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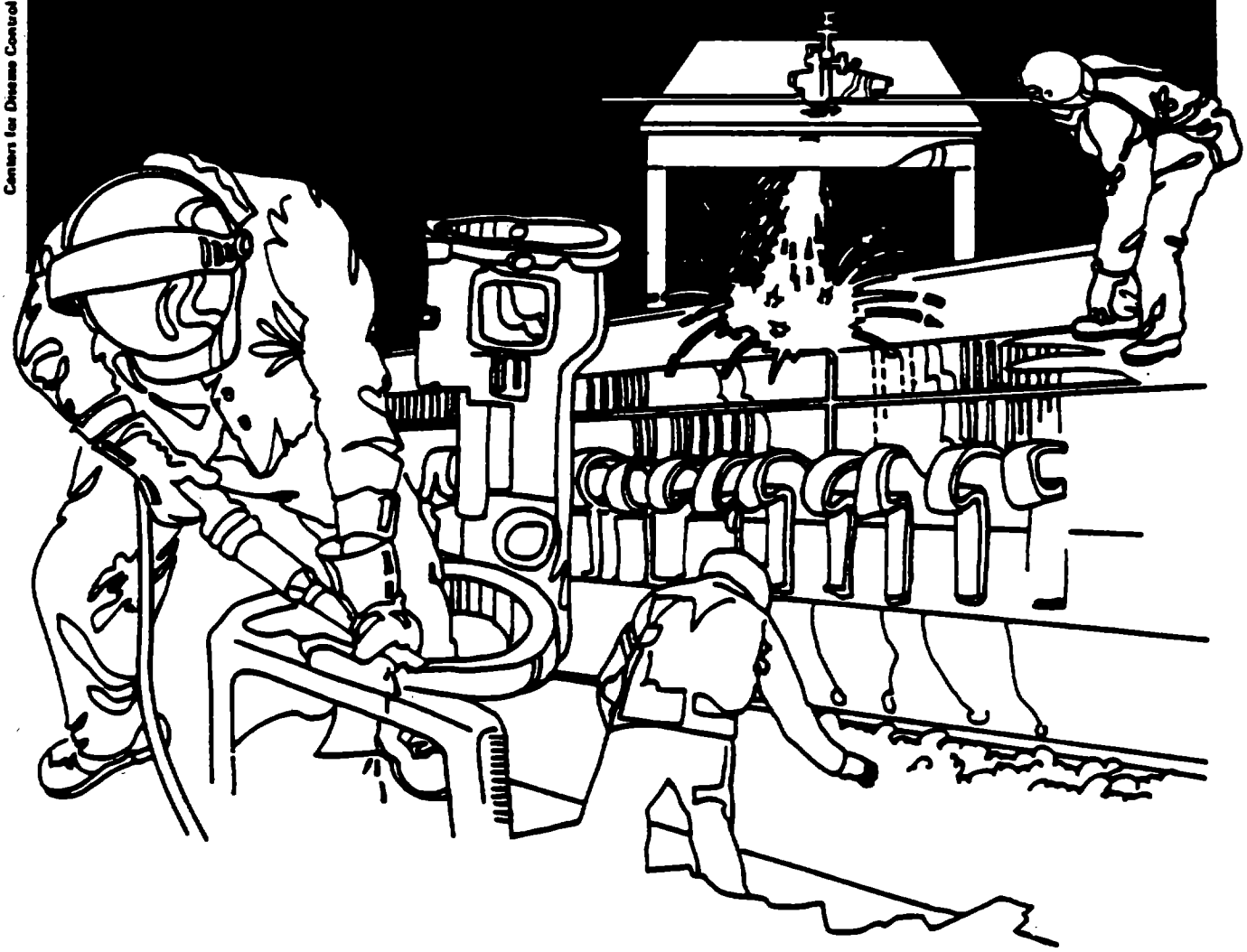

Health Hazard Evaluation Report

HETA 85-323-1677
CUYAHOGA COMMUNITY COLLEGE
CLEVELAND, OHIO

PREFACE

The Hazard Evaluations and Technical Assistance Branch of NIOSH conducts field investigations of possible health hazards in the workplace. These investigations are conducted under the authority of Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669(a)(6) which authorizes the Secretary of Health and Human Services, following a written request from any employer or authorized representative of employees, to determine whether any substance normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The Hazard Evaluations and Technical Assistance Branch also provides, upon request, medical, nursing, and industrial hygiene technical and consultative assistance (TA) to Federal, state, and local agencies; labor; industry and other groups or individuals to control occupational health hazards and to prevent related trauma and disease.

