

U. S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 76-70-367

SPERRY-UNIVAC CORPORATION
BLUE BELL, PENNSYLVANIA

MARCH 1977

I. TOXICITY DETERMINATION

The National Institute for Occupational Safety and Health conducted a health hazard evaluation of practices and exposures relative to the operation of office copiers in the Sperry-Univac Corporation buildings, Township Line, Blue Bell, Pennsylvania. Based on the results of the preliminary environmental investigation, June 2-3, 1976, and further tests on July 22, 1976, the following determinations are made:

- (1) The preliminary detector tube tests at the delivery trays of five of six copiers sampled over approximately ten-minute periods each, identified potentially hazardous atmospheric ozone levels in the range 0.05-0.10 parts per million parts of air while the machines operated continuously.
- (2) Based on employee interviews during the study it is concluded that certain employees were exposed to excessive levels of ozone, particularly during fairly continuous operating conditions and during adverse exposure conditions.

II. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, Information and Dissemination Section, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia. Information regarding its availability through NTIS can be obtained from NIOSH, Publications Office at the Cincinnati address.

Copies of this report have been sent to:

- (a) Sperry-Univac Corporation, Blue Bell, Pennsylvania
- (b) Authorized Representative of Employees
- (c) U.S. Department of Labor - Region III
- (d) NIOSH - Region III

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

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 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 National Institute for Occupational Safety and Health (NIOSH) received such a request from an authorized representative of employees regarding occupational exposure of clerical employees while working in proximity to office copiers at the Sperry-Univac Corporation, Blue Bell, Pennsylvania. The symptoms reported by the affected employees were respiratory and eye irritation, headache, sore throat and fatigue.

IV. HEALTH HAZARD EVALUATION

A. Process - Conditions of Use

The International corporate headquarters of the Sperry-Univac Corporation employs more than 3,000 employees in a multiple building complex outside Blue Bell, Pennsylvania. In carrying out of the many executive, management, design, engineering, and other functions, many clerical operations are widespread throughout the buildings. In these, interspersed with the clerical operations in the complex, are approximately 50 office copiers. Some are placed adjacent or near desks; others located in small rooms, aisles, and hallways. The copiers of the various models are approximately 28" long by 20" wide and by 16" to 40" high, depending on whether they come equipped with their own paper and/or supply cabinet. Since the copiers are relatively compact, the emphasis seems to be on having the Remington[®] type copier handy near the user. Larger Xerox[®] copiers are provided in some areas. These were not evaluated, however: (a) They were only observed to be in physically separated areas. (b) Employee workstations were not nearby.

The following variables were discovered when an evaluation study was made:

- a. Anyone could use the copiers
- b. The demand for use of the individual machines could vary from almost no use to nearly constant use.
- c. Machines were not serviced until malfunctions occurred.

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- d. While some of the copiers were in isolated locations (main office aisles, no workstations within 12 feet or less), the NIOSH surveyors found places where the machine delivery tray was up against the desk workstations or directed toward a desk pushed into a corner against two office partition walls.

B. Evaluation Design

Since the requestors stated that their work stations had been changed from time to time, it was decided to study exposure potentials at a number of different copier models.

C. Evaluation Methods

During the initial visit on June 2 and 3, 1976, tests were made with an MSA Universal Testing Kit and ozone detector tubes. For a detector tube unit to be certified by NIOSH, the minimum set forth in the regulations are basically, 35% accuracy at 1/2 the exposure limit and 25% at one to five times the exposure limit. Certified ozone detector tubes could not be used because manufacturers evidently have not met these criteria by current manufacturing practices.

On the subsequent August 2, 1976 visit, sampling for ozone was done using a midget impinger containing 15 ml of 1% potassium iodide in 1 N sodium hydroxide at a rate of one liter per minute.

Because the majority of the copiers operated with the toner and a petroleum hydrocarbon dispersant, charcoal tube samples were taken with a low volume personal sampling pump.

In the case of the copier REM 530 02943, however, the copier toner was used dry. Hence, an atmospheric sample was taken on a type AA membrane filter in a plastic cassette and air sampled at a rate of 2 liters per minute by a battery-powered personal sampling pump.

