



NIOSH HEALTH HAZARD EVALUATION REPORT

**HETA #2005-0361-3005
Buffalo Newspress
Buffalo, New York**

June 2006

**DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health**



PREFACE

The Hazard Evaluation and Technical Assistance Branch (HETAB) of the National Institute for Occupational Safety and Health (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 (OSHA) 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 employers 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.

HETAB also provides, upon request, technical and consultative assistance 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. Mention of company names or products does not constitute endorsement by NIOSH.

ACKNOWLEDGMENTS AND AVAILABILITY OF REPORT

This report was prepared by Mark M. Methner and Loren Tapp of HETAB, Division of Surveillance, Hazard Evaluations and Field Studies (DSHEFS). Field assistance was provided by Srinivas Durgam. Analytical support was provided by DataChem Laboratories, Salt Lake City, Utah. Desktop publishing was performed by Robin Smith. Editorial assistance was provided by Ellen Galloway.

Copies of this report have been sent to employee and management representatives at Buffalo Newspress and the OSHA Regional Office. This report is not copyrighted and may be freely reproduced. The report may be viewed and printed from the following Internet address: <http://www.cdc.gov/niosh/hhe>. Copies may be purchased from the National Technical Information Service (NTIS) at 5825 Port Royal Road, Springfield, Virginia 22161.

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.

Highlights of the NIOSH Health Hazard Evaluation

On October 13, 2005, the National Institute for Occupational Safety and Health (NIOSH) received a confidential request from the employees at Buffalo Newspress to conduct a health hazard evaluation (HHE) at their facility in Buffalo, New York. The request asked NIOSH to evaluate employee exposures to ethylene glycol, propylene glycol, volatile organic compounds (VOCs), respirable particulate matter, and carbon monoxide (CO). Employee concerns included dermatitis, headaches, burning eyes, and sinus irritation.

What NIOSH Did

- We took full-shift personal breathing zone (PBZ) air samples for ethylene glycol, propylene glycol, VOCs, and respirable dust.
- We measured CO concentrations at various locations in the press room.
- We interviewed press room workers about work-related symptoms.
- We examined the skin of workers with a rash.
- We looked at work practices and the personal protective equipment (PPE) used.
- We checked hand cleaners, skin barrier creams, and gloves used by workers in the press room.
- We checked to see if rooftop exhaust fans were working.

What NIOSH Found

- No PBZ air samples exceeded occupational exposure limits.
- CO concentrations were elevated in the press room.
- About 25% of workers interviewed reported headaches at least twice a week.
- Hand/arm skin rashes were seen on 12 of 41 interviewed workers.
- The correct PPE (such as gauntlet-type nitrile gloves and barrier creams) was not readily available.

What Buffalo News Press Managers Can Do

- Improve ventilation in the press room.
- Check the oven exhaust ventilation system to make sure combustion gases exit the building.
- Start a PPE program including worker training on skin issues.
- Improve access to correct PPE such as gauntlet-type nitrile gloves and barrier creams.
- Provide less abrasive hand cleansers.

What the Buffalo News Press Employees Can Do

- Report potential work-related skin problems to the Plant Manager.
- Wear correct PPE when working with blanket wash/fountain solution and other solvents.
- Clean skin with a less abrasive skin cleanser and regularly apply a barrier cream when skin problems occur.
- Use a moisturizing lotion or cream regularly to prevent skin dryness and cracking.



What To Do For More Information:
We encourage you to read the full report. If you would like a copy, either ask your health and safety representative to make you a copy or call 1-513-841-4252 and ask for
HETA Report #2006-0361-3005



Health Hazard Evaluation Report 2005-0361-3005

Buffalo Newspress

Buffalo, New York

June 2006

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SUMMARY

On October 13, 2005, the National Institute for Occupational Safety and Health (NIOSH) received a confidential employee request to conduct a health hazard evaluation (HHE) at Buffalo Newspress in Buffalo, New York. The request asked NIOSH to evaluate employee exposures to ethylene glycol, propylene glycol, volatile organic compounds (VOCs), respirable particulate matter, and carbon monoxide (CO). Employee concerns included dermatitis (thought to be caused by contact with the blanket and fountain wash solutions), headaches, burning eyes, and sinus irritation.

Results from full-shift personal breathing zone (PBZ) air samples for ethylene glycol, propylene glycol, VOCs, and respirable dust were below occupational exposure criteria. However, dermal contact with these compounds was observed to be a significant route of exposure in press employees. In addition, employee skin examinations revealed that nearly one third of 41 interviewed had a visible hand/arm rash consistent with workplace exposure. Approximately 80% of workers wore wrist-length vinyl gloves during the handling of inks, blanket wash solutions, and other solvents. Barrier creams and gauntlet-type nitrile gloves were available on request, but were not in regular use.

General area measurements of CO at various plant locations indicated that sources (ovens, heating units, and propane-powered forklift trucks) increased CO air concentrations above the plant background of 1-2 parts per million (ppm). Although no CO sample result exceeded the NIOSH Ceiling limit of 200 ppm, some press room workers' exposures may exceed the NIOSH Recommended Exposure Limit (REL) of 35 ppm as a time-weighted average. The high prevalence of headache (56%) among press employees suggests a possible relationship between these headaches and CO concentrations.

NIOSH investigators conclude that a health hazard existed at the time of the survey from dermal exposure to blanket wash and other solvents. Observations of work practices, glove type, and glove use and availability indicate a significant opportunity for dermal exposure to Rycoline[®] blanket wash and fountain solution and other solvents among press employees. The prevalence of contact dermatitis among these workers indicates that skin exposure to workplace solvents should be minimized. PBZ air sampling in the press room indicated that no exceedence of any occupational airborne exposure criteria occurred during the survey. General area air concentrations of CO above background levels (1-2 ppm) and the occurrence of headache among press employees indicate that actions to decrease CO exposure in the press room are necessary. Recommendations include improving press room ventilation, implementing a personal protective equipment (PPE) program that includes worker training, using less abrasive hand cleaners, and supplying appropriate gloves and barrier creams.

