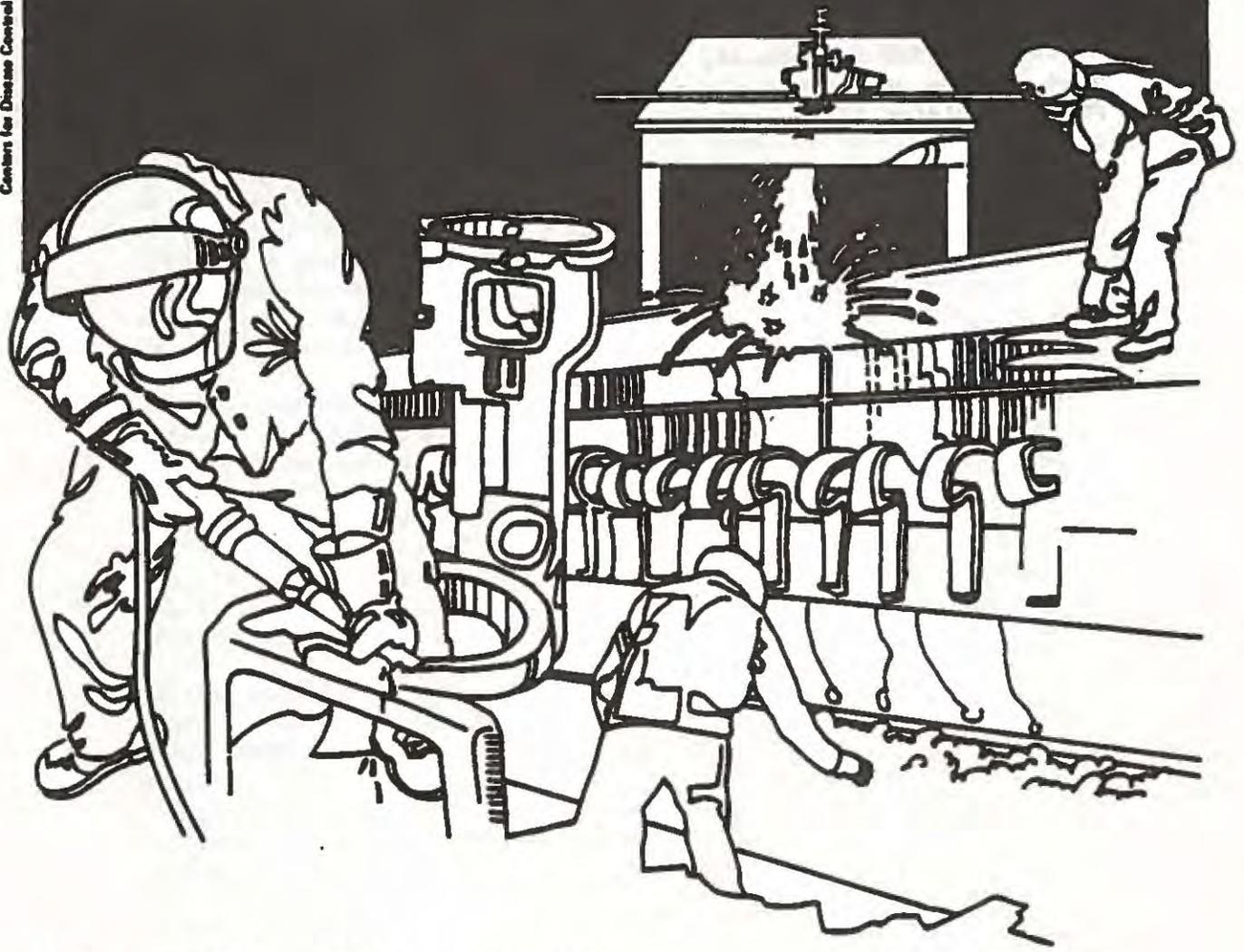


NIOSH



Health Hazard Evaluation Report

HETA 85-060-1670
CITY OF NORWOOD
NORWOOD, 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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NORWOOD, OHIO

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I. SUMMARY

The National Institute For Occupational Safety and Health (NIOSH) received a request for assistance from the Health Commissioner of the City of Norwood, Norwood, Ohio, to determine an employee's exposure to toner powder used in a xerox copier 9500 at Norwood Senior High Media Center. On January 16, 1985, NIOSH investigators conducted environmental and medical evaluations.

