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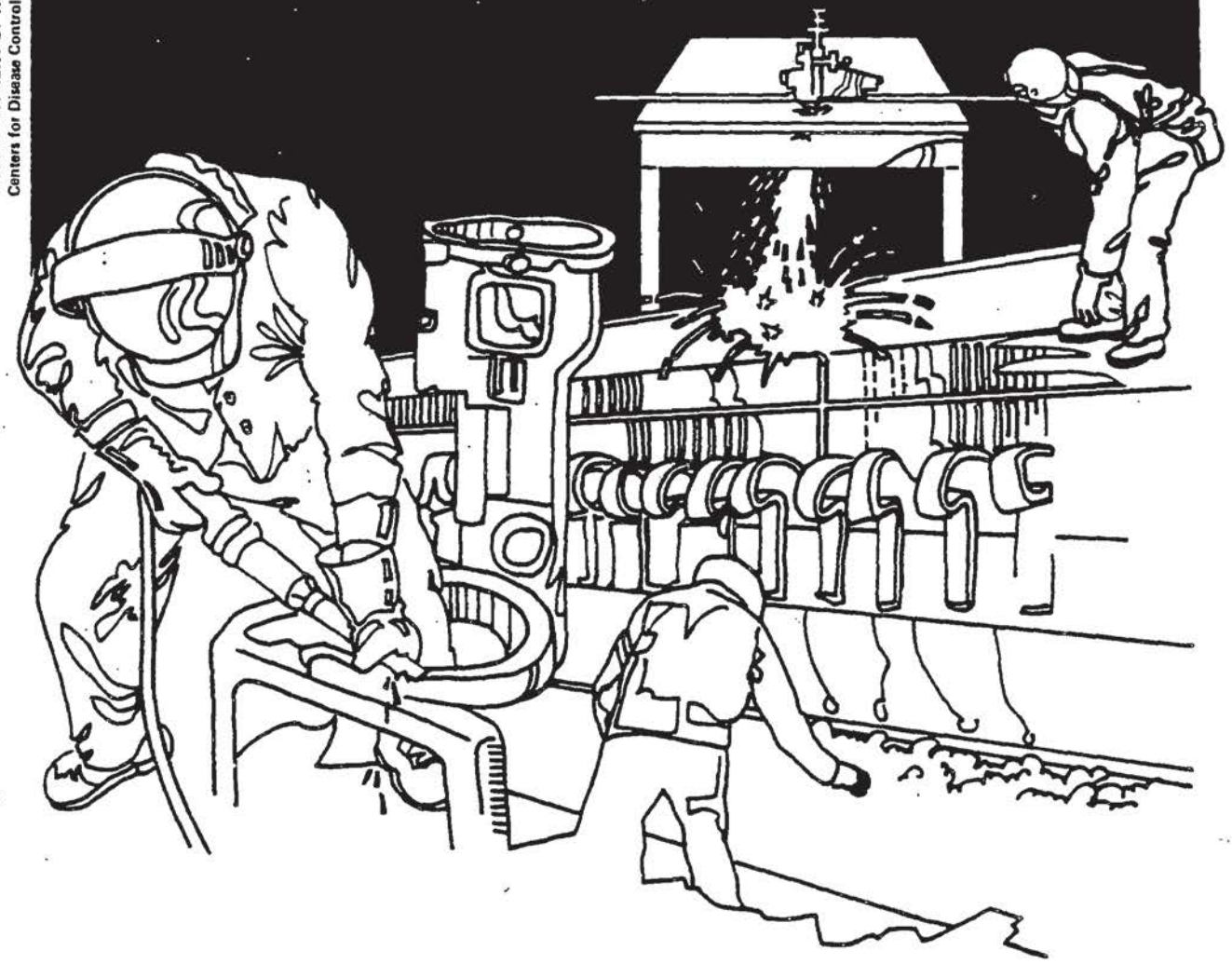

Health Hazard Evaluation Report

HETA 85-065-1578
UNITED HOSPITAL
GRAND FORKS, NORTH DAKOTA

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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UNITED HOSPITAL
GRAND FORKS, NORTH DAKOTA

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I. SUMMARY

In January 1985, the National Institute for Occupational Safety and Health (NIOSH) received a request from the United Hospital in Grand Forks, North Dakota, to evaluate a potential health hazard from exposure to ethylene oxide used to sterilize various instruments and materials.

