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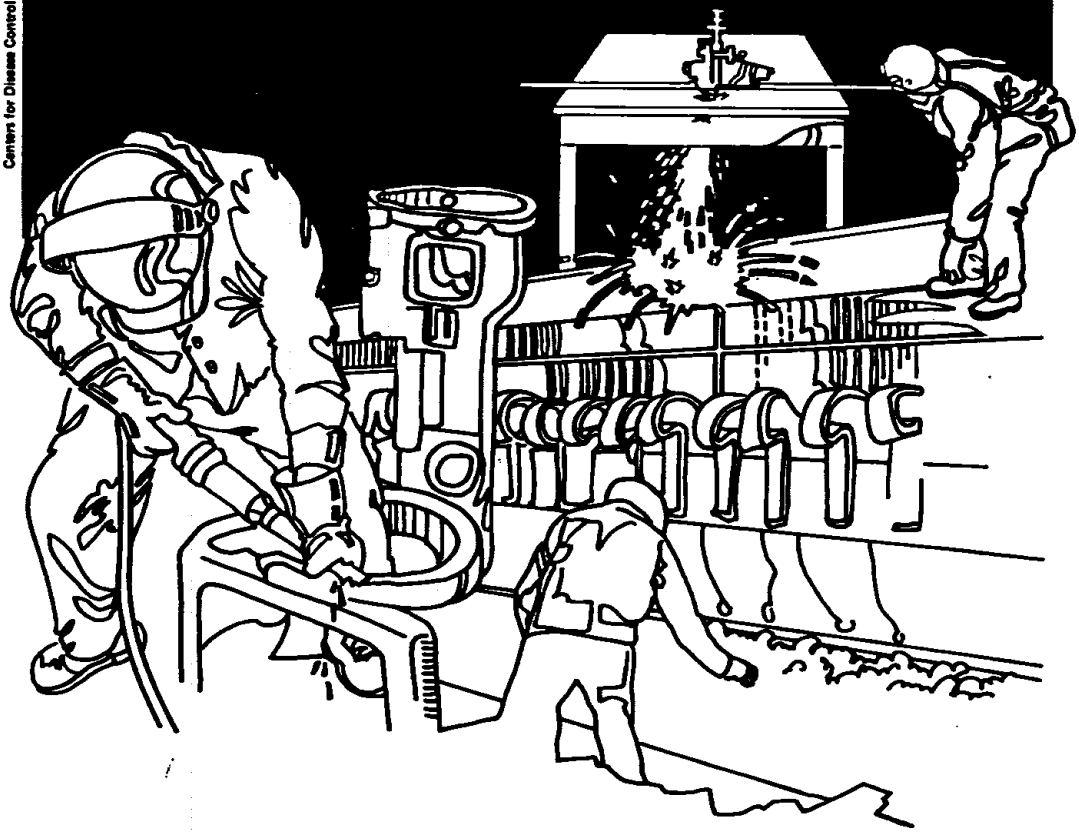

Health Hazard Evaluation Report

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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 and 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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I. SUMMARY

On August 9, 1990, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation at Associated Press, New York, New York. NIOSH was asked to evaluate the potential mercury exposure from silver-coated paper used in photo laser machines.

On December 10-11, 1990, NIOSH conducted an industrial hygiene survey. General air samples and personal breathing zone samples for inorganic mercury and dust were collected; direct reading measurements using a Jerome Model 411 Gold Film Mercury Analyzer were taken throughout the process cycle; and bulk samples of paper and paper dust were collected for analysis of mercury content.

Airborne mercury concentrations using the Jerome Mercury Analyzer ranged from non-detectable to four micrograms per cubic meter (ug/m^3). The highest levels were found in the vicinity of the ten machine area on the fourth floor. These concentrations were below the currently recommended exposure level of 50 ug/m^3 set by NIOSH, OSHA, and ACGIH.

