted exhaust system in the slop room at the Dorchester facility draws vapors from the waste ink tank across the operator's breathing zone. A more effective method for exhausting vapors would be to provide a wall-mounted exhaust system which would not draw vapors through the operator's breathing zone.

8. The eye wash station located outside the Billerica slop room should be repaired immediately and be made accessible to employees at all times in the event of an emergency.

9. To prevent the build-up of static electricity during isopropanol dispensing operations, bonding wiring connecting the dispensing nozzle to the liquid transfer container should always be used. In addition, only approved safety containers should be used for isopropanol. All secondary containers of isopropanol (as well as all other cleaning solvents) should be appropriately labelled to identify the contents.

10. In the rail car receiving area at the Dorchester plant, there were five 55-gallon drums of Type I Solvent, a class IIIA combustible liquid, and similarly, outside the reclamation room there were three 55 gallon drums of this solvent. These quantities exceed 120 gallons, the maximum allowable amount for storage outside properly designed storage areas, as specified in OSHA standard 1910.106(e)2ii(b)(2). To minimize this potential fire hazard, solvents should be stored in properly designed storage rooms. The chemical storage and oil rooms at the two plants where the majority of solvents are currently stored and dispensed must meet the requirements specified in OSHA standards 1910.106(d)(4)(i) through (v).

11. Local exhaust ventilation in the Dorchester slop room should be improved at the Solvent Type 1 cleaning station. The existing station does not appear to adequately capture emissions when the

front panels are opened to gain access to the tank, as face velocity measurements indicated a drop from 149 feet per minute (fpm) with one panel open on the right side, to 83 fpm when two panels were open on the right side. Further reductions are expected when all panels on both sides are opened. Additionally, the existing system does not appear large enough to clean all the necessary parts. Boston Globe management indicated that plans were being made to obtain a new automated cleaning system for the slop room, however, this new system has not yet been installed. Similarly, local exhaust ventilation in the Billerica slop room should be improved, as measurements indicated an average velocity of less than 50 fpm at the face of the hood. An engineer familiar with industrial ventilation systems should be consulted for assistance in developing appropriate local exhaust ventilation designs for these applications.

12. Exposure monitoring should be conducted in the pressroom (and adjacent areas such as below deck) on a periodic basis and whenever changes in work practice, ventilation, or product use are made that may affect employee exposures. Of particular concern is the clean-up operation performed during the make-ready shift. Additional personal exposure monitoring should be conducted to assess organic vapor exposures, particularly for those employees who must work beneath the presses. A qualified industrial hygienist should be consulted for further assistance.

13. A Hazard Communication Program meeting all the requirements of OSHA standard 29 CFR 1910.1220 should be implemented.

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XI. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are temporarily available upon request from NIOSH, Hazard Evaluations and Technical Assistance Branch, 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 the NIOSH Publications Office at the Cincinnati address. Copies of this report have been sent to:

1. Boston Globe Safety and Health Committee No. 3
2. The Boston Globe
3. OSHA Region 1

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.

Table 1

Boston, Massachusetts
HETA 88-236
November 1988

Job Description	Sampling Time (min)	Sample Volume (L)	Particulate Concentration (mg/m^3)[a]
Dorchester Plant			
(11-20-88)			
Pressman H-press	289	578	0.16
Pressman	303	606	ND
Pressman	310	620	0.08
Pressman H-press	326	652	0.05[b]
Pressman G-press	326	652	0.05
Colorman I-press	264	528	0.04
Colorman G-press	321	642	0.02
Plate handler K-press	315	662	0.09
Foreman	336	672	0.13[b]
Floor Boss	286	572	ND
Pressrunner G-press	306	612	0.07
Reel Room worker	308	616	0.08
Reel Room worker	320	640	0.11
Tension man - Reel Room	294	588	0.05
Paper handler -Reel Room	337	674	0.12
(11-21-88)			
Pressman I-press	320	640	0.58
Pressman H-press	304	608	0.16[b]
Colorman K-press	310	620	0.27
Colorman I-press	305	610	0.23
Paper handler I-press	361	722	ND
Paper handler	355	710	0.08
Tension man J-press	318	636	0.24
Tension man H-press	303	606	6.60
Tension man I-press	141	282	0.21
Tension man H-press	377	754	0.68
Tension man I-press	306	612	0.25
Billerica Plant			
(11-25-88)			
Pressman M-press	351	702	0.20[b]
Pressman L-press	376	752	0.12[b]
Plate handler L-press	467	887	0.23
Plate handler M-press	356	712	0.08
Packer and Colorman L-press	431	832	0.16
Packerman M-press	422	841	9.93
Paper handler	386	772	0.09
Paper handler	385	770	0.31
Tension man - Reel Room	340	680	0.12
Tension man M-press	461	922	4.60
Tension man L-press	455	910	0.34
Tension man M-press	456	912	3.91