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16. Abstract (Limit: 200 words)

An environmental survey was conducted in the photography laboratory of the Learning Resources Support Services at Cuyahoga Community College (SIC-8222), Cleveland, Ohio on July 10 and 11, 1985 to assess exposures to reagents and byproducts of processes used. The evaluation was requested by District 925, Service Employees International Union for the investigation of worker complaints of dizziness, nausea, headaches and other symptoms they believed were related to photographic developing and printing processes. Air samples were collected for acetic-acid (64197), sulfuric-acid (7664939), ammonia (7664417), formaldehyde (50000), and sulfur-dioxide (7446095); a personal breathing zone sample for acetic-acid and sulfuric-acid was collected on a laboratory worker over a six hour period. The time-weighted average exposure was 0.2 milligram per cubic meter (mg/M3) for acetic-acid (NIOSH Recommended Exposure Limit (REL) of 25mg/M3) and 0.02mg/M3 for sulfuric-acid (REL of 1mg/M3). Short term exposure to ammonia was about 1 part per million (ppm) (REL of 50ppm). The other compounds were not detected in breathing zone samples. The existing ventilation system was evaluated. The author concludes that workers were not overexposed to substances used in photographic developing and printing. Inadequate fresh outside air was being supplied and local exhaust ventilation was not effective. Recommendations are made regarding general work room air quality and work practices for the laboratory.

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NIOSH INVESTIGATORS:
Katherine Hunninen

I. SUMMARY

In April 1985, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Service Employees International Union for a health hazard evaluation of the photography laboratory in the Learning Resources Support Services at Cuyahoga Community College in Cleveland, Ohio. Laboratory workers reported experiencing dizziness, nausea, headaches and other symptoms they felt were related to developing and printing processes.

An environmental survey was conducted on July 10-11, 1985, to assess workers' exposures to reagents used in the various processes or to by-products of the processes conducted. Air samples were collected for acetic acid, sulfuric acid, ammonia, formaldehyde and sulfur dioxide. An evaluation of the existing ventilation system was also performed.

A personal breathing zone sample for acetic acid and sulfuric acid was collected on a laboratory employee over a six-hour time period. Results indicated a time-weighted average exposure to acetic acid of 0.2 mg/M^3 (NIOSH Recommended Exposure Limit (REL) - 25 mg/M^3) and to sulfuric acid of 0.02 mg/M^3 (REL - 1 mg/M^3). Short-term detector tube samples in the breathing zone during specific operations indicated only low (1 ppm) level exposure to ammonia (REL - 50 ppm). All other breathing zone samples for the above listed compounds were non-detected.

Evaluation of the ventilation as it existed at the time of the survey, indicated that the local ventilation system was not effective and inadequate make-up air was being supplied.

Based on the data collected during this survey, we concluded that workers were not overexposed to substances used in photographic developing and printing operations. Results did, however, indicate that local exhaust ventilation was not operating effectively and that minimum recommended levels for fresh outside air were not being provided. Recommendations for increasing the general quality of the workroom air and improved workpractices are made in Section VII of this report.

KEYWORDS: SIC 8222 (Junior Colleges and Technical Institutes) acetic acid, sulfuric acid, ammonia

II. Introduction

On April 25, 1985 the National Institute for Occupational Safety and Health (NIOSH) received a request from District 925, Service Employees International Union for a health hazard evaluation of the photography laboratory in the Learning Resources Support Services at Cuyahoga Community College in Cleveland, Ohio. Employees working in this laboratory were reportedly suffering from dizziness, nausea, headaches and other symptoms they believed were related to the photograph developing and printing processes.

The initial site visit and the environmental survey were conducted on July 10 and 11, 1985 to assess exposures to selected chemicals used as process reagents that may have caused the reported health problems, and to evaluate a recently installed ventilation system.

A report with preliminary results and recommendations was provided to the college and union on August 19, 1985.

III. Background

The photography laboratory processes media work for the college administration; the area is not used by students. The laboratory consists of two primary work areas, the black and white and the color film developing room (Room A) and the black and white print room (Room B). No color printing is done in this laboratory. Three full and three part-time employees work in these areas; employees can spend an average of 4 to 6 hours processing film. The majority of that time is spent in black and white developing and printing.

Employees believed that symptoms including headaches, dizziness, fatigue and eye irritation were related to the inadequate ventilation and the lack of fresh air circulation in the Print Room B. Working in Room A, where the film developing is done manually, did not produce the reported symptoms related to the processing in Room B.

