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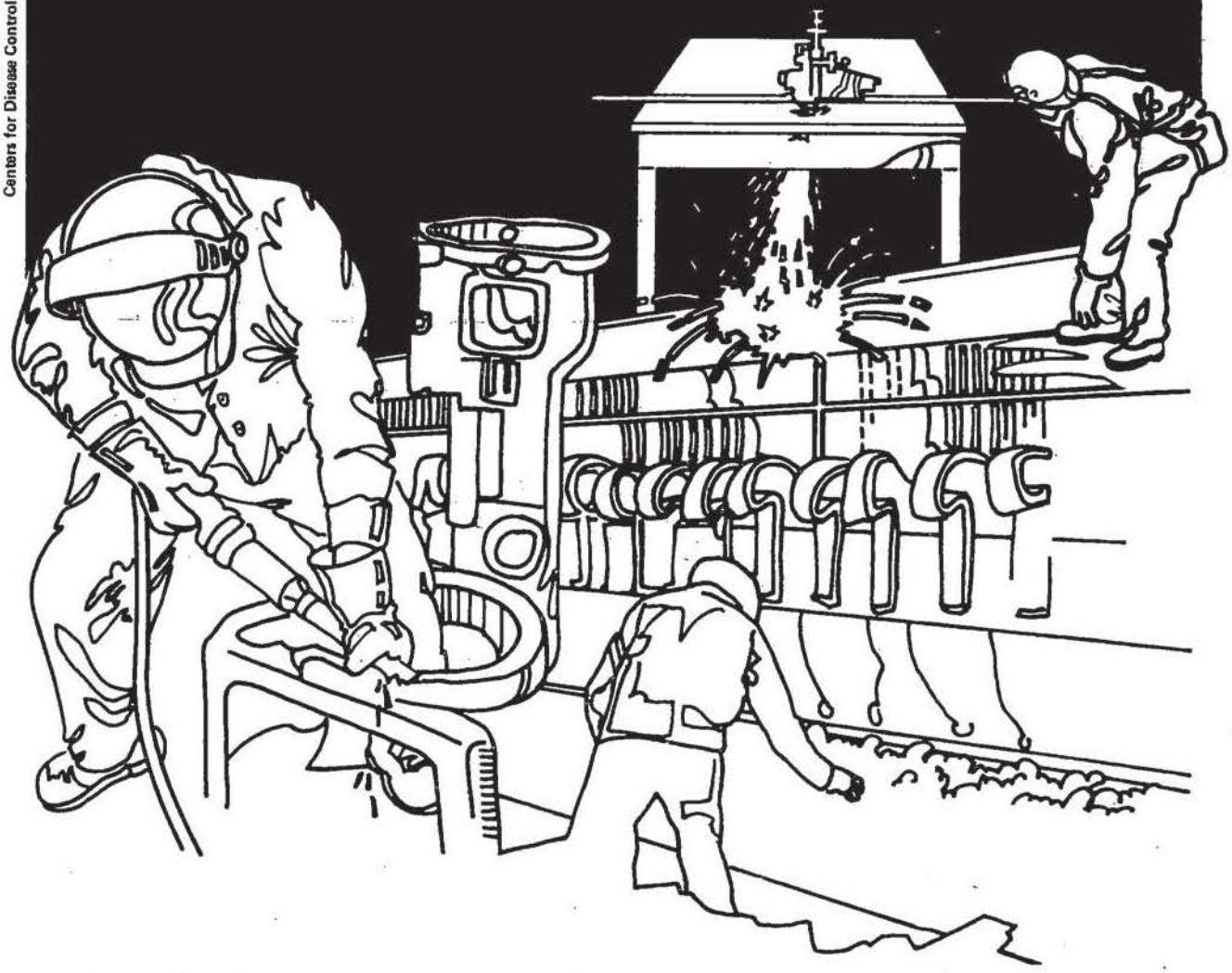

Health Hazard Evaluation Report

HETA 85-453-1787
SPERRY RAND CORPORATION
GREAT NECK, NEW YORK

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.

HETA 85-453-1787
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SPERRY RAND CORPORATION
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I. SUMMARY

In July 1985, the National Institute for Occupational Safety and Health (NIOSH) received a request from the International Union of Electrical Workers to evaluate dermatitis among employees in the Incoming Inspection area of the Sperry Rand Corporation's plant in Great Neck, New York. Workers attributed the problem to polyethylene tote boxes impregnated with an anti-static agent. The symptoms reportedly persisted even after the tote boxes were no longer used.

