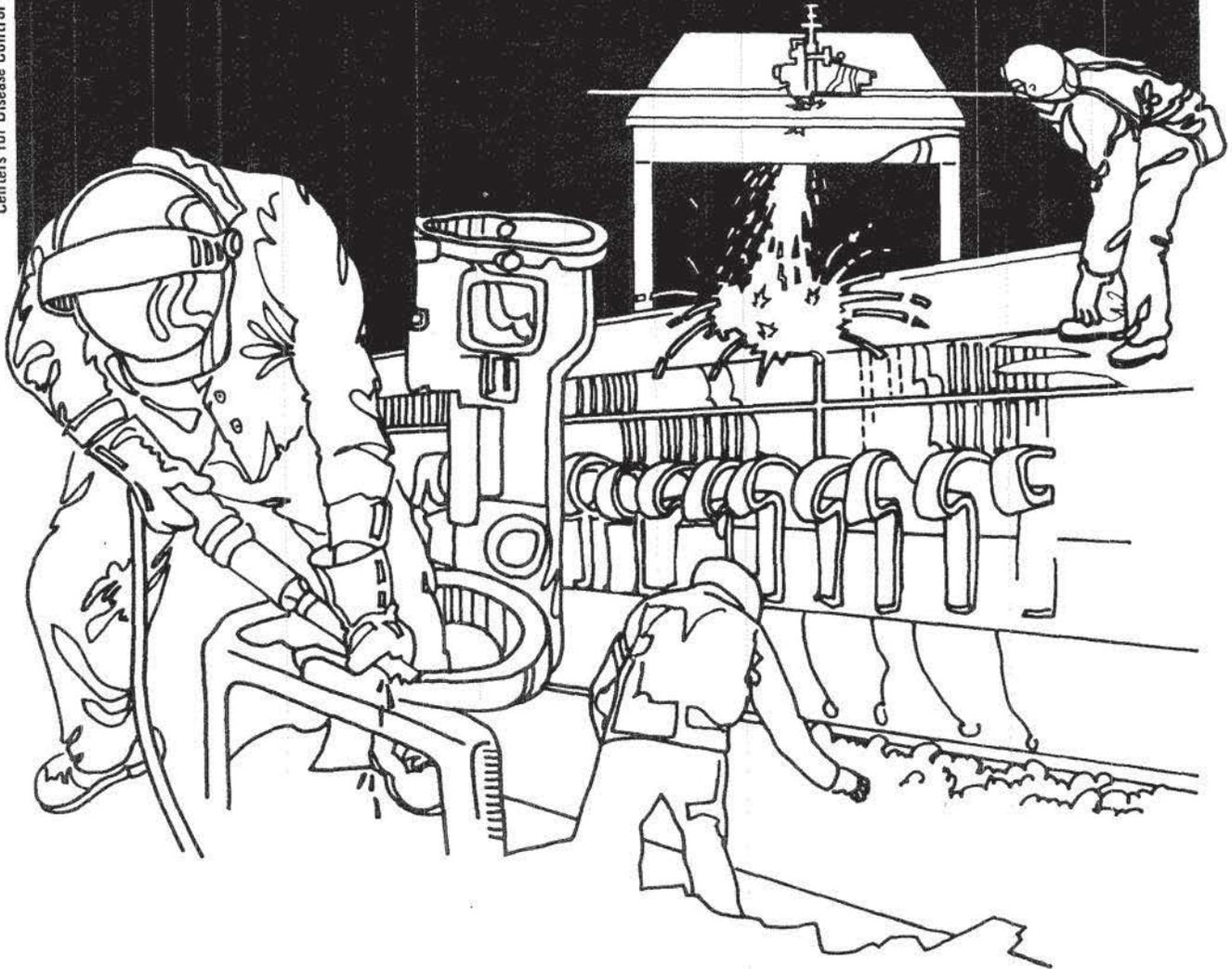


NIOSH



Health Hazard Evaluation Report

80-204-794

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. 699(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.

Mention of company names or products does not constitute endorsement by the National Institute for Occupational Safety and Health.

HE 80-204- 794
January 1981
Chesapeake and Potomac Telephone Co.
Washington, D.C.

