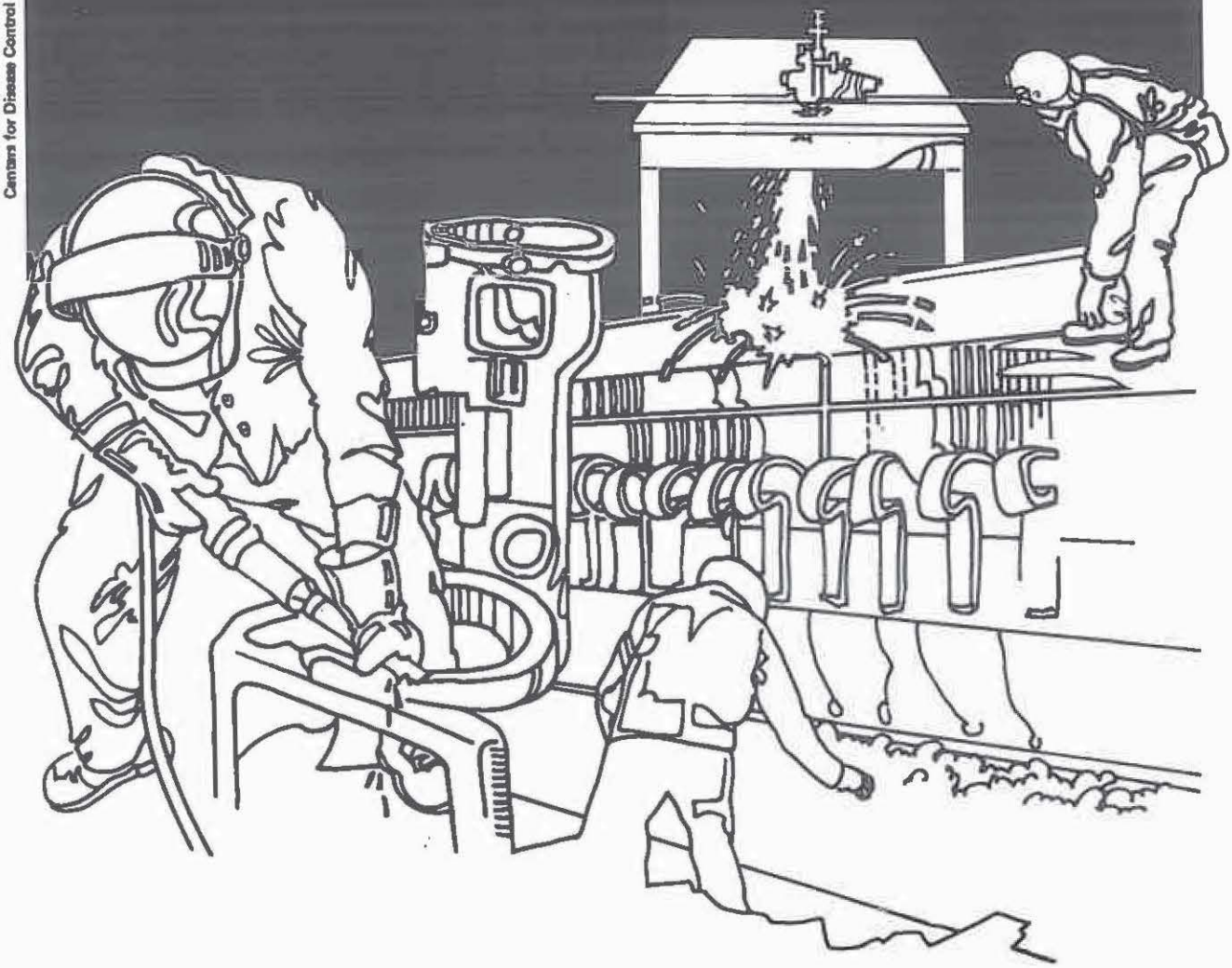
U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES ■ Public Health Service
Centers for Disease Control ■ National Institute for Occupational Safety and Health

NIOSH



Health Hazard Evaluation Report

HETA 81-468-1036
UNITED UNION OF ROOFERS,
WATERPROOFERS, AND ALLIED WORKERS
BALTIMORE, MARYLAND

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.

