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. 74-148-239

LANGE COMPANY
BROOMFIELD, COLORADO

DECEMBER 1975

## I. TOXICITY DETERMINATION

A health hazard evaluation was conducted by the National Institute for Occupational Safety and Health on April 8, 1975, at the Lange Company, Broomfield, Colorado. At the time of this evaluation, breathing zone and general room samples were taken for MOCA, TDI, methylene chloride, carbon monoxide, and Stoddard solvent. Concentrations of MOCA and TDI during this evaluation posed a health hazard. Concentrations of methylene chloride, carbon monoxide, and Stoddard solvent were below the most recent hygienic standards.

## II. DISTRIBUTION AND AVAILABILITY

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

(a) Lange Company
(b) U.S. Department of Labor - Region VIII
(c) NIOSH - Region VIII

This report should be posted in a prominent place accessible to the workers for a period of approximately 30 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 employees at the Lange Company, Broomfield, Colorado, to evaluate the potential hazards associated with exposures to MOCA, TDI, methylene chloride, carbon monoxide, and Stoddard solvent.

## IV. HEALTH HAZARD EVALUATION

### A. Plant Process

The Lange Company's Boot Division manufactures several types of ski boots. The boots are made from a mixture of TDI and MOCA, which are pre-mixed and then automatically poured into boot molds. The molds are then transferred by conveyor to ovens. It is during this process that exposures to TDI and MOCA occur. Plant management is continually improving this operation by local exhaust ventilation and enclosing more of the process. Due to a decrease in the number of purchases of ski boots, the Lange Company has laid off many people in this division; they now have employees working two 12-hour shifts per week. Many of Lange's ski boot shells are now produced in Italy. The company is presently investigating the possibility of producing a boot from polyvinyl chloride.

In the boot finishing and polishing areas, methylene chloride and Stoddard solvent were monitored. Carbon monoxide was monitored in all areas of the plant.

### B. Evaluation Design

Breathing zone samples were taken on all of the workers in the ski boot mold department. These samples were taken with impingers, using Marcali solution, and were all analyzed for MOCA and TDI. Carbon monoxide was monitored in the quality control, staging, ski boot mold, stripping, boot trim, boot repair, and ski boot finishing areas. Methylene chloride and Stoddard solvent were monitored in the boot finish and ski boot mold areas. Confidential employee interviews were completed on all the workers who were exposed to TDI and MOCA and on workers who were exposed to all the compounds included in this evaluation.

### C. Evaluation Methods

All solvent vapor samples were taken on organic vapor sampling tubes and analyzed by gas chromatography. TDI and MOCA samples were taken with Marcali solution. TDI was analyzed by the Marcali method. MOCA was extracted from the Marcali solution with benzene and analyzed by gas chromatography.

### D. Criteria for Assessing Workroom Concentrations of Air Contaminants

The three sources of criteria used to assess workroom concentrations of air contaminants in this evaluation are: (1) Recommended and proposed threshold limit values (TLV's) and their supporting documentation as set forth by the American Conference of Governmental Industrial Hygienists (ACGIH) (1974); (2) occupational health standards as promulgated by the U.S. Department of Labor (Federal Register, June 27, 1974, Title 29, Chapter XVII, Subpart G); and (3) NIOSH recommended criteria for occupational exposures.

In the following tabulation of criteria, the most appropriate value is presented with its reference footnoted.

| Substance | Permissible Exposures 8-Hour Time-Weighted Exposure Basis | | |
|---|---|---|---|
| [1]MOCA | 0 | | |
| [2]TDI | 0.005 | $mg/M^3$ | (a) |
| [3]Methylene Chloride | 360.0 | $mg/M^3$ | |
| [4]Carbon Monoxide | 35.0 | ppm | (b) |
| [5]Stoddard Solvent | 575.0 | $mg/M^3$ | |

(a) $mg/M^3$ = approximate milligrams of substance per cubic meter of air

(b) ppm = parts of vapor or gas per million parts of contaminated air

[1]Reference: A carcinogen; NIOSH recommends zero exposure level.

[2]Reference: 1974 ACGIH TLV (notice of intended changes) and NIOSH criteria for recommended standard.

[3]Reference: 1974 ACGIH TLV (notice of intended changes).

[4]Reference: NIOSH criteria for recommended standard.

[5]Reference: 1974 ACGIH TLV (notice of intended changes).

Compliance with 0.005 ppm of TDI for an 8-hour day, 40 hour week over a working lifetime will protect workers that are not already sensitized to TDI. Workers already sensitized to TDI should not be exposed to any amount of TDI.

Occupational health standards are established at levels designed to protect individuals occupationally exposed to individual toxic substances on an 8-hour per day, 40-hour per week basis over a normal working lifetime.

E. Evaluation Results

Results of these samples illustrated that at the time of this evaluation, excessive exposures to TDI and MOCA occurred in the ski boot mold area.

Exposures to carbon monoxide, Stoddard solvent, and methylene chloride were all below the most recent hygienic standards. Since the time of this evaluation, the Lange Company has had a large reduction in its work force and is presently in the process of adding more ventilation to the ski boot mold area.

