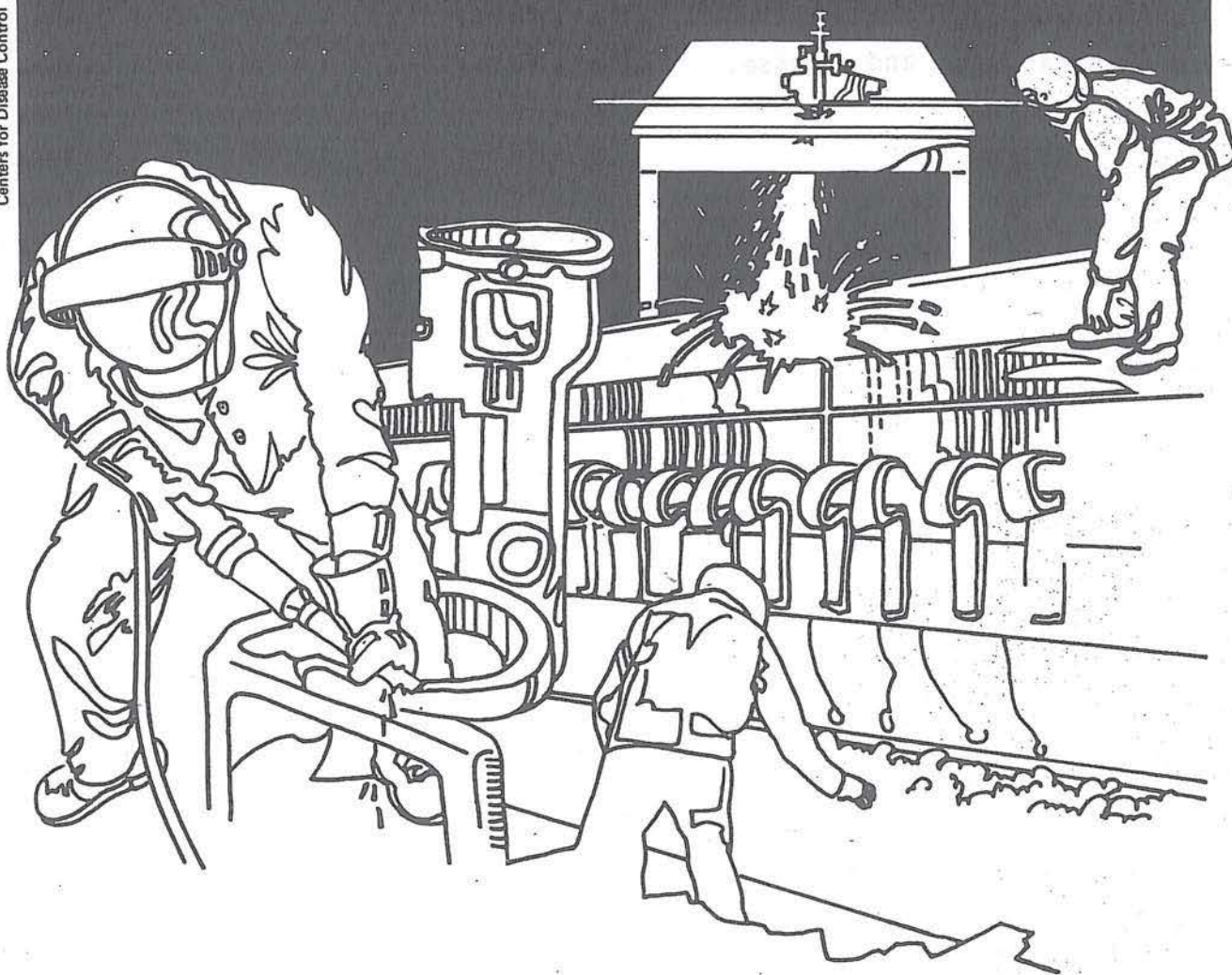


# NIOSH



## Health Hazard Evaluation Report

HETA 83-261-1448  
ROLLING HILL HOSPITAL  
ELKINS PARK, PENNSYLVANIA

## 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.

HETA 83-261-1448  
April 1984  
ROLLING HILL HOSPITAL  
ELKINS PARK, PENNSYLVANIA

NIOSH INVESTIGATOR:  
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## I. SUMMARY

On May 3, 1983, the National Institute for Occupational Safety and Health (NIOSH) received a request from the Administrative Assistant of Rolling Hill Hospital, Elkins Park, Pennsylvania for a health hazard evaluation. The laboratory technicians were routinely exposed to formaldehyde and xylene which are used in the preparation and preservation of anatomical specimens. Because of the strong chemical odors, the employees were concerned about the health effects from these chemicals.