Mercury vapors and dust were collected using a sampling train consisting of a cellulose ester membrane filter followed by a solid sorbent tube (hopcalite) and analyzed using cold vapor atomic absorption spectroscopy. The mercury content of bulk paper and paper dust samples were also measured using the same laboratory technique. All of the personal breathing zone and area air samples showed non-detectable airborne concentrations for inorganic mercury. The unprocessed and processed paper samples both contained 220 micrograms per gram (ug/gram) of inorganic mercury. The dust collected from the wall behind the photo laser machines on the sixth floor contained a trace level of mercury. There was similar dust build-up on the supply diffusers and exhaust grills on the sixth floor.

The environmental sampling data indicate that the mercury levels found around the photo laser machines do not constitute any long or short term health hazard to the employees working with or around the machines. Working directly with the paper and dust inside the machine does have the potential for higher exposure because of possible skin absorption of mercury.

KEYWORDS: SIC 2711 (Newspapers: Publishing, or Publishing and Printing), mercury, photo laser machines.

II. INTRODUCTION

In August 1990, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation at Associated Press in New York, New York. The request was submitted by an authorized employee representative and expressed concern over potential inorganic mercury exposure to staff working with and around photo laser machines. A site visit was conducted on December 10-11, 1990, to evaluate this issue.

A. Facility Description

The photo laser machines at the Associated Press Building are located on the fourth and sixth floors. The fourth floor is open office space separated into cubicles by four foot partitions. There were a total of twenty-two machines on the floor. There was a bank of ten machines next to the large computer system; two additional machines were located on the opposite side of the computer system; six machines were in a row toward the center of the office area; three machines were along the outside wall under the windows; and one machine was located next to the darkrooms. Most of the machines were less than two years old. Approximately twenty people worked in the vicinity of the machines.

There were thirteen machines on the sixth floor. Three machines were located in an area where there were no employees in the near vicinity for any period of time. Ten machines were located in a small room adjoining an open office area containing about twenty people. The machines in this room produce 75 to 100 photos per day.

B. Process Description

The photo laser machines are manufactured by Associated Press Communications. The Material Safety Data Sheet (MSDS) indicated that the dry silver paper used in the AP photo laser machines contains less than 0.1% mercuric bromide. The process time for each photo depends on the size of the photo. The machines function 24 hours a day in a intermittent pattern.

The machine receives an audio signal which the laser beam interprets into different intensities onto the silver-coated paper. The paper is cut from the large roll and enters an oven which fixes the image. The oven builds up a blackened substance which can interfere with the automatic paper feed system and add streaks to the developing pictures. The service attendant is responsible for servicing and maintaining the machines.

III. MATERIALS AND METHODS

On December 10, 1990, after the opening conference, which was attended by management and union representatives, a walk-through survey of the areas of concern was conducted. On December 11, 1990, environmental monitoring was undertaken.

Direct mercury vapor measurements were obtained using a Jerome Instrument Corporation's Model 411 Gold Film Mercury Vapor Analyzer. This instrument utilizes a thin gold film which selectively absorbs inorganic mercury from a measured air volume. This absorption results in an increase in electrical resistance across the film which is proportional to the mass of inorganic mercury in the sample. The analyzer was used in the "sample mode" which collects a 125 milliliter air sample and has a minimum detectable concentration of 1 microgram of mercury per cubic meter of air (ug Hg/m^3)[1]. Sampling was conducted in the vicinity of the machines at different times throughout the process cycle.

Four area samples and one personal breathing zone sample for inorganic mercury vapor and dust were collected using a sampling train consisting of a cellulose ester membrane filter followed by a solid sorbent tube (hopcalite). A battery operated sampling pump calibrated at 0.2 liters per minute was used to collect the air sample. After sampling, the hopcalite was ashed with nitric and hydrochloric acids. After dissolution was complete, the samples were diluted with deionized water. The mercury was then reduced by the addition of stannous chloride and the samples were analyzed by cold vapor atomic absorption spectroscopy. The limit of detection (LOD) for this method is 0.09 micrograms of mercury per sample. The limit of quantitation (LOQ) is 0.31 micrograms of mercury per sample.[2]

The process for analyzing the cellulose ester membrane filters was similar. Sulfuric and nitric acids were added to the filters and heated in a steam bath. Deionized water, potassium permanganate ($KMnO_4$), and potassium persulfate ($K_2S_2O_8$) were added, and the filters were heated an additional half hour in the steam bath. In order to reduce the permanganate, hydroxylamine hydrochloride (NH_2OH-HCl) was added. Stannous chloride was added to reduce the mercury which was then analyzed by cold vapor atomic absorption spectroscopy. The LOD for this method is 0.09 ug of mercury per sample. The LOQ is 0.31 ug of mercury per sample.

