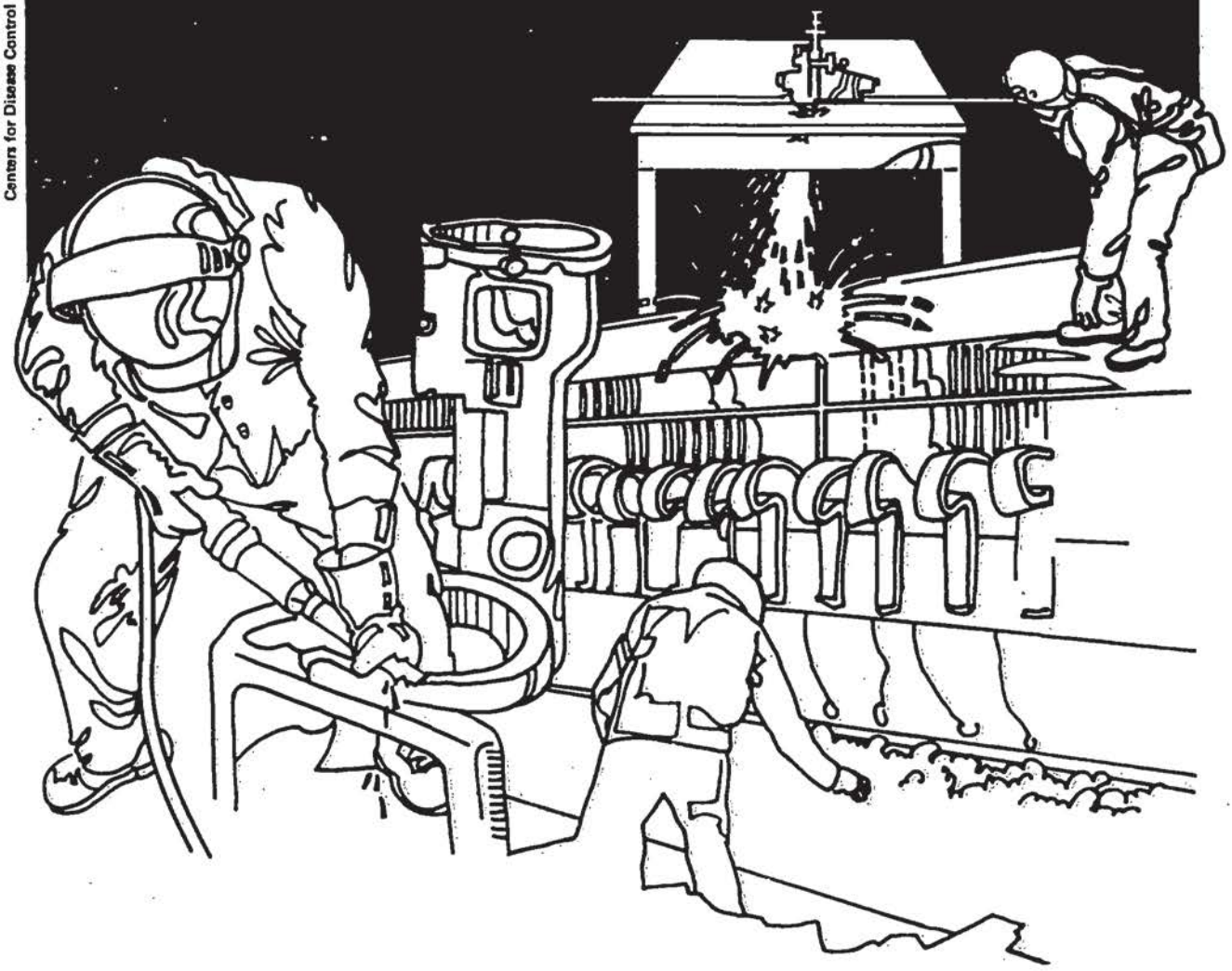
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 82-287-1240
HERCULES, INCORPORAT
HOPEWELL, VIRGIN

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 82-287-1240
DECEMBER 1982
HERCULES, INCORPORATED
HOPEWELL, VIRGINIA

NIOSH INVESTIGATOR:
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I. SUMMARY

On June 14, 1982, the National Institute for Occupational Safety and Health (NIOSH) received a request from Local 13061, United Steel Workers of America at Hercules, Incorporated, Hopewell, Virginia, to evaluate employees' exposures to air concentrations of ethyleneimine during the changing of ethyleneimine cylinders in the Klucel® area. Klucel (hydroxypropylcellulose) is a cellulose derivative used in the manufacturing of adhesives, cosmetics, paint removers, paper coating, pharmaceuticals, and printing inks.

