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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 73-191-149

OSBORNE PHOTOGRAPHIC LABORATORIES, INC.
CINCINNATI, OHIO
OCTOBER 1974

I. TOXICITY DETERMINATION

It has been determined that employee exposures to acetic acid and formaldehyde vapors in the hand print room are not toxic in concentrations measured during the evaluations performed on February 7 and 18, 1974. Potentially toxic acetic acid air concentrations were found in the chemical mix in the loft area; exposures to formaldehyde in the loft area were not toxic. These determinations are based on results of employee interviews and environmental measurements obtained during the survey, and the available information on toxicity of these substances.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of the Determination Report are available upon request from the Hazard Evaluation Services Branch (NIOSH), U.S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202.

Copies have been sent to:

- a) Osborne Photographic Laboratories, Inc.
- b) U.S. Department of Labor - Region V
- c) NIOSH - Region V

For the purposes of informing the three "affected employees", the employer will promptly "post" the Determination Report in a prominent place(s) near where exposed employees work for a period of 30 calendar days.

III. INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U.S.C. 669 (a)(6), authorizes the Secretary of Health, Education, and Welfare, following a written request by an employer or representative of employees to determine whether any substance(s) normally found in the place of employment has potentially toxic effects in such concentrations as used or found.

The National Institute for Occupational Safety and Health (NIOSH) received a request from the employer regarding exposures to acetic acid and formaldehyde mist in the chemical mix loft and hand printing areas of the Osborne Photographic Laboratories, Inc. in Cincinnati, Ohio.

IV. HEALTH HAZARD EVALUATION

A. Description of Process - Condition of Use

Osborne Photographic Laboratories, Inc. processes and develops color, black and white films, and prints. With the exception of the hand printing operation most of the developing and printing operations are automatic. The chemical mix facility located in a loft and the hand printing process were the operations evaluated. Twenty-five gallon stock photographic solutions (commonly referred to as a "fix" and a "stop-fix" solution) are prepared in the loft on an as needed basis, usually once a week. The stop-fix solution container is partly filled with water; part A, a dry chemical, is added and mixed with an electric driven stirrer-agitator until the chemical is dissolved. One gallon of acetic acid is then added and mixed. The procedure for preparing "fix" solution is identical to "stop-fix" solution except that Part A, is a different dry chemical and 1 quart of formaldehyde is substituted for the gallon of acetic acid. During the addition of acetic acid or formaldehyde the worker holds the gallon or quart container as it is poured into the partly filled stock solution containers. The dilution proportions of the work solutions are 20:1 and 30:1 for the "fix" and "stop-fix" solutions respectively.

Three employees are assigned the responsibility of preparing batch stock solutions in addition to other duties. The time consumed in preparing a batch of solution varies from 10-15 minutes. While preparing the stock solution the worker usually remains in the loft until the stock solution is properly prepared. It is not necessary that he remain atop the containers while the solution is being mixed. Space is available where the employee can position himself away from the container if necessary. It is only during addition of chemicals that the worker is atop the container to which the chemicals are added. A total of 5 stock solution containers are located in the loft.

Two employees are engaged in black and white hand printing process in the dark room. Stop and stop-fix solutions used in the hand printing process are diluted stock solutions. Rubber gloves are available to the employees working in the black and white hand print.

B. Evaluation Method and Design

An environmental evaluation of exposures to acetic acid and to formaldehyde vapor was made on February 2 and March 8, 1974. Personal air samples for acetic acid and formaldehyde were collected in midjet impinger and fritted glass bubblers in the chemical mixing area (loft). The air sampling period in the loft was 10 to 12 minutes. MSA* and Dräger* color indicator tubes were also used to measure peak acetic acid and formaldehyde concentrations. Stationary air samples were obtained in the dark room adjacent to the hand printing process. Samples were analyzed by the NIOSH laboratory for formaldehyde and acetic acid.

Employees were asked non-directed questions regarding related health problems. Their responses were recorded and later evaluated with the air sampling data.

C. Evaluation Criteria

1. Evaluation standards are intended to protect the health of workers and have been suggested by several sources. These standards are established at levels designated to protect workers occupationally exposed to a substance on an 8 hour per day 40 hour per week basis for a working lifetime or to protect people from the irritant effects of short-term exposures to irritant vapors when the substance has a "C" notation. For this study the recommended limits for exposure to these substances are presented below:

| <u>Substance</u> | <u>8-Hr Time Weighted Average</u> | <u>Ceiling Value</u> |
|------------------|---------------------------------------|--------------------------|
| Acetic Acid | 10 ppm | |
| Formaldehyde - C | | 2 ppm |

ppm - Parts of vapor or gas per million parts of contaminated air by volume at 25°C and 760 mm Hg pressure.