Bulk samples of processed and unprocessed paper and paper dust were collected. The mercury content was analyzed using the same method as that used for the cellulose ester membrane filters. The LOD for paper is 20 micrograms of mercury per gram (ug/gm) of sample. The LOQ for paper is 62 ug/gm. The LOD for the dust sample was 5 ug/gm. The LOQ for the paper dust was 18 ug/gm.

Additionally, air movement around the photo laser machines was checked using smoke tubes.

IV. EVALUATION CRITERIA

In order to assess the hazards posed by workplace exposures, industrial hygienists use a variety of environmental evaluation criteria. These criteria propose exposure levels to which most employees may be exposed for a normal working lifetime without adverse health effects. These levels do not take into consideration individual susceptibility such as pre-existing medical conditions or possible interactions with other agents or environmental conditions. Evaluation criteria change over time with the availability of new toxicologic data.

There are three primary sources of environmental evaluation criteria for the workplace: 1) NIOSH Recommended Exposure Limits (RELs), 2) the American Conference of Governmental Industrial Hygienists' (ACGIH) Threshold Limit Values (TLVs), and 3) the U.S. Department of Labor (OSHA) Permissible Exposure Limits (PELs). The OSHA PELs may include the feasibility of controlling exposure in various industries where the agents are used; the NIOSH RELs are based primarily on concerns relating to the prevention of occupational disease. It should be noted while reviewing this report that industries are legally required to meet those levels specified by an OSHA standard.

NIOSH, ACGIH and OSHA currently recommend that exposure to inorganic mercury vapor be limited to 50 micrograms per cubic meter (ug/m^3) determined as a time weighted average exposure for up to an 8-hour workday.[3,4,5] Inorganic mercury has been designated with a skin notation indicating that there is a potential contribution to the overall exposure by the cutaneous route. There are currently no criteria that address mercury exposure from paper or dust contact.

V. Toxic Effects of Inorganic Mercury

Acute exposure to high concentrations of inorganic mercury vapor can cause headaches, cough, chest pains, chest tightness, and difficulty in breathing. Additionally, mercury can produce soreness of the mouth and gums, nausea, fever, and diarrhea.[6,7]

Chronic exposure to mercury is more common, with the central nervous system as the target organ. The clinical manifestation is called erethism, which results in various personality changes associated with mercury intoxication. These changes include increased irritability, depression, paranoia, insomnia, loss of memory, and tremors of the limbs (usually the hands). Mercury may be unsuspected as the cause of these symptoms since their onset is gradual. Other symptoms of chronic mercury intoxication include inflammation of the mouth and gums, damage to the kidneys (proteinuria, which can lead to nephrosis), allergic skin rash, loss of appetite and weight, fatigue, and anemia.[8]

VI. RESULTS

Direct read data taken during the process cycle of the photo laser machines using the Jerome Model 411 Mercury Vapor Analyzer are shown in Table 1. Airborne concentrations ranged from non-detectable to 4 micrograms per cubic meter. The highest levels were found in the bank of ten machines near the large computer.

The results from the area and personal monitoring are presented in Tables 2 and 3. All of the samples showed non-detectable airborne concentrations of inorganic mercury.

The mercury concentrations found in the bulk samples of paper and paper dust are shown in Table 4. The unprocessed and processed paper samples contained 220 micrograms per gram (ug/gram) sample of inorganic mercury. The paper dust from the wall behind the machines on the sixth floor contained a trace amount (10 ug/gram) of inorganic mercury which was between the limit of detection (5 ug/gram) and the limit of quantitation (18 ug/gram) for this method.

The ventilation around the photo laser machines on the fourth floor was examined using smoke tubes. Results indicate that there was some air movement around each of the machines at the time of the survey. The supply diffuser and exhaust grills in the separate photo laser machine room on the sixth floor were covered with dust.