Xerox toner is fine powder composed of plastics, colorants, and minor quantities of functional additives. Styrene acrylic polymer is the major component of the toner. Xerox reports that epoxy polymers are not used in their toners. In black toners, several different speciality grade carbon blacks are used as colorants. Cordage,® a cold adhesive padding compound, consists of polyvinyl acetate, polyvinyl alcohol, and dibutyl phthalate (plasticizer) and is used in the media center to bind the copies together.

The environmental survey found 8-hour time-weighted average (TWA) exposure for airborne total particulates (4 samples) concentrations ranging from less than the limit of detection to 0.02 milligrams per cubic meter of air (mg/m^3). The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) for total particulate is $10 \text{ mg}/\text{m}^3$. The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) is $15 \text{ mg}/\text{m}^3$. Results of the indicator tube samples for carbon monoxide and ozone were non-detectable.

Private medical interviews were conducted with three employees in the Media Center to elicit symptomatology possibly related to exposures of toner powder. Two of these workers reported no respiratory or skin problems. One employee was subsequently seen by a board-certified dermatologist under contract to NIOSH for this evaluation. The employee had no prior history of skin disease or symptoms until approximately three weeks of operating a Xerox 9500 duplicator. At that time she developed hives on both hands progressing to involve her earlobes and right cheek, and since that time she continued to develop hives when working with the Xerox machine. The employee states individual lesions may last one or two hours. She also experiences cough and shortness of breath when working with the Xerox machine. Her condition improves and doesn't occur during the weekends or when not working with the xerox duplicator. No co-workers are similarly affected.

The dermatologist performed "standard delayed hypersensitivity patch testing". No positive skin reactions were seen from the patch tests, but the employee did develop cough, tearing eyes, and itching two hours after the patches were applied.

The affected employee was advised to request an administrative transfer away from photocopy activities. The request was granted and symptoms subsided and the problem was taken care of.

Based on the dermatologic evaluation, it is concluded that one employee's condition is precipitated by materials to which she is exposed in the workplace. The cause does not seem to be direct skin contact, but rather inhalation of one or more of the chemicals, which may cause an allergic reaction manifested by cough and the development of hives. Recommendations to aid in providing a safe and healthful working environment are presented in Section VIII of this report.

KEYWORDS: SIC 8211 (Elementary and Secondary Schools) Xerox copier, indoor air, styrene acrylic, cordage®, polyvinyl acetate, polyvinyl alcohol, and dibutyl phthallate, hives.

II. INTRODUCTION

In November 1984, NIOSH received a request from the Health Commissioner City of Norwood, Norwood, Ohio for assistance in determining employees' exposure to toner powder used in a Xerox copier 9500 at the Norwood Senior High Media Center. On January 16, 1985, NIOSH investigators conducted an environmental and medical evaluation. One employee was subsequently seen by a board-certified dermatologist under contract to NIOSH for this evaluation on January 28, 1985. On April 15, 1985 the dermatologist performed standard delayed hypersensitivity patch testing using toner powder and cordage®.

III. BACKGROUND

Norwood Senior High Media Center is located in a room approximately 35' x 20' on the third floor of the high school. A model 9500 Xerox copier, located in the center of the room, is used to make 350,000 to 450,000 copies per month. The work force is comprised of three fulltime employees; namely, a supervisor, secretary, and a xerox machine operator who work from 8:00am to 4:30pm, five days per week.

In the xerographic imaging process, an electrostatic charge is applied to a photoconductive layer composed of selenium. Following light exposure, the resultant latent image is developed with a finely divided electrostatic powder known as toner. The toner is supplied to the latent image in the form of a developer mixture, composed of large carrier and small toner particles adhering to it, and is transported by a cascading conveying process. The toner adhering to the imaged areas is transferred electrostatically to the paper and is permanently affixed to it by application of heat and pressure. The residual toner on the photoconductor is removed, and the photoconductor is prepared for the next imaging cycle. The emissions of dust are limited by design of the cleaning system and by exhaust filters.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

Three personal and one area air sample for total particulate were collected on preweighed FWSB filters using a battery-powered vacuum pump at a flow rate of 2.0 liters per minute (LPM). The total weight of each sample was determined by weighing the sample plus the filter on an electrobalance and subtracting the previously determined tare weight of the filter. The tare and gross weighings were done in duplicate. Indicator tube sampling was done for carbon monoxide and ozone.