The initial walk-through visit to Rolling Hill Hospital was made June 16, 1983. It was determined that environmental sampling would be done for xylene and formaldehyde.

On August 4, 1983, environmental air samples were collected for formaldehyde and xylene. Due to a change in the laboratory analysis method for formaldehyde a reevaluation was necessary. A follow-up survey for formaldehyde and organic vapors was conducted on September 29, 1983. The employee exposures to formaldehyde ranged from none detected (N.D.) to 0.25 milligram per cubic meter ( $\text{mg}/\text{M}^3$ ) of air sampled. This is below the OSHA recommended standard of  $3.6 \text{ mg}/\text{M}^3$ . NIOSH recommends that formaldehyde be handled as a potential occupational carcinogen and exposures be reduced to the lowest feasible limit (LFL). Xylene exposures ranged from 1.4 to  $42.6 \text{ mg}/\text{M}^3$ . This is below the NIOSH recommended standard of  $435 \text{ mg}/\text{M}^3$ .

During the environmental air sampling, analysis showed two additional organic substances to be present, limonene and ethyl benzene. Limonene concentrations ranged from 3.1 to  $8.1 \text{ mg}/\text{M}^3$ . There are no standards for this substance. The ethyl benzene concentrations were 5.5 to  $5.8 \text{ mg}/\text{M}^3$ ; the OSHA standard for this material is  $435 \text{ mg}/\text{M}^3$ .

On the basis of data obtained in the investigation, NIOSH determined that a health hazard did not exist from exposure to organic solvent vapors xylene, limonene, and ethyl benzene. Recommendations have been incorporated into this report to further control exposure to formaldehyde gas in the Gross Pathology Laboratory.

KEYWORDS: SIC 8062 (General and Medical Hospitals) formaldehyde, xylene, limonene, ethyl benzene.



## II. Introduction

On May 3, 1983, a request was submitted by the Assistant Administrator of the Rolling Hill Hospital, Elkins Park, Pennsylvania expressing concern about formaldehyde and xylene toxicity.

## III. Background

Rolling Hill Hospital is a general medical hospital. Human tissue, removed during an operation, is examined visually and sent to the laboratories where it is mounted on slides and examined microscopically for tissue and cellular structure. The areas of concern were the Gross Pathology Laboratory, where tissue is preserved in a ten-percent (%) formalin solution with a phosphate buffer prior to visual examination, and the Cytology and Histology Laboratories where organic solvents are used in the preparation of slides for microscopic evaluation.

The initial walk-through visit was made on June 16, 1983 to determine what the contaminants were and what sampling media was to be used.

On August 4, 1983, environmental air samples were collected for formaldehyde and xylene. Due to a change in the laboratory method for formaldehyde, a reevaluation was necessary. A reevaluation for formaldehyde and organic vapors was conducted on September 29, 1983.

## IV. Evaluation Design and Methods

a) Formaldehyde - Five air samples were collected by a sorbent tube containing Chromosorb 102<sup>R</sup> with N-benzylethanolamine. Personal sampling pumps operating at 0.05 liter per minute were used. The samples were analyzed by NIOSH method P&CAM 354 (1).

b) Xylene - Three breathing zone and one general air samples were collected for xylene in the Gross Pathology and Histology, Cytology Laboratories on August 4, 1983. Samples were collected on charcoal, utilizing personal sampling pumps operating at 0.15 liter per minute. These samples were analyzed for xylenes by NIOSH method P&CAM S-318 (2). These samples showed additional hydrocarbons to be present. Upon further investigation, it was revealed that the xylene contained a solvent screen.

