U. S. DEPARTMENT OF HEALTH, AND HUMAN SERVICES
CENTER FOR DISEASE CONTROL
NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH
CINCINNATI, OHIO 45226

HEALTH HAZARD EVALUATION DETERMINATION REPORT

HE 80-21-721

COLGATE-PALMOLIVE CO.
BERKELEY, CALIFORNIA

JULY, 1980

I. SUMMARY

On November 13, 1979 the National Institute for Occupational Safety and Health (NIOSH) received a confidential request from an authorized representative of the International Longshoremen's and Warehousemen's Union (Local 6) to evaluate worker's exposure to 1,4 Dioxane, a contaminant of 3EO-sulfate® compound used in liquid detergents at the Colgate-Palmolive Company, Berkeley, California. (Sic # 2840)

Twenty-nine environmental air samples (personal and area) were collected from the storage area, the mixing area and the finishing line for the measurement of 1,4 dioxane. Also, six bulk samples of liquid detergents and one bulk sample of 3EO-sulfate were analyzed for 1,4 dioxane concentration. The airborne concentration of dioxane was measured to be below the limit of detection. Furthermore, the concentration of dioxane in the bulk samples was less than one percent by weight -- the limit recommended in the NIOSH Dioxane Criteria Document for materials where dioxane is present as an unintentional contaminant.

Based on the environmental air results and the analysis of the bulk samples, NIOSH concluded that a health hazard of exposures to 1,4 dioxane did not exist at Colgate-Palmolive, Berkeley, CA., during the dates of this survey.

II. INTRODUCTION

In November 1979, NIOSH received a confidential request* from an authorized representative of the International Longshoremen's and Warehousemen's Union (Local 6) to evaluate worker exposure to 1,4 dioxane, an unintentional contaminant of 3EO-sulfate which is a component of several detergents.* The areas of major concern were the storage area, the liquid mixing department, and the finishing line where the final product is bottled and packaged.

An initial environmental survey was conducted December 7, 1979 during which time bulk samples of detergents and 3EO-sulfate were collected. Environmental air samples were collected during the follow-up surveys on February 1 and 7, 1980. Analytical results of the bulk samples and environmental air samples for dioxane concentration were reported to the appropriate personnel as soon as data were available (March 11,1980).

It should be noted that Cal/OSHA collected several personal and area air samples from the liquid finishing department during the month of November, 1979. The dioxane concentration for the three samples was below the California Occupational Safety and Health Administration (OSHA) Standard (50 ppm) and the NIOSH recommended criteria of 1 ppm (parts of contaminated gas or vapor per million parts of air).

III. BACKGROUND

Colgate-Palmolive Company at Berkeley, CA., employs 450 workers of which approximately 70 work one of three 8-hour shifts, five days per week in [illegible] in either the chemical storage area, liquid mixing area or liquid finishing area.

1. Storage Area - chemical transfer of 3EO-sulfate from the delivery truck to the storage tank is done by two plant employees and the truck driver. The truck access covers are cracked open, transfer lines are connected and the chemical is gravity fed from the truck to the storage tank pump. The chemical transfer of 3EO-sulfate (6400 gals) takes about 2.0 - 2.5 hours. The truck driver monitors the transfer operation. No special protective equipment is worn by any of the workers.

2. Liquid Mixing Area - One operator monitors the liquid making operation. Chemicals are transferred from the storage containers to the mixing vessels via a computerized closed transfer system. The 3EO-sulfate is heated (140-160 F) to facilitate transfer. On occasion dry chemicals are added to the mixer by the operator. Once the necessary ingredients have been added to the heated vessel, the chemicals are mixed for the prescribed time. After mixing is complete, the operator obtains a bulk sample of the detergent which is analyzed for proper pH and total solids. Once the liquid detergent meets proper specifications, it is transferred to the storage area where it is held until bottled. The mixing tanks are periodically washed out if there is a major change in the color or ingredients.

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*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, and Human Services, (HHS) following a written request by an 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.

In addition to local exhaust ventilation at the tank access cover, there are process fans which provide general room air ventilation. These fans must be activated in order for the mixer to operate. The processor exhaust fans provide about 6.5 air changes per hour.

3. Liquid Finishing Area - There are four bottling lines of which 2-3 are operational three shifts per day. Each line is designed to handle a specific detergent and container. The detergent is piped from the storage area to the bottle filler. The container is filled, capped, washed, dried, labeled and boxed. Two operators are assigned to each line. One employee monitors the bottle filling and services the label and cap machine, and the other employee monitors the packing operation. Sinks and eye wash facilities are readily available in case of unnecessary exposure to detergents. Workers are each assigned a plastic apron, latex and cotton gloves, and safety glasses.

Each line has local exhaust ventilation at the bottle washing and drying position. Line # 2 has a specially designed filler station which is enclosed with local exhaust ventilation. This line handles a cleaner which contains ammonia.

The liquid filling department has window exhaust fans and process exhaust fans which provide 4.5 air changes per hour.

IV. EVALUATION DESIGN AND METHODS

Bulk samples of six detergents and one sample of 3EO-sulfate were collected during the initial survey and analyzed for percentage by weight of dioxane.