Keywords: NAICS 511110, Color newspaper, printing, blanket wash, roller wash, Rycoline[®] press wash solvents, inks, ethylene glycol, propylene glycol, respirable dust, carbon monoxide, contact dermatitis, headache, upper respiratory irritation

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INTRODUCTION

On October 13, 2005, the National Institute for Occupational Safety and Health (NIOSH) received a confidential request from the employees at Buffalo Newspress to conduct a health hazard evaluation (HHE) at their facility in Buffalo, New York. The request asked NIOSH to evaluate employee exposures to ethylene glycol, propylene glycol, volatile organic compounds (VOCs), respirable particulate matter, and carbon monoxide (CO). Employee concerns included dermatitis (thought to be caused by contact with the blanket and fountain wash solutions), headaches, burning eyes, and sinus irritation.

NIOSH representatives held an opening conference with management officials and representatives from the International Union of Painters and Allied Trades (IUPAT), Local #17 on November 28, 2005. Between November 28-30, 2005, NIOSH investigators observed work practices, conducted air sampling, interviewed employees, performed medical evaluations of skin conditions, and reviewed injury/illness logs, medical records, and personal protective equipment use and availability.

BACKGROUND

Buffalo Newspress is a four-color commercial offset web printer serving the Buffalo metropolitan region. Their products include weekly newspapers, tabloids, booklets, and catalogs. The company has been in business for more than 20 years and operates a 7-day/24-hour schedule. There are 60 workers in the press department who operate four Cold-set and two Heat-set high-speed presses over four rotating 12-hour work shifts. There are four job categories associated with press operations: Roll Tender, First Pressman, Man-in-Charge, and Press Helper (also called "Flyguy"). Roll Tenders supply the press with large rolls of paper. The First Pressman monitors the press, ensures all ink and solvent levels (fountain wash) are adequate and adjusts the tension on the rollers. The First Pressman also uses squirt

bottles containing Rycoline® "blanket and roller wash" to rinse and remove ink from rollers and print templates on an as-needed basis. The Man-in-Charge is considered the foreman of the press and monitors the quality of the product. The Press Helper (Flyguy) works at the end of the press where printed bundles exit. This job mainly consists of stacking "finished" bundles on pallets prior to shipment to the customer. All four press jobs include varying exposures to the fountain wash and/or blanket and roller wash.

The Rycoline® Fountain Wash (305 RO) solution is an acid-based product with a pH of approximately 3.0. The main components of this product are ethylene glycol and propylene glycol. This solution is dispensed to ink-containing trays via plumbing attached to an automatic dispensing pump. Within each tray, a print roller picks up the ink-fountain wash mixture and transfers it to the paper.

The Rycoline® Blanket and Roller Wash 9000WM (also known in the pressroom as "bug juice") is a petroleum-based solvent consisting of xylenes, 1,2,4-trimethylbenzene, cumene, and Stoddard solvent. The First Pressman and the Man-in-Charge regularly use this product to remove excess ink on print rollers and blankets. Other cleaning solutions used less frequently and in smaller quantities include Safety-Kleen Premium Solvent® (which contains naphtha) and Sprayway Glass Cleaner® (which contains 2 butoxyethanol, ethyl alcohol, methyl alcohol, deionized water, and liquefied petroleum).

All presses are considered "high speed," capable of producing large quantities of product (millions) during each 12-hour shift. Both heat-set and cold-set presses were in operation during the survey. Each heat-set press uses natural gas-fired ovens to "heat-set" the ink on the paper web as it travels through the press. Heat-set ovens are vented to the outdoors via ductwork that passes through the roof. The cold-set presses use unheated air to dry the ink and are not vented directly outdoors. The use of each style of press is dictated by the type of product required.

Use of personal protective equipment (PPE) was not evident during this survey. However, gloves and a barrier cream are available in the Plant Manager's office and can be requested by employees. Health and safety training is conducted by either the Plant Manager or the Director of Human Resources on an as-needed basis. Employee medical evaluations are performed by an off-site contracted medical provider.

Approximately 10 years ago, Buffalo Newspress contracted with an industrial hygiene consultant to measure personal breathing zone (PBZ) and general area air concentrations of nuisance dust, respirable dust, oil mist, and trimethylbenzenes. No air sampling was conducted for the two types of glycol compounds in the fountain wash. The consultant's sampling results indicated that air concentrations for the above-mentioned substances were below relevant occupational exposure criteria.

METHODS

Industrial Hygiene Evaluation

We collected PBZ air samples for ethylene glycol, propylene glycol, VOCs, and respirable particulate matter. All sampling pumps were calibrated before and after each sampling period.

Ethylene glycol and propylene glycol were sampled and analyzed according to the NIOSH Manual of Analytical Methods (NMAM) Method 5523.¹ Airborne glycol concentrations were measured using XAD-7 OVS tubes that were pinned to the workers' lapels, at a position that approximated their breathing zone. Each sampling tube was connected to a battery-operated personal sampling pump via Tygon[®] tubing. The pump was then attached to the workers' belts and set to operate at a flow rate of 1 liter per minute (Lpm).

Air samples for VOCs were collected during press operations using thermal desorption tubes (TD) for qualitative analysis, and charcoal tubes for quantitative analysis. Thermal desorption tubes were used at a flow rate of 50 milliliters

per minute (mL/min) and analyzed per NIOSH Method 2549.¹ The charcoal tubes were run at a flow rate of 200 mL/min, and analyzed by NIOSH Method 1501.¹ Based on the TD sample results, the charcoal tubes were analyzed for the following VOCs: xylenes, 2-butoxyethanol, toluene, trimethylbenzenes, cumene, propylbenzene and Stoddard solvent.

During bundle handling operations (performed by the Press Helper), air samples for respirable particulate matter were collected on polyvinylchloride (PVC) filters attached to pumps operating at 1.7 Lpm, according to NIOSH Method 0600.¹

Carbon monoxide measurements were made at various locations within the plant (warehouses, near ovens and workstations) with a Q-Trak[®] direct reading instrument (TSI Inc., St. Paul, Minnesota) that displays the air concentration in parts per million (ppm).

Medical Evaluation

Confidential interviews were conducted with all press employees working during one night shift and one day shift. Occupational Safety and Health Administration (OSHA) Injury and Illness logs (OSHA 300 logs) for years 2003-2005 and company injury/illness logs for years 2000-2005 were reviewed. Medical records of employees with dermatitis who had seen a medical professional for this problem were requested and reviewed. Employee hand cleaning agents, gloves, and barrier creams provided by management were also reviewed.