In Room B the processing is done automatically with the Luth Mini 500. The processing chemicals are added manually and include Kodak Developer 55, and Kodak Rapid Fixer A and B. The Luth Mini operates at a temperature between 110° and 120°F and exhausts directly into the work area. The spent chemicals are discharged through a hose into an open sink for disposal.

The ventilation in Room B, with dimensions of 21' X 15' X 8.7', was supplied at a specification rate of 340 cubic feet per minute (cfm) through two vents; it was returned at the same rate through one vent. This should have provided 6.6 air changes per hour, which did not meet the minimum of ten room changes per hour recommended by Kodak.

According to the heating, ventilation and air conditioning (HVAC) contractor who maintains the College's units, a minimum volume of 5% fresh air is maintained in the winter and the summer months. The balance of the air volume is recirculated through the system. During the other months, the system circulates fresh air. Thermostat controlled automatic dampers regulate the volume of outdoor air that is supplied to the dual duct (hot/cold duct) ventilation system serving the photography laboratory.

A canopy hood over the Luth Mini had been installed just prior to our survey. The fan was designed to directly exhaust outside an additional 300 cubic feet per minute. With a balanced supply air volume, this should have increased the room changes per hour to 14.

A portable air cleaning unit (Abbeon Cal, Inc. Model PM 180) was also operating in the area and was designed to filter up to 8000 cfm every 30 minutes. According to the manufacturer, this unit contained a filtration system including "foam, activated charcoal and gas absorbing material" and would remove formaldehyde, ammonia and acetic acid, among other contaminants.

IV. Methods

A number of photographic chemicals were used in the black and white and the color developing and in the black and white printing processes. Based on the quantity of chemicals used and their chemical characteristics including toxicity, the following chemicals were selected for measurement in Room A and/or Room B: formaldehyde, sulfur dioxide, ammonia, acetic acid and sulfuric acid.

Both time-averaged and direct reading methods were used to assess the exposures. Draeger detector tubes were used to measure short-term exposures in the employee's breathing zone to formaldehyde, acetic acid, ammonia and sulfur dioxide in Rooms A and/or B and to measure long-term exposures to sulfur dioxide. Area grab samples were also taken with detector tubes. Long-term samples using calibrated sampling pumps and the appropriate collection media were obtained for formaldehyde, sulfuric acid and acetic acids in both the developing and the printing rooms. Formaldehyde samples were collected in impingers using 1% sodium bisulfite solution at a flowrate of 1 liter per minute (lpm) and analyzed colormetrically by NIOSH Method 3500. Samples for sulfuric acid and acetic acid were collected on washed silica gel tubes at a flowrate of 0.8 lpm and analyzed using Ion Chromatography (NIOSH Method 7903).

The effectiveness of the newly installed ventilation system was evaluated using smoke tubes to trace the air streams around the hood and the work area.

V. Evaluation Criteria

A. Environmental Criteria

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

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects, even if the occupational exposures are controlled at the level set by the evaluation 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 criteria for the workplace are: 1) NIOSH Criteria Documents and recommendations, 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLV's), and 3) the U.S. Department of Labor (OSHA) occupational health standards. Often, the NIOSH recommendations and ACGIH are lower that the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on recent information that are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposures in various industries where the agents are used; the NIOSH recommended exposure levels, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is required legally to meet those levels specified by an OSHA standard.

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

Listed below are the evaluation criteria for the sampled substances in this evaluation.

Substance	Recommended Exposure Limit	Source	OSHA Standard
Formaldehyde	Lowest Feasible Level	NIOSH	3 ppm
Acetic Acid	25 mg/M^3	OSHA	25 mg/M^3
Ammonia	50 ppm ceiling	NIOSH	50 ppm
Sulfur Dioxide	0.5 ppm	NIOSH	5 ppm
Sulfuric Acid	1 mg/M^3	NIOSH	1 mg/M^3

VI. RESULTS AND DISCUSSION

A personal breathing zone sample for acetic acid and sulfuric acid was collected on one of the employees working in the laboratories. The sample was collected over a six-hour period of time with detector tube samples being taken to characterize specific short-term procedures occurring during that time period. Results indicate a time-weighted average exposure to acetic acid of 0.2 mg/M^3 and a sulfuric acid exposure of 0.02 mg/M^3. The respective recommended exposure levels (RELs) for these substances are 25 mg/M^3 and 1 mg/M^3.