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UNITED UNION OF ROOFERS, WATERPROOFERS,
AND ALLIED WORKERS
BALTIMORE, MARYLAND

NIOSH INVESTIGATOR:
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I. SUMMARY

On September 21, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request for Health Hazard Evaluation from the United Union of Roofers, Waterproofers, and Allied Workers to evaluate any hazards posed by the installation of a Sarnafil Corporation one-ply, polyvinyl-chloride roofing system on the Baltimore Opera House.

An environmental survey was performed during September 23-25, 1981. Personal and area air samples were taken to determine worker exposures to the solvent mixture contained in the roofing-material adhesive. Additional sampling was performed for hydrogen chloride (HCl) aerosol generated by the heat sealing of the edges of the polyvinyl-chloride roofing material.

Exposures to airborne vapors of methylene chloride ranged from none detected (ND) to 31.1 mg/m^3. Other solvent exposures to the workers, as measured, were ND to 17.6 mg/m^3 for 2-butanone, 2.8 to 16.6 mg/m^3 for toluene, and ND to 1.3 mg/m^3 for xylene. NIOSH recommends an 8-hour TWA (time-weighted average) exposure of 260 mg/m^3 for methylene chloride, 590 mg/m^3 for 2-butanone, 375 mg/m^3 for toluene, and 435 mg/m^3 for xylene. No hydrogen chloride was detected in any of the three samples taken during 15-minute sampling periods. During the survey, winds were measured in excess of 15 miles per hour. This undoubtedly contributed to the low exposures measured during the survey.

NIOSH concludes that no health hazards from exposures to solvents contained in the roofing adhesive, or hydrogen chloride from the heat sealing of polyvinyl-chloride roofing material existed during the period of the survey. It is recommended that workers try to maintain an upwind attitude when applying roofing adhesive, or heat-sealing edges of the roofing sheets. Other recommendations are found in Section VII of this report.

KEYWORDS: SIC 1760 (Roofing and Sheet Metal Work), solvents, one-ply roofing, hydrogen chloride, polyvinyl chloride, Sarnafil Corporation.

II. INTRODUCTION

On September 21, 1981, the National Institute for Occupational Safety and Health (NIOSH) received a request from the United Union of Roofers, Waterproofers, and Allied Workers to determine hazards posed by the installation of a one-ply roofing system on the Baltimore Opera House.

An environmental survey was performed during September 23-25, 1981. Personal and area air samples were taken to determine worker exposures to the solvent mixture contained in the roofing-material adhesive. Additional sampling was performed for hydrogen chloride (HCl) generated by the heat sealing of the polyvinyl-chloride roofing material.

III. BACKGROUND

The particular one-ply roofing system used to cover the Baltimore Opera House was produced by Sarnafil Corporation. Roofing paper is asphalted to the concrete slab on top of the building. Insulation is then adhered on top of the paper. A contact-type adhesive (two surfaces that are to be glued are coated with adhesive, the adhesive is allowed to dry, the pieces are then stuck together) is used to glue the polyvinyl-chloride composite plastic sheet to the insulation. The solvent is rolled onto the roof and plastic sheeting with a paint roller on the end of a 6' handle. The sheets are 5' X 60' X 1/8" and are overlapped 3" on edge. Edges are heat welded using a heat gun that produces a stream of hot air at 1200°F.

The exact composition of the roofing adhesive was not supplied by Sarnafil, but mass spectral data indicates that the primary solvents used in the mixture are, in order of predominance, methylene chloride, 2-butanone (methyl ethyl ketone), toluene, xylene isomers, and smaller amounts of C_7 alkanes, benzene, 1,1,1-trichloroethane, and carbon tetrachloride.

IV. EVALUATION DESIGN AND METHODS

Personal (breathing zone) air samples for the various solvents were taken using SKC Model 223-3 pumps at a flow rate of either 100 or 200 cc/min. The samples were collected on SKC Lot 107 charcoal tubes. Hydrogen chloride samples were collected on treated silica gel tubes at a flow rate of 200 cc/min for a 15-minute, short-term exposure determination.

Area samples were collected using a 3M Brand Organic Vapor Monitor and also with pump and charcoal tube.

V. EVALUATION CRITERIA

Exposure to solvents may cause irritation of mucous membranes, eyes, and skin. Higher concentrations may lead to dizziness and drowsiness

(narcosis). Chronic exposure to high concentrations may result in liver damage. Contact dermatitis may occur in some individuals.