EVALUATION CRITERIA

As a guide to the evaluation of the hazards posed by workplace 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 even though 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 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 increases 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 Recommended Exposure Limits (RELs),² (2) the American Conference of Governmental Industrial Hygienists' (ACGIH®) Threshold Limit Values (TLVs®),³ and (3) the U.S. Department of Labor, Occupational Safety and Health Administration (OSHA) Permissible Exposure Limits (PELs).⁴ Employers are encouraged to follow the OSHA limits, the NIOSH RELs, the ACGIH TLVs, or whichever are the more protective criteria.

OSHA requires an employer to furnish employees a place of employment that is free from recognized hazards that are causing or are likely to cause death or serious physical harm [Occupational Safety and Health Act of 1970, Public Law 91-596, sec. 5(a)(1)]. Thus, employers should understand that not all hazardous chemicals have specific OSHA exposure limits such as PELs and short-term exposure limits (STELs). An employer is still required by OSHA to protect their employees from hazards, even in the absence of a specific 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 STEL or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from higher exposures over the short-term.

The potential health effects and occupational exposure criteria for the substances evaluated during this survey are given below.

Ethylene Glycol and Propylene Glycol

Ethylene glycol and propylene glycol are colorless, odorless liquids at room temperature; they are used to make antifreeze, other de-icing solutions, and polyester compounds. They are used as solvents in the paint and plastics industries. Ethylene glycol is an ingredient in inks and photographic developing solutions, and is an ingredient of Rycoline® 305 RO Fountain Solution. Propylene glycol is used to absorb extra water and maintain moisture in certain medicines, cosmetics and food products, and has been classified by the Food and Drug Administration as "generally recognized as safe" for use in food.⁵

Direct contact with ethylene glycol may cause irritation of the eyes, nose, and skin; and skin sensitization.⁶ It is not significantly absorbed through the skin. If consumed in large amounts (as in a suicide attempt), it can result in nausea, convulsions, heart and kidney problems, and death. Inhalation of ethylene glycol is unlikely because of its low volatility at room temperature, but is possible if heated or agitated.⁵ The ACGIH TLV for ethylene glycol (as an aerosol) is 100 mg/m³ (ceiling); there is no TLV for propylene glycol. There is no OSHA PEL or NIOSH REL for either of these chemicals.

Volatile Organic Compounds

Volatile organic compounds describe a large class of chemicals that contain carbon and have a sufficiently high vapor pressure to allow some

of the compound to exist in the gaseous state at room temperature. These compounds are basically solvents used for tasks such as cleaning, degreasing, thinning, and extraction, and are emitted in varying concentrations from numerous sources including, but not limited to, carpeting, fabrics, adhesives, solvents, paints, cleaners, waxes, cigarettes, and combustion sources. Occupational exposure criteria do not exist for VOCs as a group, and collection of VOCs is a screening method to establish the presence of specific VOCs that have known health effects and criteria. Some of the VOCs used in this facility include xylene, toluene, trimethylbenzenes, cumene, propylbenzene, Stoddard solvent, and ethylene glycol monobutyl ether (EGBE or 2-butoxyethanol). EGBE is an ingredient in the Rycoline® 305 RO Fountain Solution; the other compounds are ingredients in the Rycoline® Blanket and Roller Wash 9000WM. OSHA and NIOSH have given cumene and EGBE Skin Designations indicating the potential for dermal absorption.

Inhalation and dermal exposure are both important routes of exposure to organic solvents in the workplace. Absorption through the skin depends upon the degree of lipid and water solubility of the solvent.⁷ Almost all organic solvents cause irritation of the skin because they remove fat from the skin. Organic solvents may cause minimal to mild irritation of the respiratory system.⁸ This irritation is usually restricted to the upper airways, mucous membranes and eyes, and it generally resolves quickly without long-term effects.⁷

Almost all volatile, fat-soluble organic solvents can acutely cause nonspecific central nervous system depression. The symptoms of significant acute solvent exposure are similar to those from drinking too many alcoholic beverages, including headache, nausea and vomiting, dizziness, slurred speech, impaired balance, disorientation, and confusion. These symptoms go away quickly upon cessation of exposure.⁹ Rarely, death from respiratory depression can occur at very high exposure levels. Subtle, reversible decrements in performance on attention and reaction time testing have been

observed with acute exposures to solvents, but may not be directly attributable to nervous system dysfunction, since similar effects are seen when the main effect of exposure is headache or eye irritation.⁹ There is controversy over whether long-term exposure to solvents can cause toxic encephalopathy, which is a constellation of symptoms such as fatigue, irritability, depression, headaches, and forgetfulness. Workers in whom this has been described generally have at least 10 years of relatively intense exposure to solvents.⁹

Respirable Particulate

If chemical(s) comprising an airborne particulate do not have an established occupational exposure limit, the convention is to apply a generic exposure criterion. Formerly referred to as nuisance dust, the current terminology for the nonspecific particulate ACGIH TLV is "particulates not otherwise specified (PNOS)," or "particulates not otherwise regulated" (PNOR) for the OSHA PEL.^{3,4}

The OSHA PEL for total PNOR is 15.0 mg/m³ and 5.0 mg/m³ for the respirable fraction, determined as an 8-hour average.⁴ The ACGIH TLVs for exposure to particulates not otherwise specified (PNOS) are 10.0 mg/m³ (total dust, 8-hour TWA) and 3 mg/m³ (respirable particulate, 8-hour TWA).³ These are generic criteria for airborne dusts, which do not produce significant organic disease or toxic effect when exposures are kept under reasonable control.¹⁰ Excessive concentrations of PNOSs in the workroom air may seriously reduce visibility; may cause unpleasant deposits in the eyes, ears, and nasal passages; or can injure the skin or mucous membranes by chemical or mechanical action by the rigorous skin cleansing procedures necessary for their removal.¹⁰ NIOSH does not have a REL for non-specific particulates.

Carbon Monoxide

CO is a colorless, odorless, tasteless gas produced by incomplete burning of carbon-containing materials (e.g., natural gas). The initial symptoms of CO poisoning may include headache, dizziness, drowsiness, and nausea. These initial symptoms may advance to

vomiting, loss of consciousness, and collapse if prolonged or high exposures are encountered. Coma or death may occur if high exposures continue.