Long-term area samples collected in Room A over a six-hour time period indicated an acetic acid concentration of 0.05 mg/M^3, a trace amount (<0.003 mg/M^3) of sulfuric acid and a formaldehyde concentration of 0.02 ppm. No formaldehyde was detected using detector tubes during the color film and the litho reversal development, where formaldehyde was a reagent. No acetic acid or ammonia was detected during the chemical mixing or during the black and white litho reversal development in Room A. Thirty mg/M^3 of acetic acid was detected at the process tank surface while the rolls of film were hand-dipped into an acetic acid wash in the black and white litho reversal development.

In Room B, a long-term area sample for formaldehyde indicated an average concentration of 0.01 ppm over a six-hour time period. Detector tube samples were taken at the employee's breathing zone for ammonia and for acetic acid while operating the Luth Mini printer and replenishing the chemicals. Ammonia, sulfur dioxide and formaldehyde were measured during the chemical mixing for the Luth Mini printer. One ppm of ammonia was detected during chemical mixing. All other samples detected nothing. An area grab sample was also taken for ammonia and acetic acid at the hose discharge during chemical replenishing. About 20 ppm of ammonia was detected but there was no indication of acetic acid.

Long-term (six-hour) samples were collected with detector tubes for sulfur dioxide in both Room A and Room B. No sulfur dioxide was indicated.

The smoke tubes indicated the new ventilation system was not effective for removing the exhaust generated by the Luth Mini printer. The room was under a strong positive pressure indicating that the supply air exceeded the exhaust capacity of the system. During the evaluation, both the exhaust and supply air volumes were increased. As a result, the supply air stream was directed toward the walls, creating air turbulence that was strong enough to disrupt the slight draw into the canopy hood. The exhaust fan on the Luth Mini generated a stream of air, which also disrupted the weak draw of the hood, yielding it ineffective.

VII. RECOMMENDATIONS

1. The ventilation system over the Luth Mini needs to be re-evaluated by the contractor to assure an adequate air velocity effectively exhausts the Luth Mini. Contacting the Luth Mini manufacturer about the appropriate ventilation design for their unit may be helpful. For future reference, the use of a canopy hood is discouraged because the contaminated air is exhausted past the breathing zone of the operator while working at the machine. Instead of a canopy hood, a side draft hood with a tapered take-off to minimize capture velocity losses would be a better design.

2. The appropriate balance of air supply and exhaust needs to be provided in the Printing Room B. The American Society of Heating, Air Conditioning, and Refrigeration Engineers (ASHRAE) recommends that a minimum of 20 cfm of outdoor air be provided per person. The possibility exists, based on the low volume of outdoor make-up air entering the system, that this criteria may not have been met during the winter months. The lack of fresh air in the small Printing Room, combined with the exhaust from the Luth Mini could have produced a decrease in the quality of the air in this work area.

3. A personal protective equipment program should be implemented in the photography laboratory. It should include the use of aprons, gloves and goggles while handling the chemicals. For the best protection against the liquid inorganic acids and bases and formaldehyde, aprons and long-cuffed gloves should be made of neoprene or nitrile. Chemical goggles or a faceshield should be worn whenever any chemicals are handled or transferred to different containers. Adequate storage and maintenance programs should be established with the use of protective equipment.

4. An eyewash station should be located conveniently between Rooms A and B and it should not be obstructed by any equipment or supplies.

5. If tongs were available to replace the hand dipping of the rolls of film in the processing room, this would eliminate the potential for some skin contact with the chemicals.

6. The ventilation rate in each of the photography labs should not be less than 10 room changes per hour. Adequate make-up outdoor air should be available to meet the ASHRAE criteria of 20 cfm per person.

7. A joint labor-management health and safety committee should be established and should meet regularly. A program to address (a) the use of toxic chemicals in the College, (b) the adequacy of the engineering controls such as local exhaust ventilation and (c) the use and maintenance of personal protective equipment should be developed and audited by the Committee.

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

Report Prepared by:	Katherine Hunninen Industrial Hygienist Industrial Hygiene Section
Originating Office:	Hazard Evaluations and Technical Assistance Branch Division of Surveillance, Hazard Evaluations, and Field Studies
Report Typed By:	Lynette K. Jolliffe Secretary Industrial Hygiene Section

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1. Cuyahoga Community College, Cleveland, Ohio
2. Service Employees International Union, Cleveland, Ohio
3. NIOSH, Region V
4. OSHA, Region V

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.