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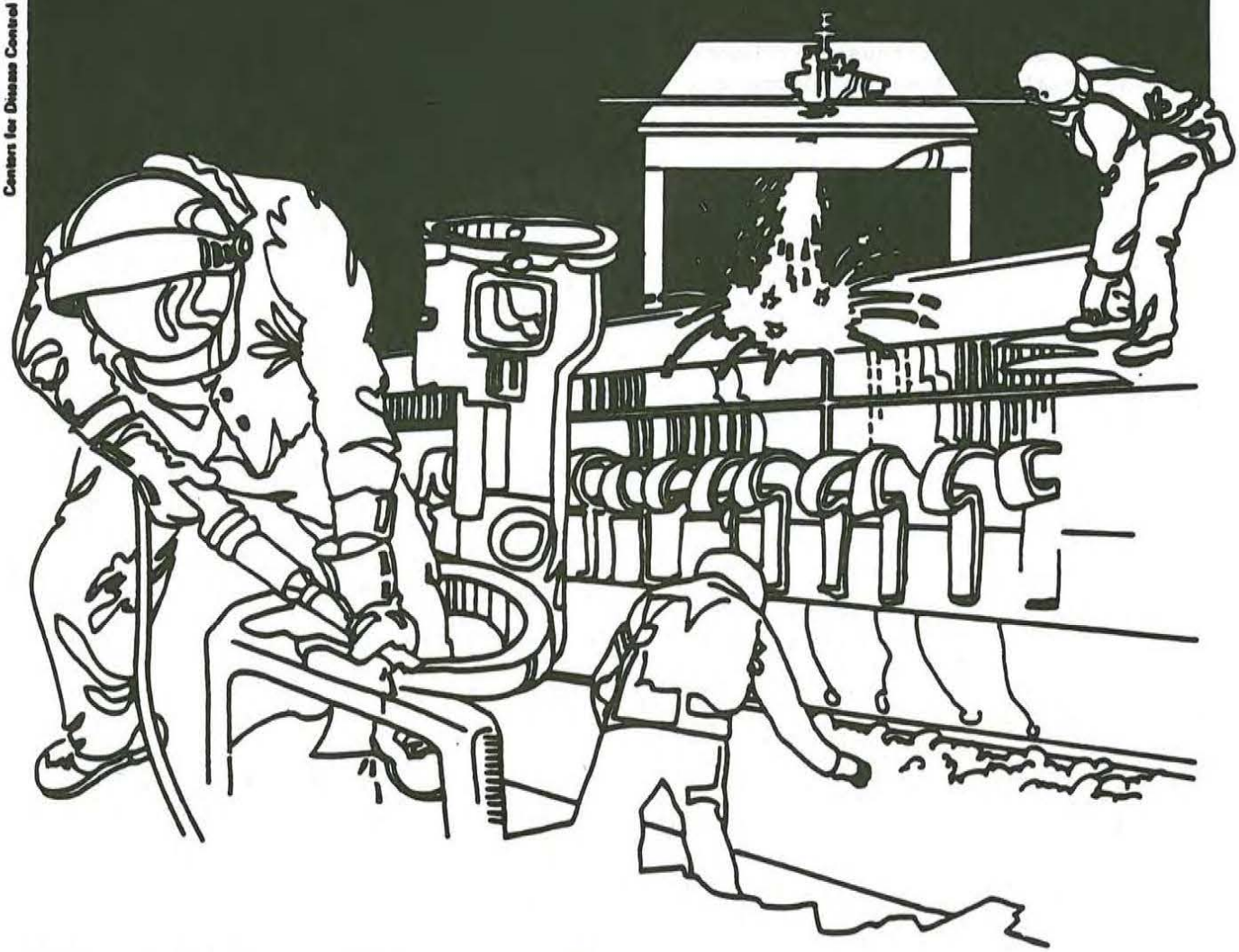

Health Hazard Evaluation Report

HETA 85-538-1667
GENERAL TELEPHONE COMPANY
SHERMAN, TEXAS

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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GENERAL TELEPHONE COMPANY
SHERMAN, TEXAS

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I. SUMMARY

In September 1985, the National Institute for Occupational Safety and Health (NIOSH) received a request for a Health Hazard Evaluation at the General Telephone Company, Sherman, Texas. NIOSH was requested to evaluate potential health problems among telephone cable splicers.

A NIOSH investigator conducted an initial site visit on November 21, 1985. Information was collected on materials used and work procedures, a splicing operation was observed, and a self-administered medical questionnaire was provided to employees. An Occupational Safety and Health Administration (OSHA) compliance inspection had been conducted earlier in the year and the results from this inspection, including environmental sampling results, were obtained and reviewed.