The NIOSH REL for CO is 35 ppm for an 8-hour TWA exposure, with a ceiling limit of 200 ppm that should not be exceeded.² The ACGIH has established an 8-hour TWA-TLV of 25 ppm, with a ceiling level of 400 ppm.³ The OSHA PEL for CO is 50 ppm for an 8-hour TWA exposure.⁴

RESULTS

Industrial Hygiene Evaluation

Air Sampling

A total of 12 PBZ samples for ethylene glycol and propylene glycol were collected across three shifts. Two of the samples measured very low concentrations (0.07 mg/m³ and 0.10 mg/m³ for ethylene glycol; 0.14 mg/m³ and 0.23 mg/m³ for propylene glycol). The remaining 10 samples exhibited a phenomenon called “breakthrough.” This means that compounds that would normally be trapped on the primary section of sorbent media migrated to a secondary “backup” section of sorbent media, suggesting that the compounds were not adequately trapped and may have continued to migrate out of the tube. Therefore, while the results for these samples appear in Table 1, they may underestimate the actual air concentrations since some of the substances being sampled may not have been retained in the sorbent tube.

A total of 13 PBZ samples for VOCs using charcoal tubes were collected across three shifts. All samples had measurable amounts of VOCs; however, none of the samples exceeded any occupational exposure criteria, and were approximately 100 times below the REL. Data for these samples appear in Table 2.

A total of 15 PBZ respirable dust samples were collected across three shifts, and all were below the analytical detection limit (0.02 mg), thereby

indicating that no occupational exposure criterion was exceeded.

A total of 55 short-term measurements for CO were collected with a direct-reading instrument across three shifts at various positions where workers spend the majority of their shift. CO concentrations ranged from 2 ppm to 65 ppm. For comparison, the NIOSH REL and OSHA PEL for CO is 35 ppm and 50 ppm, respectively, as a full-shift TWA. The NIOSH Ceiling limit is 200 ppm. The highest concentrations occurred near sources such as ovens, heating units, and propane-powered forklift trucks. In general, night-shift concentrations were higher than day-shift, and CO concentrations at workstations between the 936 and the LR Press were the highest of all measurements (Figure 1).

Medical Evaluation

Interviews

A total of 41 out of 60 press employees, all male, were interviewed during the site visit. All 19 night shift employees (8 p.m. Monday, November 28, 2005, to 8 a.m. Tuesday, November 29, 2005), all 21 day shift employees (8 a.m. to 8 p.m. Tuesday, November 29, 2005), and one additional employee from the Tuesday, November 29, 2005 night shift (8 p.m. to 8 a.m.) were interviewed. The average age of these employees was 40 years (range: 20 to 57 years), the average number of years worked at Buffalo Newspress was 11 years (range: 2 weeks to 23 years), and the average number of years worked at their current job was 6.3 years (range: 2 days to 22 years). Of the 41 employees, there were 14 Press Helpers (Flyguys), 12 First Pressmen, 11 “Man-in-Charge”, and 4 Roll Tenders. Nineteen employees worked with heat set presses, 21 with cold presses, and one worked with all types.

Table 3 describes the prevalence of reported non-dermal symptoms occurring during work hours among press workers in the month prior to the site visit. The most prevalent symptoms, in descending order, include headache, eye irritation, congestion and/or nose irritation, throat irritation, and cough. When comparing the frequency of reported symptoms among job

types, First Pressmen reported eye, nose, and throat irritation, cough, and rash slightly more frequently than “Man-in-Charge,” Helpers, or Roll Tenders. Helpers reported headaches slightly more frequently than the other job types. However, the small number of workers in each job type prevents making any clear conclusions about symptom patterns among the different job categories.

Of the employees interviewed, 20 of 41 (49%) reported experiencing skin rash since working at Buffalo Newspress; 15 (37%) had medical and occupational histories suggestive of dermatitis related to workplace exposures. Table 4 describes the prevalence of reported characteristics of these 20 employees and their rash. Among the 20 with history of rash, four reported history of eczema (two only as children), one reported history of psoriasis, three reported history of asthma (one current, two as children only), and 11 reported symptoms of environmental allergies, such as hay fever. Three reported hobbies or household use of solvents, paints, or cleaners. Eight of the 20 had seen a medical professional concerning the rash, and four reported being diagnosed with contact dermatitis (CD); one of the four was also diagnosed with dyshidrosis (lack of moisture of skin). These four employees’ medical records were requested for review. Another employee described an episode of urticaria (hives) that began at work and necessitated a visit to the local hospital emergency department.

Thirteen of the 20 employees with history of rash had a visible rash at the time of the site visit. The medical officer examined each of these 13 employees; 12 had rash on fingers, hands, wrists, and/or forearms; one had a patch of dry, flaky, pustular skin changes on the upper thigh. Nine of the rashes had characteristics of chronic contact dermatitis (dry, thickened, slightly hyperpigmented skin), and seven had characteristics of subacute dermatitis (red, raised areas with papules or pustules). Among these seven, five had characteristics of both chronic and subacute dermatitis. Overall, 12 of 41 (29%) workers had a rash consistent with occupational exposure to solvents.

Of the 41 interviewed employees, 33 reported wearing gloves intermittently when exposed to inks, solvents, or other messy work (e.g., cleaning rollers, washing blankets, hanging plates, changing rollers), four reported rarely ever wearing gloves, and four reported never wearing gloves. However, no gloves were worn during the days of this survey.

Observations and Worker Comments

Gloves

Green, wrist-length, vinyl gloves were provided for all press employees and were kept in the supervisor’s office. We observed that there were times when the supply of gloves ran out. Employees reported that these gloves tended to tear easily, trapping solvents against the skin. In addition, because the gloves did not cover the wrist, ink and solvent exposure to the wrist area was common, even if when the employees wore long-sleeve shirts. Additionally, some employees reported that they did not wear gloves because they felt it was a safety hazard due to 1) the potential of loose gloves getting caught in operating machinery and 2) lack of grip and tactile sensation.

Black elbow-length (gauntlet style) nitrile gloves were not available in the supervisor’s office during the NIOSH visit. Many employees were not familiar with these gloves, and other employees reported that they were only provided to employees who asked for them. This was confirmed by the plant manager. Some employees reported wearing white cotton liners under the green vinyl gloves for comfort and to absorb sweat.

Barrier Creams

Management reported that only employees with skin irritation who notified management of their problem were provided with barrier creams; they were not available to all employees. Management provided two types of barrier creams. Clear Shield® contained purified water, dimethicone, isobutene/propane, stearic acid, glycerin, caprylic/capric triglyceride, triethanol-

amine, aloe vera gel, coconut acid, cetyl alcohol, polyvinylpyrrolidone, cetareth-20, cetearyl alcohol, fragrance, tocopheryl acetate, hydroxyethyl cellulose, methylparaben, tetrasodium EDTA, and propyl paraben. North 222 Barrier Cream with Silicone® contained water, dimethicone, mineral oil, stearic acid, cetyl alcohol, glyceryl stearate, triethanolamine, glycerin, disodium EDTA, propylparaben, and quaternium-15. The eight employees who had tried the barrier creams reported that they are helpful; their hands were much easier to clean so they did not need to scrub and use harsh abrasive soaps.