Ethyleneimine is charged to the Klucel® plant reactor from individual 320-pound cylinders through a closed system of stainless steel tubing. Upon reaching the reactor, the ethyleneimine concentration is immediately diluted to less than 1% concentration. The area where the ethyleneimine cylinders are stored and connected to process delivery lines is a regulated area where only authorized personnel are allowed to enter. Authorized employees are required to be trained on ethyleneimine handling procedures, sign a log book, and obtain a written pass from shift supervision before entering the regulated area. Protective gear required includes rain suit, rubber gloves, and rubber boots or overshoes. In addition, when in the ethyleneimine shed, where cylinders are connected and disconnected to the reactor charging lines and ethyleneimine is delivered to the reactor, an airline respirator is also required. A medical surveillance program for all authorized employees is also in place.

On October 13 and 14, 1982, NIOSH conducted an industrial hygiene survey to determine potential exposures to airborne ethyleneimine during changing of the cylinders. Six lapel air samples for ethyleneimine were collected with impinger samplers at a rate of 0.2 liters per minute (LPM) and analyzed according to NIOSH Method P&CAM 300 modified.[1] Workers wore airline respirators while changing cylinders.

Air concentrations of ethyleneimine ranged from 0.01 milligrams per cubic meter (mg/m^3) to 0.03 mg/m^3. The Occupational Safety and Health Administration (OSHA) Permissible Exposure Limit (PEL) is 1.0 mg/m^3, 8-hour time-weighted average (TWA). However, based on the potential carcinogenic properties of ethyleneimine, NIOSH recommends that exposure be controlled to the lowest feasible level. The four Klucel® operators interviewed reported no current health problems.

Airline respirators were worn by employees. It can be assumed that actual inhalation exposures of these persons making proper use of prescribed respiratory protection were materially reduced from the calculated values derived from the lapel air samples.

Based on the environmental sampling results and employee's interviews, NIOSH concludes a potential health hazard did exist at the time of this survey. The practice of wearing the appropriate personal protective equipment should be continued.

KEYWORDS: SIC 2819 (Industrial Inorganic Chemicals), ethyleneimine, Klucel®, hydroxypropylcellulose.

II. EVALUATION CRITERIA

Ethyleneimine[2,3]

The vapor is strongly irritating to the conjunctiva and cornea, the mucous membranes of the nose, throat, and upper respiratory tract, and the skin. The liquid is a severe irritant and vesicant in humans, and severe eye burns have followed contact with the cornea. Skin sensitization has occurred. Acute exposures in humans have caused nausea, vomiting, headaches, dizziness, and pulmonary edema.

Two animal studies have confirmed the carcinogenic potential of ethyleneimine. In one study, subcutaneous injection of single doses in suckling mice produced an increased incidence of lung tumors in males. In another study with mice fed ethyleneimine for 77 to 78 weeks, over 80 percent of the animals developed tumors, including more than 50 percent with hepatomas and almost 75 percent with pulmonary tumors. The LC_{50} in mice was 2236 ppm for 10 minutes: there were signs of irritation of eyes and nose, delayed onset of pulmonary edema, and rental tubular damage with proteinuria, hematuria, and elevated blood urea nitrogen. In other exposed animals, a decrease in the white blood cell count and a depression of all blood elements have also been observed.

III. REFERENCES

1. National Institute for Occupational Safety and Health. NIOSH manual of analytical methods. Vol 5, 2nd ed. Cincinnati, Ohio: National Institute for Occupational Safety and Health, 1979. (DHEW (NIOSH) publication no. 79-141).

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).

3. Proctor NH, Hughes JP. Chemical hazards of the workplace. Philadelphia: J.B. Lippencott Company, 1978.

IV. AUTHORSHIP AND ACKNOWLEDGEMENTS

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V. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), 5285 Port Royal, Springfield, Virginia 22161. 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. Hercules, Incorporated
2. Local 13061 United Steel Workers of America
3. Requestor
4. NIOSH, Region III
5. OSHA, Region III

For the purpose of informing 15 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 Lapel Air Samples for Ethyleneimine

Hercules, Incorporated
Hopewell, Virginia
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Date	Job	Sampling Period	Sample Volume (Liters)	Ethyleneimine mg/m^3*	8-Hour TWA
10-13-82	Klucel Operator	0840-1120	28.4	0.08	0.03
10-13-82	Klucel Mechanics	0900-1100	24.6	0.06	0.02
10-13-82	Klucel Foreman	0837-1100	28.8	0.02	0.01
10-14-82	Klucel Operator	1345-1500	15.1	0.10	0.02
10-14-82	Klucel Mechanics	1355-1500	13.0	0.08	0.01
10-14-82	Klucel Foreman	1350-1500	13.8	0.02	0.01
Environmental Criteria (OSHA Standard) mg/m^3					1.0
Limit of Detection (ug)				0.3	

* mg/m^3 = milligrams of substance per cubic meter of air sampled.