C - A value bearing a "C" designation refers to a "ceiling" value that should not be exceeded; all values should fluctuate below the listed value.

* Mention of trade names does not constitute endorsement by NIOSH.

2. Toxicity

a. Acetic Acid¹

Acetic acid is one of the most widely used organic acids. The important effects are those resulting from the direct contact of the acid on skin, eye and mucous membranes or teeth. Studies of the effects of acetic acid on guinea pig skin indicate that concentrations from 80% to glacial produce severe burns, from 50-80 per cent moderate burns to severe burns, and below 50 per cent relative mild injury. No injury is noted at 5 to 10 per cent concentrations. The effects of eye contact are thought to be similar. Few studies have reported adverse health effects to exposed persons. Except for these local effects no evidence of cumulative toxicity has been found.

b) Formaldehyde

Formaldehyde is a colorless substance with an irritating odor that is perceptible at less than one ppm.²

The principal hazard in industrial use is from the vapors of formaldehyde. Irritation of the membranes of the eyes and upper respiratory passages results from excessive exposure. Repeated exposure may result in inflammation of the eyelids. Chronic irritation to the eyes, nose and upper respiratory tract may result from repeated exposure to the vapors. Inhalation of high concentrations can cause laryngitis, bronchitis, and broncho-pneumonia.

Repeated contact with skin has a hardening or tanning effect and causes irritation. Prolonged or repeated contact may produce cracking of the skin and ulceration, particularly around the fingernails. Dermatitis has been a common occurrence from prolonged and repeated contact with formaldehyde solutions or with products containing free formaldehyde.

D. Evaluation Results and Discussion

1. Environmental Evaluation

Determination of an 8-hour-time-weighted average exposures to acetic acid and formaldehyde at the loft area was complicated since the employee preparing the chemical batch is not permanently based in the loft area. Moreover, exposures to these substances are infrequent and usually about three minutes; the preparation of the solution takes less than 14 minutes. Since both of these chemicals produce irritant vapors, a short term exposure evaluation is more meaningful.

Acetic acid vapor samples were obtained at the operator's breathing zone and at stationary locations (in the loft area) in midjet

impingers containing 15 ml of 0.05 normal sodium hydroxide. After collection and upon analysis back in the NIOSH laboratories it was found that valid impinger acetic acid vapor samples, in the loft area, were not obtained due to the short time required in preparing a batch solution and difficulties encountered in the wet chemistry determination relative to sensitivity of the analytical method. Thus, it was necessary to rely on MSA detector tubes which had been collected concurrently with the midget impinger samples. Five MSA detector tubes were used to determine acetic acid vapor concentrations. Short term acetic acid concentrations ranging from 300 - 400 ppm were obtained during preparation of a batch solution. Acetic acid concentrations found in the hand printing room were less than 3.0 ppm. Formaldehyde vapor samples were obtained at the operator's breathing zone and at stationary locations in the loft using a sampling train composed of two all glass impingers equipped with fritted glass tips. The formaldehyde impingers concentrations were less than 5 micrograms per impinger, the sensitivity limit of the analytical procedure. The formaldehyde detector tubes did not register any formaldehyde vapor concentrations in the loft area or the hand printing room.

2. Medical Evaluation

Hand print operators and chemical mixers were interviewed in a non-directed manner to elicit any medical symptomatology regarding exposures to acetic acid and formaldehyde. Several cases of dermatitis were reported among hand print operators. This was caused primarily by direct contact while placing or removing prints from the developing solutions. No other work related health problems were reported.

Based on airborne acetic acid concentrations and upon results of employee interviews it was determined that acetic acid levels were considerably above the recommended levels of exposure during preparation of a batch solution. Therefore, a potentially toxic exposure is judged to exist in this area. It should be pointed out that the current Federal health standard of the Department of Labor, OSHA, limits occupational exposure for acetic acid to 10 ppm on an 8 hour TWA basis, and excursions only to 20 ppm. Formaldehyde concentrations measured in the loft during this evaluation were found to be below levels believed to be toxic. Acetic acid and formaldehyde vapors in the hand printing facilities were also found to be below levels normally considered to be toxic.

V. RECOMMENDATION

To preclude acetic acid exposure during batch preparation, local exhaust ventilation should be made available. In the interim an approved respirator should be worn by the operator preparing a chemical batch.

VI. REFERENCES

1. Patty, F.A., Industrial Hygiene & Toxicology, Vol. II, pp. 1777-1778, Interscience Publishers - Division of John Wiley & Sons, Inc., N.Y.
2. Hygienic Guide Series, American Industrial Hygiene Association, Southfield, Michigan, 48078.

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