Hand Washing

Sinks with hand cleaners were located on outside walls of the press work areas and not at individual press machines. Employees reported great variability in the number of times they washed their hands at work (from 2 to 20 times during a shift) and stated that it depended on the type of job they were doing, e.g., if they were changing plates often during the work shift they washed many times. Some employees reported that they did not have time to wash their hands because their job was happening so fast they could not leave the press.

Hand Cleaners

The most accessible hand cleaner was liquid Trounce® (a product containing water, petroleum distillates, ammonium tallate, propoxylated ethoxylated linear C₆₋₁₂ alcohol, pumice, carbomer, fragrance, chloroxylenol, lanolin, methylchloroisothiazolinone, methylisothiazolinone, and aloe vera) and green, pumice-containing bars of soap. Some employees reported that they could not use Trounce® because it was too irritating; others reported that they prevented skin irritation from Trounce® by rinsing well with water. Some employees reported that when they used Trounce® without water it did not bother them.

Several employees reported that they used Fast Orange Hand Cleaner® (a Permatex® product containing water, pumice, dipentene, ethoxylated C₁₁₋₁₆ alcohol, triethanolamine, carbomer, glycerin, dimethylhydroxymethyl

pyrazole, methylchloroisothiazolinone, methylisothiazolinone, lanolin, aloe barbadensis, and jojoba oil) instead of Trounce® to prevent skin irritation, but it was not always available on the press floor, only in the bathroom upstairs. Moisturizing lotion was also available in the upstairs bathroom but not on the press floor. Some employees reported that they did not use the lotion because it was too greasy and they were afraid they would drop things.

One employee reported using a hand cleaner that he bought on his own because it was less irritating and abrasive to the skin. Another employee reported sometimes using the Rycoline® Blanket and Roller Wash to clean his hands and arms. LHS Hand and Body Cleanser® (a product containing water, sodium laureth sulfate, cocamide DEA, ammonium chloride, glycol stearate, PEG-150 distearate, DMDM Hydantoin, Tetrasodium EDTA, fragrance, citric acid, D and C Red #28) was available in the bathroom upstairs, but no employees reported using it.

Review of Injury/Illness Logs

The OSHA Log of Work-Related Injuries and Illnesses (Form 300) was reviewed for the years 2003, 2004, and 2005. There were 12 entries for 2003 and 8 entries each for 2004 and 2005. One entry from 2005 was for rash on hands (27 lost work days) and one entry from 2003 was for knee cellulitis (15 lost work days); there were no other dermal problems entered.

The company Accident and Incident Log, kept in the supervisor's office, was reviewed for the years 2000 to 2005. In 2000, there were three eye spray/splash injuries and one infected finger out of 105 entries. In 2001, there were three eye spray/splash injuries and one illness from odors/vapors out of 61 entries. In 2002, there were four eye foreign body injuries, one "bug juice in armpit" injury and one headache from oven dust out of 47 entries, while in 2003, there was one rash on arms, and one rash on hands out of 52 entries. In 2004, there were three eye foreign body injuries, two eye splash injuries, and two rash on arm entries out of 53 entries. Finally, in 2005, there were two rash on back,

one eye and throat irritation from heatset press smoke during TV book manufacturing, two eye foreign body injuries, and two eye injuries.

Review of Medical Records

Three of six physician offices returned requested medical records concerning four press employees. These records documented dermatitis in three employees; two of the records specified contact dermatitis as the diagnosis, and one of the three employees was given oral steroid medication and leave from work. This last record indicates a high level of severity of contact dermatitis. No patch testing was reported.

DISCUSSION

Airborne Exposures

None of the 40 PBZ samples for ethylene glycol, propylene glycol, VOCs, or respirable dust exceeded their respective occupational exposure limits. Most PBZ air samples (10 of 12) collected for ethylene glycol and propylene glycol exhibited breakthrough. Therefore, these analytical results should be considered as minimum PBZ concentrations. However, since TD tube results indicated low concentrations of both ethylene glycol and propylene glycol in the air near the various presses, and two air samples that did not exhibit breakthrough measured very low concentrations of both glycols, the remaining PBZ concentrations for these two glycol compounds are likely to be low. The 55 measurements of CO at various locations within the plant indicate that sources (ovens, heating units, and propane-powered forklift trucks) are increasing CO air concentrations above the plant background of 1-2 ppm, and that workers may have exposures above the NIOSH REL of 35 ppm (TWA) especially at work locations near the presses. While full-shift sampling for CO was not performed, these data can be used to estimate a worker's TWA. Furthermore, the prevalence of headache during the work shift (56%) reported in press employees is consistent with CO concentrations measured in the press room. An increase in general plant ventilation may be necessary to lower CO concentrations.

Dermal Exposures and Dermatitis

Although air sampling for ethylene glycol, propylene glycol, and VOCs revealed air concentrations below occupational exposure criteria, dermal exposure to these compounds was observed to be a significant route of exposure in press employees. In addition, employee interviews revealed that one third of the employees had developed rash consistent with workplace exposure.