The materials of primary concern to employees were the substance in the filled cable (petrolatum), the cable cleaner (petroleum distillates), and the two part reenterable encapsulant (isocyanates). The OSHA inspector had sampled for isocyanates during four pouring operations and found no detectable concentrations. Based on these results, the variable frequency and conditions of the operation, and the short exposure times (typically 10-15 minutes), additional sampling was not felt to be warranted by the NIOSH industrial hygienist.

Only nine (9) of 32 potentially exposed workers completed the questionnaire. The most frequently reported symptoms by these nine employees were headaches at work (78%) and sinus congestion (78%). The occurrence or reoccurrence of warts was also reported by 67% of the respondees.

On the basis of the environmental and medical information obtained, it was concluded that a health hazard to employees did not exist under normal operating conditions. However, to reduce the potential for sensitizing employees, recommendations are provided regarding employee training, the use of personal protective equipment, and good work practices.

KEYWORDS: SIC 4811 Telephone Communications (wire or radio), isocyanates, petroleum distillates, petrolatum, cable splicers.

II. INTRODUCTION

In September 1985, the National Institute for Occupational Safety and Health (NIOSH) received an employee request to evaluate potential health problems among telephone cable splicers at the General Telephone Company, Sherman, Texas.

A NIOSH investigator conducted an initial survey visit to the facility on November 21, 1985. An opening conference was held with representatives of management and the local union during which the nature of the request was discussed. Information was obtained from the Company related to materials used and work procedures, a splicing operation was observed, and a self-administered, medical questionnaire was provided the union representative for distribution to and completion by the employees.

III. BACKGROUND

There are approximately thirty-two (32) cable splicers operating out of the Sherman facility. Sixteen (16) are classified as R-splicers (repair) and sixteen (16) as C-splicers (construction). The greatest potential for exposure involves the underground operation. This operation basically involves: uncovering of the buried cable (minimum depth of two feet), opening of the non pressurized and/or waterproof main cable, splicing wires with those in the incoming cable (pressure closure), fitting the cable with a cylindrical case (stainless steel or plastic), preparing a soft reenterable elastomer, filling of the case with the compound, and closing off the case.

Sources of employee exposure would be:

1. the jelly-like material in the filled cable, primarily petrolatum (81.9%) and polyethylene (9%);

2. the cable cleaner, an organic solvent primarily consisting of petroleum distillates; and

3. the two part reenterable encapsulant.
   a. Part I - polyurethane prepolymer containing polymethylene polyphenyl isocyanate, castor oil and dioctyl adipate.
   b. Part II - polybutadiene castor oil polyal containing dibutylene dilaurate, paraffinic oil and dioctyl adipate.

IV. MATERIALS AND METHODS

During the initial visit of November 21, 1985, information was obtained related to the activities conducted by the splicers, the materials used, work practices followed, and personal protective equipment worn. A walk-through inspection was made of the warehouse to identify the materials and products used which might contribute to employee exposure. A splicing operation was observed to identify possible sources of exposure and assess employee work practices, and a self-administered, medical questionnaire was provided for completion by cable splicers.

A compliance inspection had been conducted earlier in the year by the Occupational Safety and Health Administration (OSHA). The results from this inspection, including environmental sampling results, were obtained and reviewed.

The splicing operation is conducted at irregular intervals, outdoors under differing weather conditions, in pits of varying depths, and with potential exposure times to the elastomer variable depending on the size of the cable but typically of a 10-15 minute duration. Based on these considerations and the results from the OSHA monitoring, it was decided that environmental sampling for employee exposure would not represent the various possible exposure conditions and add little to the evaluation. Consideration was given to the determination of total reactive isocyanate groups (TRIG), however, the same problems of varing exposure conditions existed as well as the problem of the analytical sensitivity of the method given the short exposure/sampling time.

V. EVALUATION CRITERIA

Environmental Criteria and Toxicological Effects

As a guide to the evaluation of the hazard posed by workplace exposures, NIOSH field staff employ environmental evaluation criteria for assessment of a number of chemical and physical agents. Those criteria are intended to suggest levels of exposure to which most workers may be exposed up to 10 hours per day, 40 hours per week for a working lifetime without experiencing adverse health effects. It is, however, important to note that not all workers will be protected from adverse health effects if their exposures are maintained below these levels. A small percentage may experience adverse health effects because of individual susceptibility, pre-existing medical conditions, and/or a hypersensitivity (allergy).

In addition, some hazardous substances may act in combination with other workplace exposures, the general environment, or with medications or personal habits of the worker to produce health effects even if the occupational exposures are controlled at the level set by the evaluation criterion. These combined effects are not usually considered in the evaluation criteria. Also, some substances are absorbed by direct contact with the skin and mucous membranes, and thus potentially increase the overall exposure. Finally, evaluation criteria may change over the years as new information on the toxic effects of an agent become available.