During the initial survey, in August 1985, 11 of 26 Incoming Inspection area workers interviewed reported a skin complaint involving the hands or arms, lasting at least 48 hours, and first occurring during the half-year period the tote boxes were in use. During the follow-up medical survey, in December 1985, 1 of 17 employees from the Electronics Assembly area, where the tote boxes were not handled, reported such a rash first occurring during the preceding 12 months (relative risk for Incoming Inspection vs. Electronics Assembly: 7.19, 95% confidence interval 1.60-32.3). At the time of the initial survey, three workers had a residual rash on the hands or arms consistent with contact dermatitis.

Six NIOSH employees had various concentrations of the anti-static agent, bis-hydroxyethyltallowamine (BHETA), in olive oil applied to their skin. All had irritant reactions to concentrations of 50% and 25% BHETA. Reactions to 12.5% and 6.13% BHETA varied. Lower concentrations produced no reactions. One person developed a delayed reaction at the test site several days later and subsequently reacted to a closed patch containing 0.5% BHETA; these findings are indicative of allergic sensitization. Two applications of 25% BHETA to guinea pig skin produced necrotic irritant reactions. Three applications of 2.5% BHETA produced shallow cutaneous ulcerations.

Wipe samples of work surfaces in the Incoming Inspection area, collected in November 1985, contained no detectable BHETA (limit of detection: 0.3 milligrams per sample).

In December 1985, to determine if allergic sensitization to BHETA had developed, the NIOSH investigators patch tested 18 Sperry Rand employees who had had skin complaints. The patches contained 0.5% BHETA in olive oil. Three participants had only weakly positive reactions, which were not definitely indicative of allergic sensitization.

This study demonstrates that BHETA can cause both irritant and allergic contact dermatitis. Exposure to BHETA was a likely cause of dermatitis among the Incoming Inspection area employees. The previously used BHETA-impregnated tote boxes should not be reintroduced.

KEYWORDS: SIC 3679 (Electronic Components, Not Elsewhere Classified), bis-hydroxyethyltallowamine, allergic contact dermatitis, irritant contact dermatitis

II. INTRODUCTION

In July 1985, the National Institute for Occupational Safety and Health (NIOSH) received a request from the International Union of Electrical Workers to evaluate dermatitis among employees in the Incoming Inspection area of the Sperry Rand Corporation's plant in Great Neck, New York. Workers attributed the problem to polyethylene tote boxes impregnated with an anti-static agent. The symptoms reportedly persisted even after the tote boxes were no longer used.

NIOSH investigators conducted a medical survey at the plant in August 1985, collected environmental samples in November 1985, and performed an additional medical survey in December 1985. A letter describing the medical findings was distributed to the company and union April 9, 1986, and a letter discussing the environmental sampling results was sent June 10, 1986.

III. BACKGROUND

The plant manufactures electronic panel instruments. The 25-30 workers in the Incoming Inspection area unpack metal parts and components and place them into plastic tote boxes to be transported by conveyor belt to various inspection stations, where the tote boxes are emptied and the parts examined. When the employees lift the tote boxes onto or off the conveyor belt their hands and arms touch the sides of the boxes.

In December 1984, new tote boxes were introduced. Unlike the older tote boxes, they had bis-hydroxyethyltallowamine (BHETA), an anti-static agent, impregnated into them. Employees notice that the boxes developed an oily film when handled, and by April 1985 several of them had reported developing a skin rash, primarily on their arms and hands. Use of these tote boxes was discontinued in July 1985 because metal parts were corroding, apparently because of contamination with the anti-static agent. The tote boxes were replaced with those that were used previously. In an effort to remove any residual anti-static agent from the Incoming Inspection area, work surfaces were scrubbed using a detergent-based cleaner.

IV. EVALUATION DESIGN AND METHODS

A. Environmental

To determine if exposure to BHETA might still be occurring, the NIOSH Industrial Hygienist collected nine wipe samples in the Incoming Inspection area by rubbing large surface areas with gauze swabs saturated with methyl alcohol. Surfaces sampled included both those known to have been cleaned and those that may have been missed, such as tops of storage cabinets where tote boxes were thought to have been placed. The samples were analyzed for BHETA by infrared spectroscopy.