Contact dermatitis is the most common occupational skin disease. Epidemiologic data show that contact dermatitis makes up 90%-95% of all occupational skin diseases.^{11,12,13} Contact dermatitis (both irritant and allergic) is an inflammatory skin condition caused by skin contact with an exogenous agent or agents, with or without a concurrent exposure to a contributory physical agent (e.g., ultraviolet light). It is widely accepted that of all contact dermatitis, 80% is due to a nonimmunologic reaction to chemical irritants (irritant contact dermatitis) and 20% to allergic reactions (allergic contact dermatitis). Only certain chemicals are allergens, and only a small proportion of people are susceptible to them. Complete reviews of both irritant and allergic contact dermatitis are available in other sources.^{14,15,16,17}

In dermatitis, the skin initially turns red and can develop small, oozing blisters (vesicles), and bumps (papules). After several days, crusts and scales form. Stinging, burning, and itching may accompany the rash. With no further contact the rash usually disappears in one to three weeks. With chronic exposure, deep cracking (fissures), scaling, and discoloration of the skin (hyperpigmentation) can occur. Exposed areas of the skin, such as hands and forearms, which have the greatest contact with irritants or allergens, are most commonly affected. If the chemical gets on clothing, it can produce rashes at areas of greatest contact, such as thighs, upper back, armpits, and feet. Dusts can produce rashes at areas where the dust accumulates and is held in contact with the skin, such as under the collar and belt line, at the tops of socks or shoes,

and in flexural areas (e.g., front of the elbow, back of the knee). Mists can produce dermatitis on the face and anterior neck. Irritants and allergens can be transferred to remote areas of the body (such as the trunk or genitalia) by unwashed hands or from areas of accumulation (such as under rings or between fingers). It is often not possible to clinically distinguish irritant from allergic contact dermatitis, as both can have a similar appearance and both can be clinically evident as an acute, subacute, or chronic condition. Workers with previous atopic dermatitis (eczema) may be at higher risk for developing occupational skin diseases, usually of an irritant nature.

Extensive lists of irritants and allergens are available in reference books.^{14,16} The most frequent causes of irritant contact dermatitis include soaps/detergents, glass fibers (fiberglass) and particulate dusts, food products, cleaning agents, solvents, plastics and resins, petroleum products and lubricants, metals, and machine oils and coolants.^{13,18} Causes of allergic contact dermatitis include metallic salts, organic dyes, plants, plastic resins, rubber additives, and germicides/biocides.¹⁸

The work-relatedness of skin diseases may be difficult to prove. The accuracy of the diagnosis is related to the skill level, experience, and knowledge of the medical professional who makes the diagnosis and confirms the relationship with a workplace exposure. Guidelines are available for assessing the work-relatedness of dermatitis and include the following criteria: (1) clinical appearance is consistent with a dermatitis, (2) workplace exposures to irritants/allergens, (3) an anatomic distribution consistent with reported exposures in the job task, (4) a consistent temporal relationship of exposure and disease, (5) non-occupational exposures excluded as possible causes, (6) clinical improvement of the condition away from the exposure, and (7) skin patch tests or use tests identifying a probable causal agent.¹⁹ Only some of these criteria were evaluated in this HHE in defining the epidemiologic case definition of a work-related current rash. Further follow-up and diagnostic testing of affected

employees would be necessary to meet all of the criteria listed above.

Even with guidelines, the diagnosis may be difficult. The diagnosis is based on the medical and occupational histories and physical findings. The importance of the patient's history of exposures and disease onset is clear. In irritant contact dermatitis there are no additional confirmatory tests. Patch tests or provocation tests for irritants are discouraged because of a high false-positive rate. In many instances, allergic contact dermatitis can be confirmed by skin patch tests using specific standardized allergens or, in some circumstances, by provocation tests with nonirritating dilutions of industrial contactants.¹⁶

Because people with contact dermatitis can develop long-term dermatologic problems, prevention is key. Strategies in the prevention of contact dermatitis include identifying allergens and irritants, substituting chemicals that are less irritating/allergenic, establishing engineering controls to reduce exposure, using PPE such as gloves and special clothing appropriately, emphasizing personal and occupational hygiene, establishing educational programs to increase awareness in the workplace, and providing health screening.^{13,18,20} The introduction of PPE must be considered carefully as it may actually create problems by occluding allergens or irritants or by directly irritating the skin. Similarly, the excessive pursuit of personal hygiene in the workplace may actually lead to misuse of soaps and detergents, which can result in irritant contact dermatitis.²¹ The effectiveness of gloves depends on the specific exposures and the types of gloves used. The effectiveness of barrier creams is controversial,²² and at times workers using barrier creams may have higher prevalence rates of contact dermatitis compared to those who do not use the creams.²³ However, Buffalo Newspress employees who have used the barrier creams report less skin irritation.

CONCLUSIONS

Work practices such as adjusting and cleaning the presses without adequate PPE revealed an

opportunity for skin exposure to solvents among press employees. The prevalence of contact dermatitis indicates that skin exposure to workplace solvents should be minimized. The PBZ air sampling results for ethylene glycol, propylene glycol, VOCs, and respirable particulates in the Buffalo Newspress press room did not exceed occupational exposure criteria during the survey.

Spot measurements of CO indicated that the highest concentrations occurred in the press room near ovens, heating units, and propane-powered forklift trucks. These findings, in addition to the frequent occurrence of headache among press employees, indicate that actions to decrease CO exposure in the press room are needed.

RECOMMENDATIONS

1. Improve ventilation in the press room.

- a. Check the exhaust fan and vent system on each oven for operation within manufacturer specifications.
- b. Make sure the rooftop exhaust duct is not obstructed.
- c. Increase the general plant ventilation by operating overhead exhaust fans above each press during the work shift.
- d. Conduct CO sampling at workstations regularly (i.e., once per month).
- e. After increasing the general plant ventilation rate, resample for CO to make sure general plant air concentrations have been reduced to at least 1-2 ppm, preferably to zero.

2. Reduce skin exposure of press workers to solvents by using appropriate personal protective equipment.

- a. Provide easy access to appropriate gloves, goggles, and aprons. Appropriate protective clothing materials include butyl

rubber, neoprene, or nitrile rubber. Exactly which PPE and when it should be used should be determined by the company with employee involvement. OSHA standard 29 CFR, part 1910, subpart I – Personal Protective Equipment provides good guidance.²⁴ Gauntlet-style nitrile gloves are an appropriate type of glove for press room exposures. These gloves should be used whenever there is potential for skin contact with Rycoline® Blanket and Roller Wash or Rycoline® Fountain Wash. If the use of nitrile gloves proves to be a safety hazard when working around operating machinery, skin barrier creams should be used.

- b. Establish a comprehensive personal protective equipment program in accordance with the OSHA standard which includes written procedures, proper selection, inspection and maintenance, and factors affecting quality of PPE.

- i. Written Procedures. Define the necessary PPE and ensure it is properly and consistently used and maintained. The use of PPE should be mandatory.

- ii. Proper Selection and Use. Specific task assessments should be conducted to define the potential hazard(s), and evaluate the potential for contact. PPE selection should be based on factors that include chemical resistance, comfort, and dexterity necessary for the task.