Confidential employee interviews showed only minor complaints which may or may not be related to TDI exposures. The Lange Company has a full-time nurse and a consulting physician who visits the plant once a week. Responsibilities of the Lange nurse include screening all employees for any history of hypersensitivity, allergies, hay fever, and so forth. When workers have reactions to TDI, they are immediately removed from the area, which may be the reason why employees interviewed in the area of excessive TDI exposure did not complain of clinical symptoms typical of TDI overexposure.

F. Recommendations

1. Workers exposed to MOCA and TDI should be provided with NIOSH-approved respirators until a closed ventilation system is installed, eliminating any employee exposure.

2. The possibility of substitution of a non-carcinogenic compound to replace MOCA in the ski boot mold department would be advisable.

3. The Company should continue its efforts in screening personnel who may be potentially allergic to TDI.

4. The Company should institute the environmental and medical recommendations contained in NIOSH's Criteria Document for exposure to TDI.

## V. REFERENCE

[1]Criteria for a recommended standard...Occupational Exposure to Toluene Diisocyanate, National Institute for Occupational Safety and Health, 1973.

## VI. AUTHORSHIP AND ACKNOWLEDGMENT

Report Prepared By: Bobby J. Gunter, Ph.D.
Regional Industrial Hygienist
NIOSH - Region VIII
Denver, Colorado

Originating Office: Jerome P. Flesch, Chief
Hazard EValuation Services Branch
Cincinnati, Ohio

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TABLE I

ATMOSPHERIC CONCENTRATIONS OF TDI

April 8, 1975

| Sample Number | Location | Time of Sample (minutes) | Type Sample | Atmospheric Concentrations TDI ($mg/M^3$) |
|---|---|---|---|---|
| 14 | Ski Boot Mold Area | 25 | O.B.Z. [a] | 0.54 |
| 15 | Ski Boot Mold Area | 25 | O.B.Z. | 0.23 |
| 1 | Ski Boot Mold Area | 69 | O.B.Z. | 0.44 |
| 2 | Ski Boot Mold Area | 63 | O.B.Z. | 0.48 |
| 3 | Ski Boot Mold Area | 60 | General Room | 0.47 |
| 7 | Ski Boot Mold Area | 49 | General Room | 0.34 |
| 8 | Ski Boot Mold Area | 43 | General Room | 0.34 |
| 9 | Ski Boot Mold Area | 61 | O.B.Z. | 0.25 |
| 10 | Ski Boot Mold Area | 58 | O.B.Z. | 0.34 |
| | | | HYGIENIC STANDARD | 0.12 [b] |

(a) Operator's Breathing Zone

(b) 0.036 $mg/M^3$ NIOSH criteria for recommended standard

TABLE II

ATMOSPHERIC CONCENTRATIONS OF MOCA

April 8, 1975

| Sample Number | Location | Time of Sample (minutes) | Type Sample | Atmospheric Concentrations MOCA ($mg/M^3$) |
|---|---|---|---|---|
| 1 | Ski Boot Mold Area | 69 | O.B.Z.[a] | 0.042 |
| 2 | Ski Boot Mold Area | 63 | O.B.Z. | 0.028 |
| 3 | Ski Boot Mold Area | 60 | General Room | 0.001 |
| 4 | (BLANK) | | | < 0.001 |
| | | | HYGIENIC STANDARD | 0 |

(a) Operator's Breathing Zone

TABLE III

ATMOSPHERIC CONCENTRATIONS OF STODDARD SOLVENT

April 8, 1975

| Sample Number | Location | Time of Sample (minutes) | Type Sample | Atmospheric Concentrations Stoddard Solvent ($mg/M^3$) |
|---|---|---|---|---|
| 8 | Ski Boot Finish | 122 | O.B.Z.[(a)] | 355 |
| 9 | Ski Boot Finish | 120 | O.B.Z. | 451 |
| 12 | Ski Boot Finish | 120 | General Room | -0- |
| 13 | Ski Boot Finish | 118 | O.B.Z. | 345 |
| | | | HYGIENIC STANDARD | 575 |

(a) Operator's Breathing Zone

TABLE IV

ATMOSPHERIC CONCENTRATIONS OF METHYLENE CHLORIDE
April 8, 1975

| Sample Number | Location | Time of Sample (minutes) | Type Sample | Atmospheric Concentrations Methylene Chloride ($mg/M^3$) |
|---|---|---|---|---|
| 2 | Ski Boot Mold Area | 120 | O.B.Z.[a] | 104 |
| 4 | Ski Boot Mold Area | 122 | O.B.Z. | < 5 |
| | | | HYGIENIC STANDARD | 360 |

(a) Operator's Breathing Zone

TABLE V

ATMOSPHERIC CONCENTRATIONS OF CARBON MONOXIDE

April 8, 1975

| Location | Type Sample | Atmospheric Concentrations Carbon Monoxide (ppm) |
|---|---|---|
| Quality Control Area | Direct Reading CO Analyzer | 10 |
| Staging Area | Direct Reading CO Analyzer | 10 |
| Ski Boot Mold Area | Direct Reading CO Analyzer | 15 |
| Stripping Area | Direct Reading CO Analyzer | 15 |
| Boot Trim Area | Direct Reading CO Analyzer | < 10 |
| Boot Repair Area | Direct Reading CO Analyzer | < 10 |
| Ski Boot Finishing Line | Direct Reading CO Analyzer | < 10 |
| | HYGIENIC STANDARD | 35 |