B. Medical

During the first NIOSH survey, 26 Incoming Inspection area employees filled out a skin symptom and exposure questionnaire and had their skin examined by the NIOSH medical investigators. During the second medical survey, a similar questionnaire was completed by 17 employees of the Electronics Assembly area, where the BHETA-impregnated tote boxes were not handled. (In addition, three employees--including two from the Incoming Inspection area--who handled the tote boxes but were not interviewed during the first survey volunteered to participate in the second survey.)

To determine if BHETA could provoke a follicular or eczematous dermatitis, six volunteer NIOSH employees, including the two medical investigators, used cotton-tipped applicators to apply technical grade BHETA to the ventral surfaces of their forearms. They used the following concentrations, serially diluted in olive oil: 50%, 25%, 12.5%, 6.25%, 3.13%, and 1.56%. Undiluted olive oil served as a control. All dilutions were applied twice daily to the same sites (marked with ink), which were left unoccluded (open), for five days or until a skin reaction developed.

NIOSH toxicologists tested groups of six, six, and three Hartley guinea pigs (Charles River Company, Kingston, New York) to open applications of 100%, 25%, and 2.5% dilutions, respectively, of BHETA in corn oil on shaved patches (2 cm x 2 cm) of flank skin. Corn oil applied to the opposite flank served as a control. Applications were made twice daily or until a skin reaction developed.

Workers who had handled tote boxes and had had any skin complaint were eligible to participate in the December 1985 medical survey. Participants were patch tested on the outer upper arm with 0.5% BHETA in olive oil, using Al-test* strips secured to the skin with Scanpor* tape. Test results were read at 48 and 120 hours and graded according to the method of the North American Contact Dermatitis Group and the American Academy of Dermatology.[1] Two NIOSH employees served as patch test controls.

V. EVALUATION CRITERIA

BHETA is an ethoxylated tertiary amine derived from tallow. It is marketed as an anti-static agent for use in polyethylene films and molded plastics. Although the precise mechanism by which it imparts anti-static properties is unknown, it effectively eliminates the

accumulation of electrostatic charges that ordinarily result from injection, extrusion, and blowing of molded polyethylene. BHETA's principal applications are in polyethylene film used as food wrappers or containers, and in finished plastic products for holding, storing, or shipping electrical components. It is typically supplied to polyethylene plastics manufacturers in the form of high-density polyethylene pellets impregnated with high concentrations of the anti-static agent; these are subsequently mixed and blended with other polyethylene plastics.

Toxicologic data provided by the manufacturer characterize BHETA as corrosive to rabbit skin by Draize test and a possible skin sensitizer by the Buehler method (1 of 20 guinea pigs reacted slightly upon rechallenge with 0.6% BHETA in acetone). Quaternary ammonium anti-static agents derived from tallow and used as fabric softeners have been suspected causes of follicular dermatitis, although this association remains unproven.[2]

Usage concentration of BHETA in polyethylene films used as food wrappers or molded containers is regulated by the Food and Drug Administration, which requires that concentrations not exceed 0.1% or 0.15% by weight, respectively. Usage concentrations in containers designed for electrical components are not regulated.

There are no published criteria for evaluating occupational exposure to BHETA.

VI. RESULTS

A. Environmental

BHETA was not detected in any of the wipe samples. The limit of detection was 0.3 milligrams per sample.

B. Medical

Eleven of the 26 Incoming Inspection area employees who completed the questionnaire in August 1985 reported a skin problem--described as either (1) "red or inflamed skin," or (2) "hives, welts or small red bumps like mosquito bites"--involving the hands or arms, first occurring during the preceding 6 months (the period when the BHETA-impregnated tote boxes were in use), and lasting at least 48 hours. In contrast, only 1 of 17 Electronics Assembly area employees, who completed the questionnaire in December 1985, reported such a rash first occurring in the preceding 12 months (relative risk for Incoming Inspectiion vs. Electronics Assembly: 7.19, 95% confidence interval 1.60-32.3). (The three self-selected participants in the second survey all reported such a rash, but they were not included in the preceding analysis because of the obvious selection bias.) Nine of the 11 Incoming Inspection area employees reporting a hand or arm rash during the first survey

(and both of those participating in the second survey) also reported a rash involving the face or neck, as did three employees without a reported hand or arm problem. At the time of the first survey, 3 of the 11 had a residual rash consistent with contact dermatitis; these included 2 cases of papular follicular dermatitis of the forearms and 1 case of resolving eczematous patches in the elbow area.