On January 8-9, 1985, NIOSH investigators conducted an environmental evaluation of the central supply area of the United Hospital. Seven breathing zone and ten general room air samples for measurement of ethylene oxide were collected over an entire workshift. All seven breathing zone air concentrations for ethylene oxide were below the OSHA action level of 0.5 parts per million. Concentrations ranged from less than .1 ug/sample to .08 ppm. The average breathing zone level was 0.02 parts per million. The ten general room samples had an average concentration of 1.5 ppm. All the general room air samples were less than the action level of 0.5 ppm except the three samples collected behind the sterilizers in the "tank room," which is the area ethylene oxide tanks and cylinders are stored and connected to the sterilizers. Workers are only in the tank room to change the ethylene oxide tanks one or two times a week, and then for only a few minutes.

All workers were interviewed. None of the exposed workers had medical complaints. All the workers attended an hour presentation by NIOSH on the toxicology and safe work practices when working with ethylene oxide.

On the basis of the environmental data and employee interviews, NIOSH concluded that a health hazard did not exist to employees from ethylene oxide exposure in central supply. High levels of ethylene oxide were found in the tank room. The old sterilizer that caused these levels is no longer used. Recommendations on maintaining a safe workplace are included in this report.

KEYWORDS: SIC 8062 (general medical and surgical) ethylene oxide, central supply.

II. INTRODUCTION

In January 1985 the National Institute for Occupational Safety and Health (NIOSH) received a request from management at the United Hospital of Grand Forks, North Dakota to evaluate a potential health hazard from exposures to ethylene oxide in the central supply area of the hospital.

On January 8-9, 1985, NIOSH conducted an environmental evaluation. Results of this survey were discussed with the requestor in March 1985.

III. BACKGROUND

The central supply department of this hospital has a room specifically designed for gas sterilization. This room is well ventilated and has been designed for the use of ethylene oxide (ETO). An ETO monitor has been installed in the adjacent room which can give an instant reading before workers are entering the room. The ethylene oxide sterilizers are used almost constantly.

IV. ENVIRONMENTAL DESIGN AND METHODS

Seven breathing zone and ten general room air samples were collected on charcoal tubes for measurement of ethylene oxide. Samples were collected using vaccum pumps operated at 50 cc/minute. Samples were analyzed according to the NIOSH method 1607. The employees were interviewed. The only complaint consisted of an interest in the hazards of exposure to ethylene oxide. As a result, NIOSH presented an hour presentation with questions and answers on ethylene oxide.

V. EVALUATION CRITERIA AND TOXICOLOGY

A. Environmental

As a guide to the evaluation of the hazards posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assesment 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 becomes 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's (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 solely 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 exposures.

	8 hour TWA Environmental Exposure Limits
Ethylene Oxide	1 part per million (ppm) OSHA 0.5 action level* OSHA 5 ppm 10 minutes/day NIOSH (STEL)** 0.1 ppm 8 hr. TWA NIOSH

*Level where industry must initiate monitoring and medical surveillance.
**Short term exposure limit

B. Toxicology

Ethylene Oxide[1] - The Occupational Health and Saftey Administration (OSHA) standard for ethylene oxide (ETO) was published on June 22, 1984. The standard is 1 ppm (part per million) and is based on an 8-hour time weighted average (TWA) concentration. This standard is based on human and animal data that show exposure to ETO presents a carcinogenic, mutagenic, genotoxic, reproductive, neurotoxic, and sensitization hazard to workers.

An action level of 0.5 ppm as an 8-hour time-weighted average concentration is the level which employers must initiate periodic monitoring and medical surveillance. The (STEL) is a level workers may be exposed to for 10 minutes in a 8 hour work day.