Personal and area air samples were collected on the follow-up surveys during an 8-hour work shift in order to evaluate employees' exposure. Personal samples were attached to the workers' shirt collar in order to characterize breathing zone samples. Area samples were placed at a breathing zone height near the greatest source of exposure.

a) Bulk Samples Analysis - These samples were of a high viscosity hence direct injection of sample into a gas chromatograph was impossible. A headspace sample was taken by placing each vial with sample into a water bath. The samples that showed extraneous peaks were submitted for mass spectrophotometry analysis.

b) Personal and area air samples were collected using a sampling train consisting of a vacuum pump and a 150 milligram (mg) activated charcoal tube through which a known volume of air was drawn.[1] The air contaminants are absorbed by the charcoal grains and later desorbed and analyzed by gas chromatography according to NIOSH method S360 with minor modification.[2]

V. EVALUATION CRITERIA

A. Environmental

There are several criteria used to evaluate the toxic air contaminants of an employee's work environment: (1) NIOSH Criteria Documents for a Recommended Occupational Health Standard, (2) Proposed and Recommended Threshold Limit Values (TLV's) as suggested by the American Conference of Governmental Industrial Hygienists (ACGIH), 1976, (3) The Federal Occupational Safety and Health Standards (OSHA). In California, CAL-OSHA enforces the ACGIH-TLV's.

The exposure criteria for each containment is based upon the current state of knowledge concerning toxicity of these standards. The concentration is designed to allow an exposure for up to a 10-hour work day, 40-hour work week as a time-weighted average (TWA) over a normal lifetime without the worker experiencing illness. In some instances, a few employees may experience discomfort at or below the TWA.

The following table contains NIOSH recommended criterion for dioxane. The CAL-OSHA TWA Standard has been cited so that the reader may see whether the substance has been exceeded. However, no discussion of the OSHA Standard, with respect to measured airborne levels, will be presented.

TABLE A

TIME-WEIGHTED AVERAGE (TWA)[a]

Substance	NIOSH Criteria for Recommended Standard	CAL-OSHA Standard	Fed-OSHA Standard
1,4 Dioxane...	1 ppm[b]	50 ppm	100 ppm

a) TWA-NIOSH exposure is based on a work day up to 10 hours long, whereas the OSHA Standard is based on an 8-hour work day.

b) ppm - parts of a vapor or gas per million parts of contaminated air.

B. Toxicological Effects

Since the concentration of the chemical was well below the NIOSH recommended criterion, a comprehensive toxicological discussion is not warranted. However, a brief toxicological review for dioxane is presented.

TABLE B

CHEMICAL TOXICITY DATA

Substance	Primary Health Effects
Dioxane	Dioxane may be inhaled as well as absorbed percutaneously. Inhalation may produce local irritation to the eyes, nose and throat. Systemic effects may cause drowsiness, dizziness, loss of appetite, headache, nausea, vomiting, stomach pain, liver and kidney damage. Prolonged skin exposure may cause skin drying and cracking.[3] Exposure to dioxane may also cause cancer, a conclusion interpreted from experimental studies, and much of the recommended standard is based on this conclusion.[4]

VI. RESULTS AND DISCUSSION

It was learned that dioxane was formed in 3EO-sulfate during the sulfonation process. Bulk samples, of 3EO-sulfate and detergents containing this ingredient, were collected during the initial survey. Analysis of these samples indicated that dioxane concentration (percentage by weight) was well below the NIOSH recommended criterion of 1 percent by weight for an unintentional contaminant.

TABLE C

Product Trade Name	Percent by weight of Dioxane in sample
1. Colgate Lotion Detergent	0.016
2. Dermassage Dish Wash Liquid	0.019
3. Ajax Dish Wash Liquid	0.021
4. Palmolive Detergent	0.000
5. Crystal White Detergent	0.127
6. Rose Lotion - Velvet Detergent	0.423
7. 3EO Sulfate	0.135

Although dioxane was below the recommended criteria, it was decided to collect personal and area air samples to determine if any of the unintentional contaminants could be detected in the worker's breathing

zone. All the environmental air samples were below the limit of detection.

Based on the environmental results, a health hazard due to dioxane exposure did not exist at the time of the survey. However, it was observed that the line operators did not don the necessary protective equipment required for their jobs. Several workers wore cotton gloves without the latex glove underneath because the company ran out of latex gloves. Thus, workers were unnecessarily contaminated with detergents which are surfacting (defattening) agents that remove normal skin oils.

Locker facilities were provided the workers; however, housekeeping was extremely poor. One of the two shower facilities was used to store hoses and buckets.

VII. RECOMMENDATIONS

1. The company should maintain ample supplies of protective equipment - impervious gloves - to prevent unnecessary skin exposure to the surfacting agents.

2. Workers should receive periodic training regarding the importance of donning proper protective equipment (aprons, gloves and glasses).

3. The locker area should receive periodic cleaning.

4. The shower area should not be used as a storage area so as to discourage its use by employees subsequent to work.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

REPORT PREPARED BY:

Pierre L. Belanger
Industrial Hygienist
NIOSH - Region IX
San Francisco, CA

ORIGINATING OFFICE:

Hazard Evaluations and Technical Assistance Branch
Cincinnati, Ohio

ACKNOWLEDGEMENTS:

Analytical Laboratory Sciences
Measurement Support Branch
Cincinnati, Ohio

REPORT TYPED BY:

Noel Ryan
NIOSH, Region IX

IX. REFERENCES

1. NIOSH Manual of Sampling Data Sheets, DHEW (NIOSH) Publication No. 77-158.

2. NIOSH Manual of Analytical Methods, DHEW (NIOSH) Publication No. 77-157c.

3. Occupational Diseases, A Guide to Their Recognition, U.S. Department of Health, Education and Welfare, DHEW (NIOSH) Publication No. 77-181.

4. Criteria For a Recommended Standard ... Occupational Exposure to Dioxane, (1977) DHEW (NIOSH) Publication No. 77-226.

X. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this Determination Report are currently available upon request from NIOSH, Division of Technical Services, 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. Requester - Confidential

2. International Longshoremen's and Warehousemen's Union (Local #6).

3. CAL-OSHA.

4. U.S. Department of Labor - Region IX.

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