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U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45202

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74-23-216

AIR PRODUCTS AND CHEMICALS INC.
HOMETOWN, PENNSYLVANIA

AUGUST 1975

I TOXICITY DETERMINATION

It has been determined that employee exposure to ethylene glycol mist during the tank cleaning and filling operation was not excessive at the concentrations measured during an evaluation of the workplace conducted on November 19, 1974. This determination is based on the analysis of airborne samples, observation of the work practices and non-directed medical questionnaires.

The Company previously performed a steam cleaning operation using a Steam Jenny. The exhaust fumes from the machine, along with the 10 percent hydrochloric acid mist used in steam cleaning, caused an irritation to the employees and brought about the request for the evaluation. Following the initiation of the request, the use of the Steam Jenny was discontinued and outside generated steam free of hydrochloric acid was utilized.

Detailed information concerning environmental results are contained in the body of the report.

II DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U. S. Post Office Building, Room 505, 5th and Walnut Streets, Cincinnati, Ohio 45202.

Copies have been sent to:

a) Air Products and Chemicals, Inc.
b) Authorized Representative of Employees
c) U. S. Department of Labor, Region III
d) NIOSH - Region III

For the purpose of informing the approximately 3 "affected employees" the employer will promptly "post" the Determination Report in a prominent place(s) near where affected employees work for a period of 30 calendar days.

III INTRODUCTION

Section 20(a)(6) of the Occupational Safety and Health Act of 1970, 29 U. S. Code 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.

A health hazard evaluation request was submitted by an employee representative of the Air Products and Chemicals Incorporated. The request was initiated because of contaminants generated during the steaming of tanks using a Steam Jenny with 10 percent hydrochloric acid solution.

IV HEALTH HAZARD EVALUATION

A. Description of Process - Conditions of Use

The process under consideration involves the repackaging of ethylene oxide and ethylene oxide gas mixtures. The gases are received at the plant and are stored in holding tanks until such a time as needed. Prior to the repackaging, the tanks of 100 and 400 pounds capacity must be cleaned of the condensate and repaired. The condensate is a glycol of ethylene oxide. Any gas remaining in the cylinder, on reaction with steam, also forms a glycol of ethylene oxide.

Prior to this evaluation, a Steam Jenny using kerosene and a steam mixture of 10 percent hydrochloric acid was used to clean the interior of the tanks. This was an emergency measure used until improvements in an outside steam generating unit could be made. The Steam Jenny exhaust products, ethylene oxide and hydrochloric acid mist were of concern to the employees.

The present removal of the condensate involves inserting a probe into the tank and allowing steam, free of hydrochloric acid and kerosene, to soften the condensate. After a visual inspection to ascertain that the tank is clean, the residue is dumped into holding lagoons. New gaskets and cements are then used to make the tanks leak proof.

Following the cleaning and repairing of the tanks, they are filled with ethylene oxide or a combination of ethylene oxide and dichlorodiflouromethane with an inert gas, nitrogen, as a cover. This gas is then used by various institutions as a sterilizing gas mixture.

B. Study Progress and Design

On April 4, 1974, an initial survey was conducted at the plant by Walter Chrostek, industrial hygienist. A walk-through survey and non-directed medical interviews were completed. Due to a work stoppage, the atmospheric evaluation had to be delayed.

Subsequently, an atmospheric evaluation to determine if employees were being exposed to the condensate of ethylene oxide was conducted on November 19, 1974. Since the use of the Steam Jenny had been discontinued, environmental measurements for kerosene and hydrochloric acid were deemed not necessary.

The cleaning, repairing and filling operations of cylinders are intermittent and may take from a few hours to a full day. During this environmental evaluation, the operation lasted approximately four hours. One of the two employees complained of redness of the face. This was due to not wearing the face shield provided.

C. Evaluation Methods

Operator's exposure to ethylene glycol mist was evaluated utilizing midget impingers with distilled water as a collection media and personal air sampling pumps. These samples were subsequently analyzed by a gas chromatograph. No atmospheric evaluations were made for ethylene oxide gas, as under the existing working conditions it would have been converted to ethylene glycol.

D. Evaluation Criteria

The American Conference of Governmental Industrial Hygienists[1] in their 1974 Threshold Limit Values recommends the following permissible exposure levels for the substances pertinent to this evaluation:

Substance	8-Hour Time Weighted Average
Ethylene glycol, particulate	10 mg/m^3*
Ethylene glycol, vapor	260 mg/m^3

*mg/m^3 - denotes approximate milligrams of substance per cubic meter of air

E. Evaluation Results

All samples were concentrated by evaporating down the water used as the collection media. Samples were then diluted to 1 ml with acetone and analyzed by gas chromatography, using ethylene glycol standards that were also prepared in acetone. A standard concentration of 0.14 mg/ml was used as the lower detection limit for ethylene glycol. All samples had ethylene glycol concentrations below this level. When calculated using the individual samples volumes, the highest air concentration found was less than 2.5 milligrams per cubic meter of air.

F. Discussion, Conclusion and Recommendations

In the Matheson Gas Book[2] it is stated that exposure to low concentrations of ethylene oxide may result in delayed nausea and vomiting, numbing of the sense of smell and harmful concentrations can be tolerated without warning because of odor. Contact of liquid ethylene oxide with the exposed skin can cause delayed skin burns, and "Approved Personal Protective Equipment" (gas tight chemical safety goggles, rubber gloves and apron, rubber shoes or boots, full-faced approved gas mask) should be provided. During the visit to the plant one of the employees complained of a face rash which could be attributed to not wearing a face shield during accidental spills or malfunctions that may occasionally occur.

During the initial visit to the plant, an employee stated that he occasionally has a rash on his face. From the visual observation of the steam cleaning operation, it was noted the spent steam is drawn by the roof exhaust fan into the face and breathing zone of the employee. Because of these observations, the following recommendations are made:

1) Relocate the roof exhaust fan to a wall adjacent to the cleaning station. A booth type structure should be erected to draw the spent steam from the face of the employee.

2) Until Recommendation No. 1 is carried out, supply personal protective equipment as necessary and maintain it in a clean and sanitary manner.

During the evaluation, there was some concern that one employee experienced adverse health effects due to exposure to air contaminants. An investigation by a medical staff physician indicated that the worker's illness did not appear to be job-related. This employee has terminated his employment with the company.

V. REFERENCES

1. Threshold Limit Values for Substances in Workroom Air, Adopted by American Conference of Governmental Industrial Hygienist for 1974.

2. Matheson Gas Data Book, Fifth Edition, 1971, page 255-260.

VI. AUTHORSHIP AND ACKNOWLEDGMENT

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AIR PRODUCTS AND CHEMICALS INC.
HOMETOWN, PENNSYLVANIA

HEALTH HAZARD EVALUATION DETERMINATION
REPORT NO. 74 - 23

Ethylene Glycol Air Concentration Data

November 19, 1974

Sample No.	Job Description	Time Duration (minutes)	Air Volume(liters)	Concentration mg/M^3*
139	Cylinder Repair	92	97	$<$ 1.4
307	Cylinder Filling	143	145	$<$ 1.0
344		100	105	$<$ 1.3
314	Cylinder Steaming	56	57	$<$ 2.5

*mg/M^3 - denotes milligrams of substance per cubic meter of air sampled.
$<$ - denotes less than