Following the site visit, several references were noted in ACS Chemical and Engineering News discussing the exposure potential to selenium in copier rooms. The above-mentioned atmospheric dust sample, plus the bulk samples, were analyzed for selenium content.

When NIOSH more accurate sampling capabilities were made available on August 2, 1976, the employer representative declined our request to operate some of the copiers continuously to simulate the conditions described in the employees' request. When run at capacity, the copiers turn out approximately 10 copies a minute. The atmospheric tests were to be conducted only as the machines would be used as the demand arose during the day. Hence, the NIOSH investigators' judgment was, in order to develop a competent study under the circumstances, to locate the sampling heads adjacent to the delivery trays of the copiers.

The one exception was the first sample in Table II, Administration Building, A40202A Machine R140003. Here the ozone sampling tube was placed near the center of employee's desk top. This sample represents evaluation of the employee's breathing air exposure. It will be noted that the copier that day produced 69 copies, approximately 7 minutes of "on" time, or machine operating time, during the 350-minute atmospheric sample.

D. Evaluation Criteria

Ozone¹: Air concentrations of ozone in excess of a few tenths part per million (ppm) cause discomfort to exposed persons in the form of headache, dryness of throat and mucous membranes of nose and eyes, following exposures of short duration. Standard (29 CFR 1910.0000) set by the U.S. Department of Labor, Occupational Safety and Health Administration is 0.1 parts per million (ppm), or 0.2 milligrams per cubic meter (mg/M^3), averaged over an eight hour day exposure. However, this concentration is objectionable to all normal persons and irritates the nose and throat of most persons.²

Petroleum Hydrocarbon Distillate³: "----Pharmacologically, the hydrocarbons above ethane can be grouped with the general anaesthetics in the large class known as central nervous system depressants, which includes such well known chemicals as ethyl alcohol, diethyl ether, and acetone. The vapors of these hydrocarbons are mildly irritating to mucous membranes, the irritation increasing in intensity from pentane to octane----". Using Appendix B, Par. 3, on page 44, Threshold Limit Values for Chemical Substances and Physical Agents in the Workroom Environment for 1975 ACGIH, the TLV is 140 parts per million. The OSHA standard (29 CFR 1910.0000), however, is 500 ppm or 2000 mg/M^3 for Petroleum Distillates (naphtha).

Remington 530 Toner⁴: The manufacturer identifies this toner as 10% carbon black pigment and 90% a resinous co-polymeric hydrocarbon consisting of vinyl toluene and simple styrene. The OSHA standard (29 CFR 1910.0000) for exposure to carbon black is 3.5 milligrams per cubic meter of air, average eight hour a day exposure. Reference (4) states, "The authors concluded that other than the accumulation of dust in the pulmonary system, the prolonged exposure to carbon black produced no significant effects."

Evaluation of the potential hazard from inhalation of the resinous hydrocarbon is unknown. An unpublished study was brought to the attention of the surveyors by the employer's representative where approximately a dozen such toner systems were exposed to rabbits, under controlled conditions, where essentially a negative eye and dermal irritation response resulted. It was alleged by the Sperry-Univac representative that their trade name toner was the same as the materials in the unpublished study, but the study investigators would not divulge the chemical composition of the toners.

Selenium Compounds (as Se): The OSHA standard (1910.0000) is 0.2 milligrams per cubic meter of air, eight hour a day exposure. Hygienic Information Guide No. 59, issued in 1971 by the Pennsylvania Department of Environmental Resources, Occupational Health, has this to say about selenium inhalation exposures: "Selenium compounds cause nose and throat irritation and may produce fluid in the lungs when inhaled." It must be remembered, however, that the only sample taken for Selenium did not detect its presence in the workroom atmosphere (Table V). It is well documented (Frost, D.V., Lish, P.M., Ann Rev. Pharmacology, 15, 259) that selenium is a nutritionally essential trace element.

E. Evaluation Results and Discussion

It is evident that the copier machines, when put to constant use, are capable of producing ozone contamination of the air as shown in Tables I and II. Where the machine exhaust is directed toward a work station, particularly confined by adjacent file or storage cabinets or office partitions with only general ventilation, irritating exposure may result.