- iii. Inspection and Maintenance. Employees should be instructed how to inspect (before and after each use), use, and maintain their PPE. Chemical-resistant gloves, aprons, eye protection, and footwear should be thoroughly rinsed with water whenever contact with solvents is suspected. Gloves should be rinsed prior to removal and replaced frequently. After cleaning, PPE should be stored properly.

3. Employees should take prompt action whenever there is skin or clothing contact with solvents. Exposed skin should be flushed with large amounts of running water or washed with soap and water as soon as possible. Residual soap should be washed off the skin surface. Clothing contaminated with solvents should be removed and laundered prior to re-use. Special attention should be directed toward soaps and skin cleansers because they can serve as irritants. Certain components of the soaps or moisturizers (e.g., lanolin and fragrances) are known allergens and may cause allergic contact dermatitis in sensitive individuals. Information regarding moisturizers, soaps, and skin cleaners should be included in the safety training curriculum.

4. Workers should be encouraged to report all potential work-related skin problems. These should be investigated on an individual basis by the company or consulting health care providers. Because the work-relatedness of skin diseases may be difficult to prove, each person with possible work-related skin problems needs to be fully evaluated by a physician, preferably one familiar with occupational/dermatological conditions. A complete evaluation would include a full medical and occupational history, a medical exam, a review of exposures, possibly diagnostic tests (such as skin patch tests to detect causes of allergic contact dermatitis), and complete follow-up to note the progress of the affected worker. Individuals with definite or possible occupational skin diseases should be protected from exposures to presumed causes or exacerbators of the disease. In some cases of allergic contact dermatitis, workers may have to be reassigned with retention of pay and employment status to areas where exposure is minimal or nonexistent.

5. Workers should be told about factors affecting skin integrity as part of comprehensive training on preventing work-related skin disease. These factors are:

a. Temperature: too hot (excessive sweating) or too cold.

- b. Humidity: too much or not enough (dry skin).
- c. Ultraviolet light: sunburn.
- d. Water: too much washing or not enough washing.
- e. Good personal hygiene.
- f. Emphasis on good skin care.

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Table 1: PBZ Sampling for Ethylene Glycol and Propylene Glycol

Date	AM/PM	Job title	Work location	Sampling time (Minutes)	Concentration, mg/m ³	
					Ethylene Glycol	Propylene Glycol
11/28/2005	PM	Man-in-Charge	HV Press	337	0.29*	0.29*
11/28/2005	PM	Man-in-Charge	D Press Cold	381	0.29*	0.51*
11/28/2005	PM	First Pressman	936-946 Hot	375	0.11*	0.21*
11/28/2005	PM	Man-in-Charge	936 C Press Cold	388	0.14*	0.26*
11/29/2005	AM	Man-in-Charge	A Press Cold	428	0.17*	0.31*
11/29/2005	AM	First Pressman	HV Press	435	0.15*	0.23*
11/29/2005	AM	Man-in-Charge	D Press Cold	396	0.18*	0.32*
11/30/2005	AM	Man-in-Charge	936 C Cold	478	0.45*	0.22*
11/30/2005	AM	First Pressman	D Press cold	470	0.11*	0.17*
11/30/2005	AM	First Pressman	A Press Cold	410	0.14*	0.14*
11/30/2005	AM	Man-in-Charge	HV Press	469	0.07*	0.14*
11/30/2005	AM	Man-in-Charge	946 Press Hot	462	0.10*	0.23*
11/28/2005	PM	Man-in-Charge	HV Press	337	0.29*	0.29*
11/28/2005	PM	Man-in-Charge	D Press Cold	381	0.29*	0.51*
11/28/2005	PM	First Pressman	936-946 Hot	375	0.11	0.21
11/28/2005	PM	Man-in-Charge	936 C Press Cold	388	0.14	0.26
NIOSH REL					None	None
OSHA PEL					None	None

mg/m³ = milligrams per cubic meter of air

* Indicates sorbent tube breakthrough occurred. This reported concentration should be considered a minimum.

NIOSH REL – NIOSH Recommended Exposure Limit

OSHA PEL – OSHA Permissible Exposure Limit

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Table 2: PBZ Sampling for Volatile Organic Compounds (mg/m³)

Date	Shift	Job title	Work location	Sampling time (minutes)	Xylene	2-butoxy ethanol	Toluene	Trimethyl benzenes	Cumene	Propyl benzene	Stoddard Solvent
11/28/2005	PM	Man-in-Charge	936-946 Hot	388	0.09	ND	0.05	2.30	0.23	0.46	10.1
11/28/2005	PM	First Pressman	936 C Cold	392	Trace	ND	0.06	2.30	0.20	0.43	10.2
11/28/2005	PM	First Pressman	HV Hot	371	0.15	ND	0.04	4.14	0.39	0.80	17.3
11/28/2005	PM	First Pressman	D Press Cold	358	0.22	ND	0.03	6.25	0.61	1.26	26.4
11/29/2005	AM	Man-in-Charge	HV Hot	439	Trace	ND	0.05	2.03	0.18	0.40	11.2
11/29/2005	AM	First Pressman	D Press Cold	401	0.29	ND	0.04	6.48	0.65	1.34	26.9
11/29/2005	AM	Man-in-Charge	936-946 Hot	433	Trace	ND	0.03	2.30	0.21	0.44	9.9
11/29/2005	AM	First Pressman	A Press Cold	429	0.08	ND	0.05	2.67	0.24	0.51	10.8
11/30/2005	AM	Man-in-Charge	D Press Cold	480	0.13	ND	0.04	3.49	0.35	0.71	14.8
11/30/2005	AM	Roll Tender	936 C Cold	461	Trace	ND	0.04	1.83	0.17	0.37	9.3
11/30/2005	AM	First Pressman	946 Hot	464	0.08	ND	0.03	1.94	0.19	0.41	8.7
11/30/2005	AM	First Pressman	HV Hot	495	0.13	ND	0.04	3.00	0.32	0.64	13.0
11/30/2005	AM	Man-in-Charge	A Press Cold	468	0.12	ND	0.05	3.05	0.32	0.62	12.6
				MDC	0.02	1.05	0.01	0.01	0.01	0.01	0.10
				MQC	0.08	3.49	0.01	0.05	0.01	0.01	0.35
				NIOSH REL	435	24	375	125	245	NA	350
				OSHA PEL	435	240	750	NA	245	NA	2900

mg/m³ = milligrams per cubic meter of air

MDC = Minimum Detectable Concentration; MQC = Minimum Quantifiable Concentration

Trace = analytical result was between MDC and MQC.