Ethylene oxide is one of the 25 chemicals of highest production volume in the United States. Most ETO is used in the manufacturing of ethylene glycol. Only about 0.5 percent is used as a sterilant and fumigant; however, this is where most of the worker over-exposure occurs.

VI. ENVIRONMENTAL RESULTS

On January 8-9 1985, a NIOSH investigator conducted an environmental evaluation in the central supply of the United Hospital. Seven breathing zone and 10 general room air samples were collected and analyzed for ethylene oxide. None of the breathing zone air samples exceeded the OSHA action level of 0.5 ppm. The average level found in the breathing zone was 0.02 ppm, with the highest being 0.04 ppm. General room air samples showed levels ranging from below the detection limits to 7.5 ppm. The average level for the 10 general room samples was 1.5 ppm. The highest levels were found in the tank room and they were 3.87, 2.71, and 7.50 ppm. The other seven general room air sample nitrations were below the action level of 0.5 ppm. Employees do not spend excessive amounts of time in the tank room. They only enter this room to change cylinders of ETO, probably no more than 5 or ten minutes per week.

This entire system and all the ETO sterilizers and aerators had very good ventillation systems. The reason for the high levels of ETO was due to the use of an older sterilizer on the day of the NIOSH survey. This sterilizer is usually not operational, but was used on the day of this evaluation to measure a worst case situation. This machine is no longer in use.

VII. DISCUSSION AND CONCLUSIONS

Based on environmental sampling and employee interviews, a health hazard did not exist during this evaluation from over-exposures to ethylene oxide. As long as the old ETO sterilizer is not used, there is no reason to believe that there will be over-exposures to ETO.

VIII. RECOMMENDATIONS

1. The old sterilizer should not be used until it has been completely refurbished.

2. Periodic monitoring with the infrared analyzer should be performed and a log of concentrations found should be kept.

IX. REFERENCES

1. 29 CFR Part 1910, Occupational Exposure to Ethylene Oxide; Final Standard, Federal Register, Friday, June 22, 1984.

2. NIOSH Current Intelligence Bulletin, May 21, 1981, USHHS/PHS/CDC/NIOSH, Publication #81-130.

X. AUTHORSHIP AND ACKNOWLEDGMENTS

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XI. DISTRIBUTION AND AVAILABILITY

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Information Resources 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:

1. United Hospital
2. North Dakota State Department of Health
3. U.S. Department of Labor/OSHA, Region VIII
4. NIOSH, Region VIII

For the purpose of informing affected employees, a copy of this report shall be posted in a prominent place accessible to the employees for a period of 30 calendar days.

TABLE I

Breathing Zone and General Room Air Concentrations of Ethylene Oxide in the Central Supply at the United Hospital in Grand Forks, North Dakota
January 8-9, 1985

Sample Number	Job/Location	Sampling Time	Ethylene Oxide ppm
1	Technician 2	7:18 - 9:25	*
2	Technician 2	7:22 - 9:20	*
3	General Area/ Central Supply	7:25 - 9:32	0.08
4	General Area/ Central Supply	7:35 - 9:45	3.87
5	General Area #12 Aerator Sterilizer	7:40 - 9:40	0.06
6	Technician 2	9:20 - 1:00	0.01
7	Technician 2	9:25 - 1:00	0.02
8	General Area/ Top #8	9:32 - 12:00	0.27
9	General Area	9:40 - 12:00	0.20
10	General Area/ Tank Room	9:45 - 1:20	2.71
11	General Area/ Top #8	11:55 - 2:55	0.14
12	General Area/ # 12 Aerator	12:00 - 2:45	0.23
13	Technician 2	1:00 - 3:00	0.04
14	Technician 2	1:00 - 3:00	0.03
15	General Area/ Tank Room	1:25 - 2:45	7.50
16	Technician 2	7:25 - 9:15	0.03
17	General Room	7:25 - 9:15	*
Evaluation criteria			1.0 - OSHA 0.1 - NIOSH
Laboratory limits of detection ug/sample			0.1