VII. DISCUSSION AND CONCLUSIONS

The airborne mercury levels generated by the photo laser machines were non-detectable or extremely low. The airborne mercury concentrations surrounding the photo laser machines does not constitute any long or short term health hazard to the employees working with or around the machines. Direct read instrumentation gives a specific reading for a short time period. It is useful in determining the presence of a compound. Time weighted samples are used to determine an average exposure over a longer period of time. Although airborne mercury concentrations were very low, working directly with the paper and dust inside the machine poses a potential hazard due to possible skin absorption of mercury.

VIII. RECOMMENDATIONS

The following recommendations are made as a result of the conditions observed during the NIOSH survey:

1. To prevent skin contact with inorganic mercury, nitrile rubber gloves should be worn while cleaning the oven, removing paper dust from inside the machine, and restocking the paper.

2. To prevent the potential circulation of dust containing trace amounts of mercury, the diffusers and filters for the ventilation systems on the fourth and sixth floors should be cleaned and changed on a regular basis.

IX. REFERENCES

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1. Associated Press
2. The Newspaper Guild
3. Wire Service Guild
4. OSHA, Region 2

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 1

Results from Area Survey with Jerome Model 411
Mercury Vapor Analyzer

Associated Press
New York, New York
HETA 90-361

December 11, 1990

Location	Concentration ug/m^3*
Bank of 10 Machines	ND**
Near Large Computer	ND
	1
	1
	2
	2
	3
	2
	2
	4
	2
	3
Bank of 3 Machines Near	ND
Windows	ND
	ND
Bank of 6 Machines	ND
	ND
	1
	1
	2
	1
Area with 2 Machines	1
	1
	ND
	1

* ug/m^3 - micrograms per cubic meter
** ND - None Detected

Limit of Detection (LOD): 1 microgram Mercury/cubic meter

Table 2

Results of Personal Breathing Zone
and Area Mercury Samples

Mercury Vapor
Solid Sorbent Tubes

Associated Press
New York, New York
HETA 90-361

December 11, 1990

Sample Location	Sample Time	Sample Volume (Liters)	Concentration (ug/m^3)*
Personal Breathing Zone:			
Service Attendant	9:34 - 13:01 14:02 - 17:15	81.4	ND**
Area:			
Three Machines Near Window	8:12 - 16:29	99.2	ND
Between Bank of Six Machines	8:13 - 16:30	99.2	ND
On Counter Near 10 Machines Next To Large Computer	8:14 - 16:31	99.0	ND
In Middle of 10 Machine Area	8:14 - 16:31	97.4	ND
NIOSH Recommended Exposure Limit			50
OSHA Permissible Exposure Limit (Ceiling)			50

* ug/m^3 - micrograms per cubic meter
** ND - None Detected

Limit of Detection (LOD): 0.09 micrograms Mercury/sample
Limit of Quantitation (LOQ): 0.31 micrograms Mercury/sample

Table 3

Results of Personal Breathing Zone
and Area Mercury Samples

Particulate Mercury
Cellulose Ester Membrane Filters

Associated Press
New York, New York
HETA 90-361

December 11, 1990

Sample Location	Sample Time	Sample Volume (Liters)	Concentration (ug/m^3)*
Personal Breathing Zone:			
Service Attendant	9:34 - 13:01 14:02 - 17:15	81.4	ND**
Area:			
Three Machines Near Window	8:12 - 16:29	99.2	ND
Between Bank of Six Machines	8:13 - 16:30	99.2	ND
On Counter Near 10 Machines Next To Large Computer	8:14 - 16:31	99.0	ND
In Middle of 10 Machine Area	8:14 - 16:31	97.4	ND
NIOSH Recommended Exposure Limit			50
OSHA Permissible Exposure Limit (Ceiling)			50

* ug/m^3 - micrograms per cubic meter
** ND - None Detected
Limit of Detection (LOD): 0.09 micrograms Mercury/sample
Limit of Quantitation (LOQ): 0.31 micrograms Mercury/sample