Employees interviewed during the study said that their respiratory and other symptoms were initiated when the Remington™ type office copiers were being used almost constantly and the employees' work station were within a few feet or even adjacent to the delivery end of the machines. Or, there were occasions when the copier(s) malfunctioned, or even caught fire in some instances. As loyal employees, being near the machine, they aided the user in standing over the machine in an attempt to correct the machine's faults. It is concluded that certain employees were exposed to excessive levels of ozone, particularly during long-term operating and adverse exposure conditions.

The levels of atmospheric petroleum distillate, mineral hydrocarbon toner and selenium found near the Remington type copier machines when the tests were made were in the acceptable exposure range.

F. Summary and Recommendations

- (1) REM 530[®], R-3[®] and 140 Copiers[®] - Because these machines create atmospheric ozone, they should not be used in proximity to clerical and other work stations. These machines should be confined to areas apart from employee desks and/or machine operator work locations.
- (2) If office space limitations present difficulties in following out Recommendation No. 1, local exhaust ventilation should be provided to prevent escape of the gas into the workroom, Ref. 5.

- (3) Both Ref. 5 and the NIOSH/OSHA Draft Technical Standard, Set B as of January 1975, OZONE, recommend medical monitoring. A copy of the latter proposed standard was given two officials of the company during the June 2-3, 1976 visit; this standard also proposes environmental monitoring. To determine the need for both kinds of monitoring, the following recommendations are made: (a) Atmospheric ozone determinations should be made where employees will be exposed, while the copier(s) is on and producing copies, during four hours of an eight hour shift. (b) If the atmospheric ozone levels found are equal to or above one half of the TLV, namely 0.5 ppm or 0.1 mg/M³, the monitoring recommendations in these standards should be followed.

V. REFERENCES

1. Stokinger, H.E. Ozone Toxicity. A.M.A. Arch. Industrial Hyg. & Occup. Med. Vol. 9:367, 1954.
2. Patty, F.A., Ozone. Pg. 916-8, Ind. Hyg. & Toxicology, Interscience Publishers, Second Revised Edition.
3. Ibid, Page 1196.
4. CARBON BLACK, Documentation of the Threshold Limit Values for Substances in Workroom Air. American Conference of Governmental Industrial Hygienists, Third Edition 1971.
5. Pennsylvania Dept. of Health, Division of Occupational Health, Hygienic Information Guide No. 22, OZONE - 1970.

VI. AUTHORSHIP AND ACKNOWLEDGMENTS

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TABLE I

Sperry-Univac Corporation
 Results of Environmental Sampling
 for Ozone with Detector Tubes
 June 2-3, 1976

<u>LOCATION</u>	<u>DATE</u>	<u>MACHINE NO.</u>	<u>PUMP STROKES</u>	<u>PPM</u>
Adm. Bldg. A4202A Delivery End of Machine	6/3	R140003	10	0.05
Adm. Bldg. A4202A Breathing Zone At Employee's Desk	6/3	Same	10	None Detectable
Bldg. 1C Executive Suite 2nd Floor Delivery End of Machine	6/3	Rem. 530 02943	10	0.10
Bldg. 1C Executive Suite 2nd Floor Delivery End of Machine	6/3	Rem. 530 02943	10	0.075
Bldg. 1C Executive Suite 2nd Floor Breathing Zone of Copier's Operator	6/3	Rem. 530 02943	10	None Detectable
Bldg. A M2148 Breathing Zone of Copier's Operator	6/2	R-3 Copier 500260	10	None Detectable
Bldg. A M2148 Delivery End of Machine	6/2	R-3 Copier 500260	10	0.05

TABLE I
(Continued)