On September 30, 1983, three additional air samples and a bulk sample of the screen liquid were collected. The air samples were analyzed as above for total xylene and additionally analyzed for limonene, the major components of the solvent screen, and ethyl benzene by NIOSH method P&CAM 127(3) with modifications.

## V. Evaluation 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 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 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 only 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 exposure.

Following are the evaluation criteria for samples substances:

Evaluation Criteria (mg/M3)\*

| <u>Substance</u> | <u>OSHA(4)</u> | <u>NIOSH</u> |
|------------------|----------------|--------------|
| Formaldehyde (5) | 3.6            | LFL**        |
| Xylene           | 435            | 435          |
| Limonene         | ---            | ---          |
| Ethyl benzene    | 435            | 435          |

\*Denotes milligrams of contaminant per cubic meter of air sampled.

\*\* Denotes lowest feasible level.

In order to determine if there were overexposures to mixtures of organic solvents, the following formula was used:

$$\frac{C^1}{T^1} + \frac{C^2}{T^2} + \frac{C_n}{T_n}$$

where  $C^1$  is the observed atmospheric concentration and  $T^1$  the corresponding threshold limit value. If the sum of the fractions exceeds unity<sup>(1)</sup>, then the threshold limit of the mixture should be considered as being exceeded. The formula is only used when the chief effects are in fact additive, which they were in this case.

#### V. Toxicity

a) Formaldehyde (5, 6, 7). Local - Formaldehyde gas may cause severe irritation to the mucous membranes of the respiratory tract and eyes. The aqueous solution splashed in the eyes may cause eye burns. Urticaria has been reported following inhalation of gas. Repeated exposure to formaldehyde may cause dermatitis either from irritation or allergy.

Systemic - Systemic intoxication is unlikely to occur since intense irritation of upper respiratory passages compels workers to leave areas of exposure. If workers do inhale high concentrations of formaldehyde, coughing, difficulty in breathing, and pulmonary edema may occur. Ingestion, though usually not occurring in industrial experience, may cause severe irritation of the mouth, throat, and stomach.

The National Institute for Occupational Safety and Health (NIOSH) recommends that formaldehyde be handled as a potential occupational carcinogen and that appropriate controls be used to reduce worker exposure. These recommendations are based primarily on a Chemical Industry Institute of Toxicology (CIIT) nasal cancer. Formaldehyde has also been shown to be a mutagen in several short-term laboratory studies.

b) Xylene (6). Local - Xylene vapor may cause irritation of the eyes, nose, and throat. Repeated or prolonged skin contact with xylene may cause drying and defatting of the skin which may lead to dermatitis. Liquid xylene is irritating to the eyes and mucous membranes, and aspiration of few milliliters may cause chemical pneumonitis, pulmonary edema, and hemorrhage. Repeated exposure of the eyes to high concentrations of xylene vapor may cause reversible eye damage.

Systemic - Acute exposure to xylene vapor may cause central nervous system depression and minor reversible effects upon liver and kidneys. At high concentrations, xylene vapor may cause dizziness, staggering, drowsiness, and unconsciousness. Also at very high concentrations, breathing xylene vapors may cause pulmonary edema, anorexia, nausea, vomiting, and abdominal pain.

c) Limonene (8). Limonene occurs in various ethereal oils, particularly in oils of lemon, orange, caraway, dill and bergamot. It is a skin irritant and sensitizer.

d) Ethyl benzene<sup>(6)</sup>. Local - Liquid and vapor are irritating to the eyes, nose, throat, and skin. The liquids are low-grade cutaneous irritants, and repeated contact may produce a dry, scaly, and fissured dermatitis.

Systemic - Acute exposure to high concentrations may produce irritation of the mucous membranes of the upper respiratory tract, nose, and mouth, followed by symptoms of narcosis, cramps, and death due to respiratory center paralysis.

## VI. Results/Discussion

a) Formaldehyde - Two personal and three general air samples were collected in the Gross Pathology, Cytology/Histology Laboratories. Air concentrations ranged from none detected to 0.25 mg/M<sup>3</sup>. This is below the OSHA standard of 3.6 mg/M<sup>3</sup>.

b) Organics (xylenes, limonene, ethyl benzene). On August 4, 1983, four personal air samples were collected for xylenes. Exposures ranged from 1.4 to 42.6 mg/M<sup>3</sup>. Analyses of these samples showed there were additional hydrocarbons in an amount greater than 2.0 mg per sample. Upon further investigation, it was learned that a screen was added to the xylene.