ND = none detected (value was below the MDC); 2-butoxyethanol was not detected (<1.05 mg/m³)

NA = not available

NIOSH REL = NIOSH Recommended Exposure Limit; OSHA PEL = OSHA Permissible Exposure Limit

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Table 3: Prevalence of Reported Symptoms during Workshift in Month Prior to Site Visit Among Pressroom Employees

Symptom at work:	# with symptom [N=41] # (%)	# with symptom at least two times a week
Headache	23 (56)	10 of 23
Eye irritation	14 (34)	8 of 14
Nose irritation, running, or congestion	10 (24)	5 of 10
Throat irritation	10 (24)	8 of 10
Cough	10 (24)	5 of 10
Lightheadedness	5 (12)	2 of 5
Dizziness	7 (17)	2 of 7
Confusion	0	0

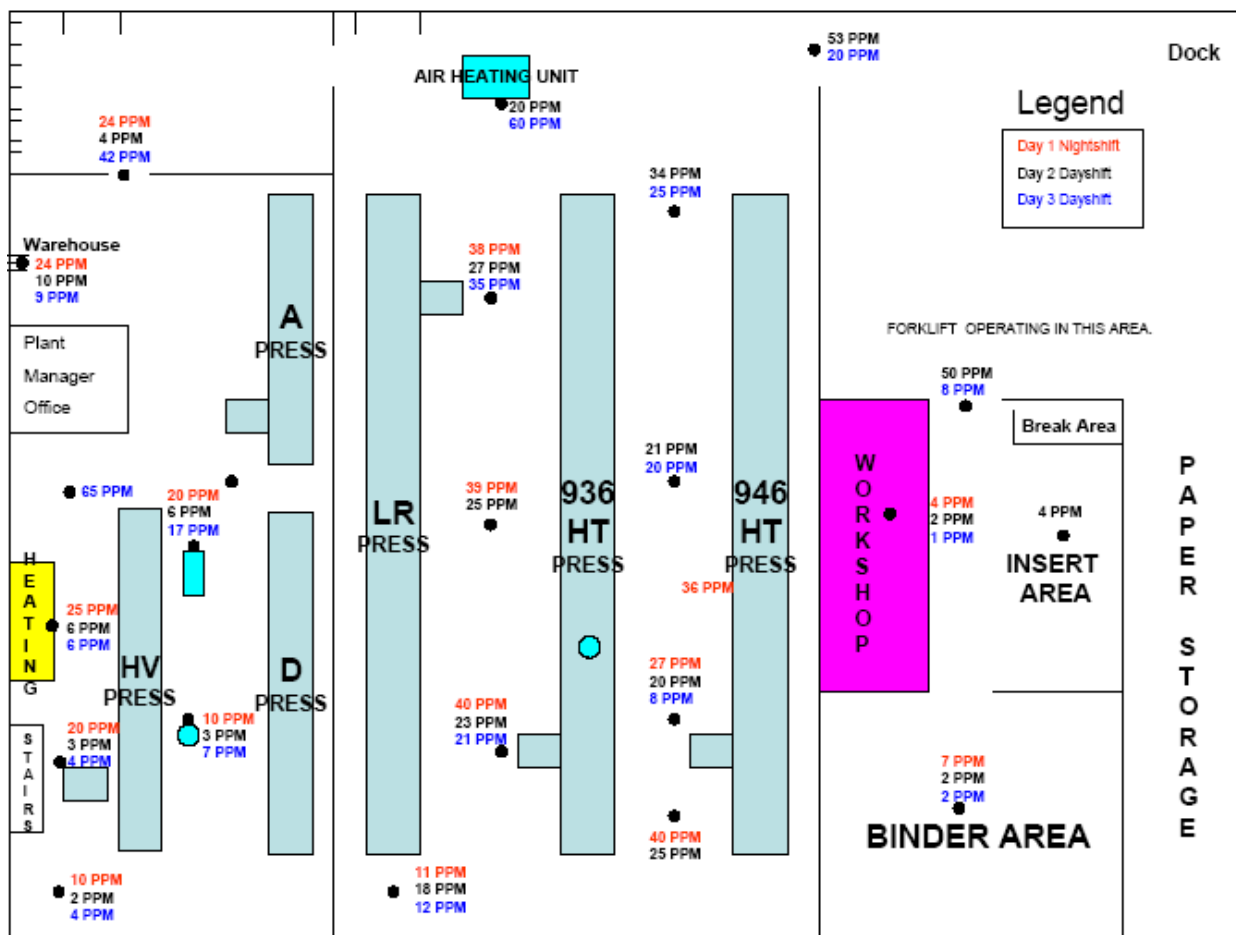
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Table 4: Prevalence of Reported Characteristics of Rash and Medical History among 20 Employees with History of Rash since Onset of Work at Buffalo Newspress

Among the 20 workers with history of rash since working at Buffalo Newspress:	Number (%) of workers responding "YES" [N=20]	Number (%) of workers responding "NO" [N=20]
Rash developed in past two years while at Buffalo Newspress	16 (80)	4 (20)
Rash improved away from work	14 (70)	6 (30)
Rash located primarily on fingers, hands, wrists, and/or forearms	14 (70)	6 (30)
Visible rash at time of site visit	13 (65)	7 (35)
Saw a medical provider for rash	8 (40)	12 (60)
Changed work area due to rash	0	20 (100)
History of skin disorder in lifetime	5 (25)	15 (75)
History of allergies in lifetime	11 (55)	9 (45)
History of asthma in lifetime	3 (15)	17 (85)

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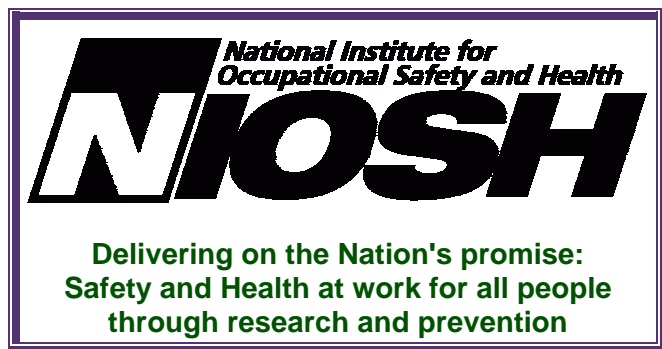
Figure 1: Carbon monoxide area concentrations (ppm)



ppm = parts per million

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