ABSTRACT

HEALTH HAZARD EVALUATION DETERMINATION

REPORT NO. 73-85

Toxic Substances: Toluene-2,4-diisocyanate (TDI)
Methylene di-(4-phenylisocyanate) (MDI)

Industry: Manufacture of decorative yard fences

Study Data: Workroom air concentrations (breathing zone and work area)

Study Date: May 31, 1973

Study Results: Six personal samples and two general room samples were taken. TDI and MDI were analyzed by the Salt Lake City laboratory. TDI samples were less than 0.01 mg/M^3, and MDI samples were less than 0.03 mg/M^3. Environmental samples were all below existing standard for isocyanates.

Toxicity Determination: At the time of this investigation, it was determined that levels of TDI and MDI were not in concentrations that were toxic to workers at Vail Enterprises, LaVeta, Colorado.

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

HEALTH HAZARD EVALUATION DETERMINATION 73-85

VAIL ENTERPRISES
LaVETA, COLORADO

SEPTEMBER 1973

I. TOXICITY DETERMINATION

Based on the results of National Institute for Occupational Safety and Health (NIOSH) environmental-medical evaluations conducted on May 31, 1973, in open spaces, it has been determined that the exposure to Toluene-2,4-diisocyanate (TDI) and Methylene di-(4-phenylisocyanate) (MDI) is not in concentrations that are toxic to the workers at Vail Enterprises, LaVeta, Colorado.

Prior to the date of this evaluation, problems had been experienced in conducting these operations in confined, non-ventilated areas. To avoid future problems with isocyanate, the manufacturing process at Vail Enterprises should be performed with adequate down-draft ventilation and proper protective clothing. At least one person has already become sensitized to the isocyanate; therefore, other adhesives should be considered to replace the isocyanate.

II. DISTRIBUTION AND AVAILABILITY

Copies of this hazard determination report are available upon request from the Hazard Evaluation Services Branch, NIOSH, U.S. Post Office Building, Room 508, 5th and Walnut Streets, Cincinnati, Ohio 45202. Copies have been sent to:

(a) Vail Enterprises, LaVeta, Colorado
(b) U.S. Department of Labor, Region VIII
(c) NIOSH, Region VIII

For purposes of informing your exposed employees, this report should be posted in a prominent place readily accessible to workers for a period of thirty days.

III. INTRODUCTION

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

The National Institute for Occupational Safety and Health received such a request from the employer to evaluate the potential hazards associated with the alleged exposure to isocyanate during the manufacture of decorative yard fences at Vail Enterprises, LaVeta, Colorado.

IV. HEALTH HAZARD EVALUATION

A. Plant Process

This plant manufactures decorative yard fences. Processed wood is purchased and delivered to the plant, where it is cut into sections for later assimilation into different types of decorative fences. The cut sections of wood are joined together by a mixture of isocyanate plus a hardener. The isocyanate is applied to the wood with an applicator. The isocyanate is under pressure and is pumped to the applicator from a 55-gallon container. The isocyanate is mixed with the hardener, which is located in another 55-gallon container.

Prior to the time of our visit, Vail Enterprises was applying the isocyanate mixture to the wood inside a closed building, without ventilation of any kind. Mr. Vail and several employees became sensitized to the isocyanate. These people should not be exposed even to very low concentrations because severe pulmonary reactions can occur to sensitized individuals at "non-detectable" levels. This operation was moved to an outside shed which has plenty of natural ventilation. The employer was advised by NIOSH that the operation should never be performed inside the building unless adequate ventilation was installed.

B. Evaluation Design

The process was evaluated in the open shed by taking personal samples on all workers. General room samples were also taken.

C. Methods

All TDI samples were collected with impingers, using the solutions required for the Marcali determination of isocyanate.

D. Evaluation Criteria

The Occupational Health Standards, as promulgated by the U.S. Department of Labor (Title 29, Chapter XVII, Part 1910, Subpart G, Section 1910.93, Table G-2), applicable to the substances for this evaluation are:

Toluene-2,4-diisocyanate (TDI)[c]	0.02 ppm	0.14 mg/M^3
Methylene di-(4-phenylisocyanate) (MDI)[c]	0.02 ppm	0.2 mg/M^3

[c] Ceiling value; this concentration shall not be exceeded for any period.

ppm - Parts of vapor or gas per million parts of contaminated air by volume.

mg/M^3 - Milligrams of contaminant per cubic meter of air.

In July 1973 NIOSH submitted to the Department of Labor, Occupational Safety and Health Administration, criteria for a recommended standard for occupational exposure to TDI. The safe exposure recommended by NIOSH was a time-weighted average of 0.005 ppm (0.036 mg/M^3)[1] for any eight-hour work day and 0.02 ppm for any 20-minute work period.[1]

E. Evaluation Results and Discussion

On May 31, 1973, a total of eight personal samples were taken. These samples were taken in the immediate area where the isocyanate was being used. Both TDI and MDI were present in all samples. Sample results are presented in the Appendix. The concentrations were all well below established Federal standards. It should be noted that the operation had been removed from a building with no ventilation to an outside shed with plenty of natural ventilation.

F. Medical Results

The medical evaluation of the workers at Vail Enterprises consisted of interviewing all the workers. The manager of the plant had experienced severe shortness of breath, while other workers had developed somewhat less severe chest tightness and shortness of breath. Prior to our visit, the isocyanate had been used indoors with frequent problems with the mixing apparatus, which perhaps contributed to the high exposures. The medical complications were caused by either primary pulmonary irritation or sensitization to the isocyanate. These substances have frequently been documented as a cause of such problems in industry.[2]

V. REFERENCES

1 Criteria for a Recommended Standard...Occupational Exposure to Toluene Diisocyanate, DHEW/PHS/NIOSH, July 1973.

2 Urethanes, Woolrich and Rye; Upjohn Company, Industrial Health Service, Kalamazoo, Michigan.

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VII. APPENDIX

TDI and MDI CONCENTRATIONS AT
VAIL ENTERPRISES, LaVETA, COLORADO

Field Number	Type of Sample	TDI mg/M^3	MDI mg/M^3
6	Personal	<0.01	<0.03
4	Personal	<0.01	<0.03
5	General Room	<0.01	<0.03
7	Personal	---None Detected---	
8	Personal	---None Detected---	
11	Personal	<0.01	<0.03
10	Personal	<0.01	<0.03
9	General Room	<0.01	<0.03

Detection limits for these samples are 0.01 mg TDI/M^3 and 0.03 mg MDI/M^3.