<u>LOCATION</u>	<u>DATE</u>	<u>MACHINE NO.</u>	<u>PUMP STROKES</u>	<u>PPM</u>
Bldg. 1A M2149 Breathing Zone of Copier's Operator	6/2	R-3 Copier R500043	10	None Detectable
Bldg. 1A M2149 Delivery End of Machine	6/2	R-3 Copier R500043	10	0.05
Plant Engineering E2125 Breathing Zone of Copier's Operator	6/2	R-3 Copier 500087	10	None Detectable
Peripheral Dept. E2120 Delivery End of Machine	6/2	R-3 Copier 500130	10	0.1
Peripheral Dept. E 2120 Breathing Zone of Copier's Operator	6/2	R-3 Copier 500130	10	None Detectable
Headquarter's Bldg. H2-229 Breathing Zone of Copier's Operator	6/2	Rem. 530 53003547	10	None Detectable
Headquarter's Bldg. H2-229 Delivery End of Machine	6/2	Rem. 530 53003547	10	None Detectable

OSHA standard - 0.1 ppm or 0.2 mg/M³

TABLE II

Sperry-Univac Corporation
 Results of Environmental Sampling
 for Ozone
 July 22, 1976

<u>LOCATION</u>	<u>DATE</u>	<u>MACHINE NO.</u>	<u>SAMPLING TIME MINUTES</u>	<u>NO. OF COPIES MADE</u>	<u>COPIER "ON" TIME @10 COPIES PER MINUTE</u>	<u>Mg/m³</u>
Adm. Bldg. A4202A Breathing Zone Top of Employee's Desk	7/22	R140003	350	69	7	0.0120
Bldg. 1C Executive Suite 2nd floor Delivery End of Machine	7/22	Rem 530 02943	445	113	11.3	0.0095
Bldg. A M2148 Delivery End of Machine	7/22	R-3 Copier 500260	382	84	8.4	0.0125
Bldg. 1A M2153 Delivery End of Machine	7/22	Rem 530 00497	355	293	29.3	0.0075
Bldg. 1A M2153 Delivery End of Machine	7/22	R-3 Copier 00043	352	13	1.3	0.0143

OSHA standard - 0.1 ppm or 0.2 mg/M³

TABLE III

Sperry-Univac Corporation
 Results of Environmental Sampling
 for Petroleum Hydrocarbon
 July 22, 1977

<u>LOCATION</u>	<u>DATE</u>	<u>MACHINE NUMBER</u>	<u>SAMPLING TIME MIN.</u>	<u>Mg/m³</u>
Adm. Bldg. A4202A Breathing Zone- Top of Employee's Desk	7/22	R140003	350	0.645
Adm. Bldg. A4202A Delivery End of Machine	7/22	R140003	455	1.05
Bldg. A M2148 Delivery End of Machine	7/22	R-3 500260	382	1.0
Bldg. 1A M2153 Delivery End of Machine	7/22	Rem 530 00497	355	0.435
Bldg. 1A M2153 Delivery End of Machine	7/22	R-3 00043	352	0.938

OSHA standard - 500 ppm or 2000 mg/M³

TABLE IV

Sperry-Univac Corporation
 Results of Environmental Sampling
 for Mineral Hydrocarbon Toner
 July 22, 1976

<u>LOCATION</u>	<u>DATE</u>	<u>MACHINE NUMBER</u>	<u>SAMPLING TIME MIN.</u>	<u>NO. OF COPIES MADE</u>	<u>Mg/m³</u>
Bldg. 1C Exec. Suite 2nd Floor Delivery End of Machine	7/22	Rem 530 02943	445	113	0.04
OSHA standard - Not Known - See pages 4 and 5					

TABLE V

Sperry-Univac Corporation
 Results of Tests for Selenium (Se)
 July 22, 1976

Atmospheric sample shown in Table IV - Less than 0.15 ug/M³ Selenium

Bulk Sample of Sperry Rand 530 Dry Toner taken from REM 530-02943 (See Table IV)	- 0.00012% Selenium*
Bulk Sample of Sperry Rand Toner from 140 Copier 140003 (including dispersant)	- 0.00005% Selenium
Bulk Sample of Sperry Rand Toner from R-3 Copier R500043 (including Dispersant)	- 0.00001% Selenium
Bulk Sample of Remington Dispersant	- 0.00001% Selenium

(The Limit of Detection of analytical procedure is 0.1 ug/g.)

OSHA standard - 200 ug/M³ or 0.2 mg/M³

* All percentages of Selenium are by weight