The primary sources of environmental evaluation criteria for the workplace are: (1) NIOSH Criteria Documents and Recommendations, (2) the American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLV's), and (3) the U.S. Department of Labor (OSHA) Occupational Standards. Often, the NIOSH recommendations and ACGIH TLV's are lower than the corresponding OSHA standards. Both NIOSH recommendations and ACGIH TLV's usually are based on more recent information than are the OSHA standards. The OSHA standards also may be required to take into account the feasibility of controlling exposure in various industries where the agents are used; the NIOSH recommended standards, by contrast, are based primarily on concerns relating to the prevention of occupational disease. In evaluating the exposure levels and the recommendations for reducing these levels found in this report, it should be noted that industry is legally required to meet those levels specified by an OSHA standard.

A time-weighted-average (TWA) exposure refers to the average airborne concentration of a substance during a normal 8-to-10-hour workday. Some substances have recommended short-term exposure limits or ceiling values which are intended to supplement the TWA where there are recognized toxic effects from high short-term exposures.

A. Isocyanates

All isocyanates contain the N-C-O group which reacts readily with compounds containing reactive hydrogen atoms to form urethanes. The di-and poly-isocyanates contain, respectively, two and three or more of these groups. The chemical reactivity of the isocyanates makes them ideal for polymer formation. Hence, they are widely used in the manufacture of polyurethane foams, paints, adhesives, fibers, resins, and sealants.

In general, the potential respiratory hazards encountered during the use of diisocyanates in the workplace are related to their vapor pressures. The lower-molecular-weight diisocyanates tend to be more readily volatilized into the atmosphere than the high-molecular-weight diisocyanates. Although the vapor pressures of the higher-molecular-weight diisocyanates are relatively low, they may generate vapor concentrations sufficient to cause respiratory and mucous membrane irritation if they are handled in poorly ventilated areas. Also, the potential for skin irritation is generally higher for the lower-molecular-weight diisocyanates, and the severity of these irritant responses is reduced with increasing molecular weight.

Exposure to isocyanates can cause skin and mucous membrane irritation, nausea, vomiting and abdominal pain. In high concentrations, isocyanates have a primary irritant effect on the respiratory tract. They can also act as respiratory sensitizers, producing asthma-like symptoms in sensitized individuals, even at very low concentrations.

Asthmatic attacks may occur immediately after exposure or at an interval of hours after cessation of exposure. Exposure to isocyanates may also result in chronic impairment of pulmonary function.(1) Isocyanate exposure during accidental spills is a major cause of sensitization, and there is evidence that massive exposures may produce effects on the central nervous system.(1)

Federal Occupational Safety and Health Administration (OSHA) exposure standards for diisocyanates have been established only for toluene diisocyanate and methylene bisphenyl isocyanate (MDI). The current OSHA standard and ACGIH TLV for MDI is a ceiling limit of 0.02 parts of MDI per million parts of air (ppm) or 0.2 milligrams per cubic meter of air (mg/M^3).

The current NIOSH recommended standard for occupational exposure to MDI is 0.05 mg/M^3 for up to a 10-hour workshift, 40-hour workweek and a ceiling limit of 0.2 mg/M^3 for any 10-minute sampling period. The NIOSH recommended standard was based on three types of effects of exposure to MDI: direct irritation, sensitization, and chronic decrease in pulmonary function. This recommendation applies to diisocyanate monomers only, and not to higher polymers of these compounds.(1) Little is known about the toxicological effects of polymeric isocyanates. No long-term studies have been conducted on the effects on humans of polymeric isocyanates.(2)

B. Petroleum Distillate

Petroleum Distillates are complex mixtures of solvents distilled from petroleum and distinguished by their boiling ranges and aromatic content. These materials are irritating to the skin, to the conjunctiva, and to the mucous membranes of the upper respiratory tract. Depression of the central nervous system is also one of the symptoms of overexposure. The OSHA standard is 2000 mg/M^3. NIOSH has recommended that the occupational exposure be reduced to 350 mg/M^3 for up to a 10-hour workshift, 40-hour workweek.(3)

C. Petrolatum

Petrolatum is a petroleum jelly widely used in pharmaceutical, medicinal, and household areas. Industrially, it is used in skin protective coatings. Physiologically, it is inert, and is noncarcinogenic. It is nonallergenic and nonirritating.(4) No OSHA standard or NIOSH recommended standard exists for this material.

VI. RESULTS

A. Environmental

Information provided by the Company indicated that over a 12 month period approximately 76 gallons of cable cleaner, 100 containers (1200 gram size) of the urethane and 332 containers (3000 gram size) of the urethane were used by 40 splicers (16 R-slicers, 16 C-splicers and 8 contractors). A review of information on products used presently and in the recent past indicated that the reenterable encapsulants have consistently contained isocyanates. The Material Safety Data Sheets (MSDS) provided for the presently used urethane prepolymer identifies the possible effects of overexposure as being mucous membrane irritation, tightness of chest, irritation of the respiratory tract, coughing, headache and shortness of breath. Two additional mixtures, a damming compound (for splicing together pressurized and unpressurized cables) and a pedestral base sealant, were also identified as containing polymeric isocyanates.