All six NIOSH volunteers experienced erythematous reactions to 50% and 25% BHETA within 24 to 48 hours after initial application; concentrations of 12.5% and 6.13% produced variable degrees of both erythema and follicular papules or pustules within 48 to 72 hours. Lower concentrations of BHETA and olive oil alone produced no reaction. One volunteer developed a delayed vesicular flare at the test site several days later; subsequent closed patch testing with 0.5% BHETA in olive oil produced a spreading vesicular reaction, indicating that allergic sensitization to BHETA had occurred.

Within six hours following a single open application, all six guinea pigs tested with 100% BHETA developed brisk erythema and moderate edema, which progressed to full thickness cutaneous necrosis within 48 hours. A similar severe necrotic reaction occurred after only two open applications in another six guinea pigs tested with 25% BHETA. After three open applications, a 2.5% concentration of BHETA produced moderate erythema and slight edema, which progressed to shallow cutaneous ulcerations within five days. No selective follicular reactions were observed in any of the guinea pigs by either gross visual inspection or microscopic examination of skin from the site of application.

Excluding one person whose patch test fell off before the first reading, 19 Sperry Rand employees, including 14 who participated in the initial survey, had patch tests in December 1985. One of the 19 had erythema and slight edema at 48 and 120 hours. Two other workers, whose patch tests were negative at 48 hours, developed erythema and slight edema by 120 hours. One of these three employees had reported rashes during the initial survey; another reported no visible rash but had "itching, burning, or stinging." The third did not participate in the initial survey but reported having a skin complaint involving the hands, arms, face, neck, and other areas, beginning in July 1985. This person was not from the Incoming Inspection area but reported handling anti-static tote boxes. One worker with a papular follicular dermatitis at the time of the initial survey had no patch test reaction; the other was the one whose patch fell off. The worker with the eczematous dermatitis during the initial survey had no patch test reaction. The two controls had no reaction.

VII. DISCUSSION AND CONCLUSIONS

Technical information provided by the manufacturer of BHETA suggests that concentrations in excess of 0.23% in final products may result in undesirable effects such as accumulation of BHETA on the product surface. Employee observations of an oily film on the tote box surfaces, together with the observed corrosion of electrical components transported in the plastic tote boxes, suggest that this tolerance limit may have been exceeded in the tote boxes used at Sperry Rand, but this hypothesis could not be confirmed.

The highly corrosive nature of BHETA was confirmed by open applications to the shaved flanked skin of guinea pigs, where cutaneous irritation was observed even at a concentration as low as 2.5%. Tests on NIOSH volunteers also establish that BHETA may be a selective follicular irritant at lower concentrations, a finding consistent with the skin examination findings during the initial survey.

Exposure to BHETA was a likely cause of dermatitis among Incoming Inspection area employees. Because of the small number of patch test controls, the relative weakness of the three positive patch test reactions, and the probable marginal irritant properties of diluted BHETA, the occurrence of allergic contact dermatitis among Sperry Rand employees could not be definitely established. However, the inadvertent sensitization of one of the NIOSH investigators confirms the allergic potential of BHETA.

VIII. RECOMMENDATIONS

To prevent BHETA-related dermatitis from recurring, the previously used BHETA-impregnated tote boxes should not be reintroduced. This investigation, however, provided no data to determine whether differently formulated BHETA-impregnated tote boxes would pose a risk of dermatitis.

IX. REFERENCES

1. Fisher AA. Contact Dermatitis. 2nd ed. Philadelphia: Lea & Febiger, 1986:9-29.

2. Ibid:299.

X. AUTHORSHIP AND ACKNOWLEDGEMENTS

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XI. DISTRIBUTION AND AVAILABILITY OF REPORT

Copies of this report are currently available upon request from NIOSH, Division of Standards Development and Technology Transfer, Publications Dissemination Section, 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. Sperry Rand Corporation
2. International Union of Electrical Workers
3. OSHA, Region II

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.