B. Medical

Private medical interviews were conducted with three media center workers to elicit symptomatology possibly related to exposure to the toner powder.

Standard delayed hypersensitivity patch testing was conducted on one employee using toner powder and Cordage®.

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 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 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 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 TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than 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 standards, 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 legally required 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.

Total Particulate (nuisance dusts)

In contrast to fibrogenic dust which, when inhaled in excessive amounts, cause scar tissue to be formed in the lungs, so called "nuisance" dusts are stated to have little adverse effects on the lungs and do not produce organic disease or toxic effects when exposures are kept under reasonable control. The "nuisance" dusts have also been called (biologically) "inert" dusts, but the latter term is inappropriate to the extent that there is no dust which does not evoke some cellular response in the lungs when inhaled in sufficient amount. However, the lung tissue reaction caused by inhalation of "nuisance dusts" has the following characteristics: 1) the architecture of the air sources remains intact; 2) collagen (scar tissue) is not formed to a significant extent; and 3) the tissue reaction is potentially reversible.

Excessive concentrations of dusts in the work room air may seriously reduce visibility; may cause irritation of the eyes, ears, and nasal passages; or cause injury to the skin or mucous membranes by chemical or mechanical action per se, or by the rigorous skin cleansing procedures necessary for their removal.

Carbon Monoxide

Carbon monoxide (CO), is a colorless, odorless, tasteless, gas partially soluble in water, but one which decomposes. Carbon monoxide combines with hemoglobin to form carboxyhemoglobin which interferes with the oxygen carrying capacity of blood, resulting in a state of tissue hypoxia. The typical signs and symptoms of acute CO poisoning are headache, dizziness, drowsiness, nausea, vomiting, collapse, coma, and death. Initially, the victim is pale, later the skin and mucous membranes may be cherry-red in color. Loss of consciousness occurs at about the 50% carboxyhemoglobin level. The amount of carboxyhemoglobin formed is dependent on concentration and duration of CO exposure, ambient temperature, health, and metabolism of the individual.²

Ozone

Ozone is a bluish gas with a characteristic punget odor, slightly soluble in water. Ozone is irritating to the eyes and all mucous membranes. In human exposures, the respiratory signs and symptoms in order of increasing ozone concentrations are: dryness of vapor respiratory passages; irritation of mucous membranes of nose and throat; choking, coughing, and severe fatigue; bronchial irritation, substernal soreness, and cough. Pulmonary edema may occur, sometimes several hours after exposure has ceased. In severe cases, the pulmonary edema may be fatal.²

Scratch Tests

A small portion of the material is injected slightly below the top layer of the skin. This is done to detect IgE mediated sensitivity, and is usually preformed to evaluate the basis for respiratory allergies. Scratch testing is performed by an allergist.

Patch Tests (xerox toner and cordage®)

Patch tests are tests for cell-mediated skin allergies which are performed by placing low concentrations of various substances on the skin, covering them with impermeable discs and tape, and waiting a standard period of time to see if the skin reacts. Patch testing is performed by a dermatologist.

VI. RESULTS AND DISCUSSION

A. Environmental

Results of the personal and area air samples collected for total particulate on January 16, 1985 in the Norwood Senior High Media Center are presented in Table I.

Three personal and one area air samples indicated exposure to total particulate ranged from less than limit of detection to 0.02 mg/m³. The ACGIH TLV® is 10 mg/m³. The OSHA 8-hour TWA PEL is 15 mg/m³.

Results of the indicator tube samples for carbon monoxide and ozone were non-detectable. The limit of detection for carbon monoxide was 5 parts per million (ppm) and ozone was 0.05 ppm.

As part of the normal operation of the copier, very small quantities of several materials become airborne and are emitted from the equipment. During normal operation, ozone is generated by the corona discharge in various corotrons. Further, extremely small quantities of the surface of the photoconductor may be abraded. In addition, the various operations involving toner result in some of the toner becoming airborne. Most of these materials are contained within the xerographic equipment, in filters, traps, etc., but a small portion is carried out of the machine. The results of typical measurements of ozone, arsenic, selenium, tellurium, and toner emitted from the copier are at or near the limit of detection. The values are based upon measurements made in an instrumentation test-chamber having limited air circulation, at Xerox Corporation Environmental Health and Safety Laboratory in Rochester, New York.