An OSHA compliance officer had visited the facility and field sites a number of times over a several month period in early 1985. Four personal air samples had been collected by him during four pouring operations and analyzed for toluene -2, 6-diisocyanate, toluene -2, 4-diisocyanate, hexamethylene diisocyanate, and methylene bisphenyl isocyanate. No detectable concentrations were reported.

The cable cleaner is used primarily for removing the jelly-like material in filled cable from the exposed wires prior to splicing and cleaning up tools. This jelly-like material also sticks to the hands, clothes, etc. of the splicers. Employees are instructed to use the waterless hand soap provided, rather than the solvent, for personal cleanup.

A review of MSDS for the various products used and toxicity information on their chemical constituents identified no unexpected health hazards.

Procedures followed during a large splicing operation were observed. Both employees involved wore goggles and disposable gloves during the operation. One employee opened and mixed 10 containers (3000 gram size) of the reenterable encapsulant, passing each down as completed to a splicer in the pit (approximately four feet deep). The handling time was 1 to 1 1/2 minutes per container with the employee mixing from the upwind side. Using a make-shift funnel on the top side of a stainless steel case, the liquid compound was poured into the case. The splicer's head was positioned over the top of the casing while pouring. When the pour was complete, the case was closed off. Mixing and pouring took approximately 15 minutes; closing off took less than five minutes.

B. Questionnaire

Only nine (9) of 32 potentially exposed workers completed and returned health-related questionnaires. Followup efforts by union representatives were unsuccessful in generating additional responses. The average age of these employees, all males, was 40.7 years. Four of the nine responders were current cigarette smokers. Five of the nine respondents gave a history of prior respiratory allergies such as hay fever or sinus congestion; however, none reported having asthma. The most frequently reported symptoms were head congestion (seven out of nine) and headaches at work (seven out of nine). These were also the two symptoms most often reported as reoccurring within the past year. Six of the nine also reported being bothered with warts; however, only three of the nine reported experiencing skin rashes. Of the seven employees reporting head congestion, four also reported having sinus troubles. Of the seven reporting having frequent headaches at work, five have sinus troubles. Five of the seven also reported having frequent headaches at home.

VII. DISCUSSION

A review of the chemicals used did not identify a potential source for the occurrence of the warts. Most warts are viral related with the exact mechanism of spread poorly understood. In general, these lesions often tend to occur at trauma sites, and among the splicers there appears to be a high prevalence of cuts and abrasions. Early treatment of skin breaks may help reduce their occurrence.

Results from the questionnaire, OSHA monitoring and observations gave no indication that acute exposure to isocyanates occurs during routine splicing operations. However, several reports in the literature have indicated that sensitization may follow exposure to spills or other unusually high concentrations. Once sensitized, it is not possible to establish an exposure level to isocyanates below which sensitized workers will not experience adverse respiratory effects.[1] To reduce the potential for sensitization to occur, intervention efforts should be directed toward minimizing exposure through employee training, the use of personal protective equipment and good work practices.

VIII. RECOMMENDATIONS

The training and education of employees regarding safe work practices is essential to reducing and/or eliminating chemical exposures. Each employee should be instructed on the potential hazards associated with each of the compounds used, the need for and proper use of personal protective clothing, and accepted work practices and sanitation procedures. This would include informing them as to the signs and symptoms associated with overexposure to chemicals found in the compounds. Additional areas which should be emphasized would include:

1. The sensitizing potential for isocyanates and associated symptoms.

2. Avoiding all skin and eye contact with the urethane prepolymer and the mixed compound. Gloves and safety goggles should be worn when potential exposure exists. If skin contact occurs, the area should be immediately washed and cleaned.

3. Mixing of the urethane prepolymer should not be carried out in the pit, but above ground and downwind from the pit. All mixing should be conducted with the employee upwind from the open containers.

4. The pouring operation should be redesigned to minimize the need for the employee to lean over the open casing when adding the compound.

5. Handling and disposal of empty containers should minimize the potential for skin contact.

6. Gloves should be worn when using the cable cleaner. It should be reemphasized that the cleaner is not to be used for cleaning the skin.

7. The employee should be instructed on the importance of first aid treatment for cuts, abrasions, etc.

Because employees are often involved in below ground activities and the possibility exists for cave ins, the appropriate OSHA standards on trenching and shoring should be reviewed and applied as applicable.

IX. REFERENCES

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2. Communication Workers of America, Local # 12171, Sherman, Texas
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