NIOSH recommends that workers not be exposed, on the basis of an 8-hour TWA (time-weighted average), to more than 260 mg/m^3 of methylene chloride, 590 mg/m^3 for 2-butanone, 375 mg/m^3 for toluene, and 435 mg/m^3 for xylene. The Occupational Safety and Health Administration (OSHA) standards for the aforementioned solvents are: 2-butanone, 590 mg/m^3; methylene chloride, 1750 mg/m^3; toluene, 750 mg/m^3; and isomers of xylene, 435 mg/m^3.

Hydrogen chloride, also known as anhydrous hydrochloric acid, is required to be at levels of not more than 7 mg/m^3 according to the current OSHA standard, based on a ceiling value obtained during a 15-minute sampling period.

VI. RESULTS AND DISCUSSION

The results of the air monitoring performed during the survey of September 23-25, 1981, are summarized in Table I along with the National Institute for Occupational Safety and Health (NIOSH) and the Occupational Safety and Health Administration (OSHA) permissible exposure levels for an 8-hour shift.

Exposures to airborne vapors of methylene chloride ranged from none detected (ND) to 31.1 mg/m^3. Other solvent exposures to the workers, as measured, were ND to 17.6 mg/m^3 for 2-butanone, 2.8 to 16.6 mg/m^3 for toluene, and ND to 1.3 mg/m^3 for xylene. No hydrogen chloride was detected in any of three samples which were taken during 15-minute sampling periods.

There was no specialization of jobs observed during the roof application process. Every worker performed all the jobs listed in Table I. The highest exposures to solvents (31.1 mg/m^3 of methylene chloride) were measured during the unroll and press portion of the roofing application. This job is done with the worker on his knees, and therefore closer to the surfaces to which the adhesive has been applied. Solvent exposures would likewise be minimal while an employee heat welds the seams of the plastic sheets, since this is usually performed the day following the application. Overall, the solvent exposures measured were low and posed no hazard to the workers during the period of the survey. During the survey, winds were measured in excess of 15 miles per hour. This undoubtedly contributed to the low exposures.

NIOSH has examined similar, although not identical, one-ply roofing systems for potential overexposure to solvents and hydrogen chloride. In both situations low exposures were measured. It can be generalized that exposures will be low in areas of unrestricted airflow (such as the roof of flat-top buildings) with moderate wind speed. Likewise, it

can be assumed that consequential exposures may occur when the material is being applied in areas of a roof shielded against the wind, confined spaces, or on calm, hot days.

VII. RECOMMENDATIONS

1. Workers should maintain an upwind attitude whenever possible to minimize their solvent exposures.

2. Skin contact with the adhesive should be avoided to prevent possible dermatitis.

3. Confined spaces or areas of restricted airflow should be entered with air-purifying, organic vapor cartridge respiratory protection.

4. Workers should be instructed to cease work and find fresh air immediately at the first signs of solvent intoxication (light-headedness, headache, dizziness, drowsiness).

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. 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. New England Roofing Co., Boston, Massachusetts
2. United Union of Roofers, Waterproofers, and Allied Workers, Washington, D.C.
3. NIOSH, Region III
4. OSHA, Region III

For the purpose of informing 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 for Personal Breathing-Zone Samples for
2-Butanone, Methylene Chloride, Toluene, and Xylene

New England Roofing
Baltimore, Maryland
HETA 81-468

September 23-25, 1981

Job	Sampling Time (Min.)	2-Butanone (mg/m^3)	Methylene Chloride (mg/m^3)	Toluene (mg/m^3)	Xylene (mg/m^3)
Glue and Apply	96	2.8	7.1	5.9	ND*
Glue and Apply	88	ND	ND	2.8	ND
Glue and Apply	63	5.1	11.5	8.7	ND
Glue and Apply	87	ND	ND	3.3	ND
Glue and Apply	141	3.2	8.2	6.2	ND
Glue and Apply	207	1.8	7.3	7.4	ND
Pre-lay Gluer	126	ND	3.4	4.8	ND
Unroll and Press	132	17.6	31.1	16.6	1.3
Unroll and Press	134	4.0	10.7	5.9	ND
Unroll and Press	128	4.3	9.9	7.8	ND
Evaluation Criteria:					
NIOSH (8-hour TWA)		590	260	375	435
OSHA (8-hour TWA)		590	1750	750	435
Limit of Detection		0.02	0.03	0.015	0.015

* ND = None Detected