A comparison of the measured values with the applicable Occupational Safety and Health Administration's (OSHA) standards shows all of them to be well within the required limits.

B. Medical

Private medical interviews were conducted with three employees in the Media Center to elicit symptomatology possibly related to exposures of toner powder. Two employees reported no symptoms associated with work. After a preliminary evaluation the third employee was seen by a board-certified dermatologist under contract to NIOSH for this evaluation. The dermatologist found that the employee had no prior history of skin disease or symptoms until she had operated the Xerox 9500 for three weeks. At that time, the employee developed hives on both hands progressing to involve her earlobes and her right cheek. Since that time, she developed hives whenever she worked with the xerox machine. Individual lesions lasted one to two hours. Her condition improved on weekends, and no new lesions developed when she was not working with the Xerox duplicator. She also had a cough and shortness of breath when working with the Xerox duplicator which improved when she was away from it. Scratch testing performed by an allergist on January 25, 1985, reportedly showed several positive sites, meaning that the employee is allergic to certain materials. The scratch testing referred to in this report was done by a private physician at the patient's own request, and results are not available to NIOSH.

The dermatologist performed "standard delayed hypersensitivity patch testing" on April 15, 1985. (Patch tests are tests for skin allergies which are performed by placing low concentrations of various substances on the skin, covering them with impermeable discs and tape, and waiting a standard period of time to see if the skin reacts.) The dermatologist was able to obtain individual components of Cordage® so that she could do a separate test for each of these, but was only sent the finished products from Xerox. No positive skin reactions were seen to the patch tests, but the employee did develop cough, tearing eyes, and itching two hours after the patches were applied.

VII. CONCLUSIONS

Based on the dermatologic evaluation, it is concluded that one employee condition is precipitated by materials to which she is exposed in the workplace. The cause of the problem does not seem to be direct skin contact, but rather inhalation of one or more of the chemicals, which may cause an immediate allergic reaction manifested by cough and the development of hives.

VIII. RECOMMENDATIONS

1. The affected employee was advised to request an administrative transfer away from further exposure to photocopy activities.
2. Although no other employees have shown symptoms, it should be emphasized that sensitization (development of an allergy) can occur after repeated exposures to a material to which an individual previously had no allergy. As the photocopy machine is used in a small office, and some of the chemicals used may be capable of causing allergies to develop, it is important that adequate ventilation be provided at Senior High Media Center.

IX. REFERENCES

1. American Conference of Governmental Industrial Hygienists. Documentation of the threshold limit values. 4th ed. Cincinnati, Ohio: ACGIH, 1980.
2. National Institute For Occupational Safety and Health. Occupational Diseases: A Guide To Their Recognition. Revised ed. Cincinnati, Ohio: National Institute For Occupational Safety and Health, 1977. (DHEW (NIOSH) Publication No. 77-181).

IX. AUTHORSHIP AND ACKNOWLEDGEMENTS

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X. DISTRIBUTION AND AVAILABILITY OF REPORT

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1. City of Norwood, Ohio Health Commissioner
2. NIOSH, Region V
3. 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.

Table I

Results of Environmental Air Samples for Total Particulate

Norwood Senior High Media Center
 Norwood, Ohio
 HETA 85-060

Sample Type Job and/or Location	Date	Sample Time	Sample Volume Liters	Total Particulate mg/m ³ *
Personal Sample Xerox Operator	1-16-85	0730-1435	850	0.01
Personal Sample Secretary	1-16-85	0731-1437	852	0.02
Personal Sample Supervisor	1-16-85	0732-1438	852	LD**
Area Sample on Table Next to Xerox Machine	1-16-85	0734-1439	850	0.01
Limit of Detection, Milligram per Sample				0.01
<u>Environmental Criteria:</u> (time-weighted average 8-hour exposure)				
ACGIH Threshold Limit Value (mg/m ³)				10
OSHA Standard (mg/m ³)				15

* mg/m³ - Milligrams of particulate per cubic meter of air sampled

** LD - Less than detectable limits

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