On September 30, 1983, three additional general air samples were collected along with a bulk sample of the screen. The major component of the screen was limonene. Ethyl benzene was also detected, however, this is a component of the xylene.

Xylene air concentrations ranged from 35 to 38 mg/M<sup>3</sup>. Limonene air concentrations ranged from 5.5 to 5.8 mg/M<sup>3</sup> and ethyl benzene air concentration ranged from 3.1 to 8.1 mg/M<sup>3</sup>. The OSHA and NIOSH proposed standard of 435 mg/M<sup>3</sup> for xylene and ethyl benzene were not exceeded. There is no standard for limonene. This data was then used to evaluate whether the cumulative exposure was exceeded. This determination was made by using the following formula:

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \frac{C_n}{T_n}$$

If this value exceeded unity, then there was an over-exposure. The level for mixtures in the Histology/Cytology Laboratory was 0.1, a value well below unity.

All Gross Pathology work is done in a small portable hood with charcoal filters.

## VII. Recommendations

From the data obtained during this evaluation and observation of the work practices, the following recommendations are made:

- 1) Establish a periodic maintenance program on the charcoal filter to assure that the contaminants are being absorbed.
- 2) All spills should be promptly wiped.
- 3) Establish a program of prompt disposal of the wipe towels which are kept in an enclosed trash receptical.

#### VIII. Authorship and Acknowledgements

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#### IX. Distribution and Availability

Copies of this Determination Report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, OH 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, VA. 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:

1. Rolling Hill Hospital, Elkins Park, PA
2. Employee Representative
3. OSHA, Region III
4. NIOSH, Region III

#### X. References

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TABLE 1

Rolling Hill Hospital  
Elkins Park, Pennsylvania

HETA 83 261

Organic Vapor Concentrations

August 4, 1983

| Sample # | Location           | Operation          | Time        | Concentrations* |               |          |  |
|----------|--------------------|--------------------|-------------|-----------------|---------------|----------|--|
|          |                    |                    |             | Xylene          | Ethyl Benzene | Limonene |  |
| 1        | Histology/Cytology | OE**<br>Technician | 07:30-13:30 | 43              |               |          |  |
| 2        | Histology/Cytology | OE**<br>Technician | 08:15-16:15 | 32              |               |          |  |
| 3        | Histology/Cytology | OE**<br>Supervisor | 08:25-16:25 | 28              |               |          |  |
| 4        | Gross Pathology    | General Air        | 08:45-15:00 | 2               |               |          |  |

September 30, 1983

|   |                                   |             |             |    |     |     |  |
|---|-----------------------------------|-------------|-------------|----|-----|-----|--|
| 1 | Imbedding                         | General Air | 07:30-15:23 | 38 | 5.8 | 4.1 |  |
| 2 | Histomatic Tissue Processing      | General Air | 07:35-14:00 | 35 | 5.8 | 8.1 |  |
| 3 | Histology/Cytology Center of Room | General Air | 07:45-15:30 | 36 | 5.5 | 3.1 |  |

\* Denotes - milligrams of contaminant per cubic meter of air sampled.

\*\* Denotes - operator's exposure.

Table II  
Rolling Hill Hospital  
Elkins Park, Pennsylvania

HETA 83 261

Formaldehyde Concentrations

September 30, 1983

| <u>Location</u>     | <u>Time</u> | <u>Concentration*</u> | <u>Remarks</u>      |
|---------------------|-------------|-----------------------|---------------------|
| Pathology           | 08:00-12:00 | 0.10                  | General air         |
| Pathology           | 08:45-12:50 | 0.04                  | Operator's exposure |
| Cytology/Histology, | 10:18-14:18 | N.D.**                | General air         |
| Pathology           | 12:00-16:00 | 0.25                  | General air         |
| Pathology           | 12:50-16:05 | 0.51                  | Operator's exposure |

\* Denotes milligram formaldehyde per cubic meter of air sampled.

\*\* Denotes none detected.

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