[a] Particulate concentrations are expressed in milligrams per cubic meter (mg/m^3) as a time-weighted average over the sampling period. ND = none detected. The limit of detection was 0.01 mg/sample.

[b] Indicates samples which were also quantitated for mineral oil mist. No ink mist was detected on these samples; the limit of detection was 0.08 mg/m^3.

Table 2

Boston, Massachusetts
HETA 88-236

November 1988

Location	Sampling Time (min)	Sample Volume (L)	Particulate Concentration[a] Total (mg/m^3)	Respirable (mg/m^3)
Dorchester Plant				
(11-20-88)				
I-press, unit 22 and folder	290	580	0.40[b]	
H-press, by folder	275	550	1.87	
H-press, unit 4	291	582	2.29	
(11-21-88)				
G-press, unit 13	281	562	0.53	
K-press, unit 5 and folder	293	586	0.68[b]	
F-press, unit 21 and folder	274	548	0.22[b]	
H-press, color deck and folder	297	594	0.88	
K-press, color deck and folder	305	610	0.77	
J-press, color deck and folder	304	608	0.92	
I-press, color deck and folder	301	602	0.32	
I-press, reel room under folder	299	598	0.12	
J-press, reel room unit 14	297	594	0.10	
H-press, reel room under folder	296	592	0.55	
H-press, by folder paper cutter	280	560	0.63	
K-press, by folder paper cutter	295	590	4.95	
H-press, by folder paper cutter	295	590	6.12	
(11-22-88)				
F-press, unit 21 and folder	309	525	1.07[b]	
F-press, unit 21 and folder	308	524		0.08
H-press, unit 4 and folder	310	527	0.46[b]	
H-press, unit 4 and folder	309	525		0.04
J-press, by folder	300	600	0.47[b]	
K-press, by folder	300	600	0.77[b]	
I-press, by folder	302	604	0.68[b]	
Billerica Plant				
(11-25-88)				
L-press, unit 3 and folder	396	673	0.61[b]	
L-press, unit 3 and folder	385	655		0.05[b]
L-press, by folder	381	762	0.18	
Reel room, by paper chute	380	760	0.14	
M-press, by folder	378	756	0.25	
M-press, unit 6 and folder	401	682	0.19[b]	
M-press, unit 6 and folder	402	683		ND[b]

[a] The concentration of total and respirable particulates is expressed in milligrams per cubic meter (mg/m^3) as a time-weighted average over the sampling period. ND = none detected. The limit of detection was 0.01 mg/sample.

[b] Indicates samples which were also quantitated for mineral oil mist. The concentration of oil mist ranged from none detected (<0.09 mg/m^3) to 0.1 mg/m^3.

Table 3

Summary of Air Sampling Data for Total Naphthas

Boston Globe
Boston, Massachusetts
HETA 88-236

November 1988

Plant Location	Shift	Sample Type[a]	No. of Samples	Naphtha Concentration[b] Range (mg/m^3)	Mean (mg/m^3)
Dorchester	Production	PBZ	26	0.5 to 2	1.1
		GA	6	0.5 to 4	2.0
	Make-ready	PBZ	10	15 to 105	42
		GA	2	67 to 88	78
Billerica	Production	PBZ	6	0.5 to 15	3.1
		GA	0		
	Make-ready	PBZ	12	7 to 23	12
		GA	3	7 to 27	18

[a] Sample type refers to either personal breathing zone air samples (PBZ) or general area air samples (GA).

[b] Naphtha concentration is expressed in milligrams per cubic meter (mg/m^3) as a time-weighted average over the sampling period.