NIOSH INVESTIGATORS:
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I. SUMMARY

In July 1980, the National Institute for Occupational Safety and Health (NIOSH) received a request for a health hazard evaluation from employees at Chesapeake and Potomac (C & P) Telephone Company in the Washington, D.C. metropolitan area. The request was prompted after five workers developed skin problems shortly after the use of a refined petroleum solvent for degreasing in confined spaces. The solvent "Soltrol 170", manufactured by Phillips Petroleum, was a mixture of C₁₃-C₁₄ isoparaffins.

Soon after these health effects were noted, C & P Telephone Co. suspended the use of the solvent. Therefore, it was not possible for NIOSH to collect environmental data to assess workplace conditions during actual use of the solvent. However, the company had developed new work guidelines for using the solvent and simulation of the degreasing operation under the proposed new work guidelines was conducted on August 26, 1980. Personal breathing zone samples were collected on charcoal tubes by battery-powered sampling pumps. All of the short-term personal breathing zone samples for the solvent were below the limits of detection (approximately 20 milligrams per cubic meter [mg/M³] of air). One area sample taken for 45 minutes contained 20 mg/M³. The NIOSH recommended 15-minute ceiling limit for refined petroleum solvents is 1800 mg/M³. Each of the degreasing operations required less than 15 minutes to complete.

The five workers reporting health effects were interviewed on September 12, 1980. All five had experienced skin effects consisting mostly of blisters, callouses, and rashes on the hands or arms that they believed were caused or aggravated by skin contact with the solvent. In three cases, however, the findings were not suggestive of solvent exposure.

On the basis of the data obtained in this investigation, NIOSH determined that skin effects from exposure to the degreasing solvent may have occurred under the former conditions of use. Using new work guidelines during a simulated degreasing operation, NIOSH determined that hazards from inhalation or skin contact did not occur. Recommendations for more thorough precautions while working in confined spaces have been incorporated into this report.

KEYWORDS: SIC 4811 (Telephone Communication), cable splicing technicians, confined spaces, degreasing solvents, "Soltrol 170", refined petroleum solvents, kerosene.

II. INTRODUCTION

The request for a health hazard evaluation by NIOSH was prompted by reports of adverse health effects among five C & P Telephone cable splicing technicians during degreasing operations in confined spaces. The job involved the degreasing of cable splicing machines in underground service vaults.

III. BACKGROUND

The cable splicing technicians provided construction and repair service of underground telephone cables. Approximately 250 technicians were employed in the Virginia area. Before they entered a manhole, the air in the enclosed space was monitored for combustible gases with an MSA Explosimeter Model 2B. Then fresh air was piped into the manholes (average size = 4' x 6' x 8') through a flexible duct reaching down to the bottom of the hole. The quantity of air supplied ranged from 350 to 450 cubic feet of air per minute depending on the size of the manhole.

A portable cable splicing machine was carried down into the manhole. Some types of cables were packed with petroleum jelly, which caused the need for periodic degreasing of the splicing head with an organic solvent. The workers reporting adverse health effects had been applying a solvent (Soltrol 170) with small spray bottles and were not wearing protective clothing.

IV. EVALUATION DESIGN AND METHODS

Because the solvent was no longer being used, NIOSH could not collect industrial hygiene data that would have been indicative of workplace environmental conditions when adverse health effects were reported. Instead, NIOSH evaluated a simulated degreasing operation in which the company's proposed new guidelines were followed while using "Soltrol 170". Precautions were taken to avoid skin contact by wearing plastic gloves. Also, the solvent was applied with a damp cloth instead of spraying. The methods of monitoring, purging, ventilating, ingress and egress were not changed.

Four personal breathing zone samples were taken during two degreasing simulations. Degreasing required about 10-15 minutes. One area sample was taken for 45 minutes at the opening of the manhole to monitor the contaminated air as it exited the confined space. The samples were collected on activated charcoal tubes by battery-powered sampling pumps at 100 cc/min. Each sample was desorbed in carbon disulfide and analyzed by gas chromatography according to NIOSH method P & CAM 127.

A series of air velocity measurements at the manhole exit were taken with an Alnor Jr. Model 8100 at the entrance of the manhole. By multiplying the average air velocity and the area of the manhole opening, the approximate quantity of supplied air was computed.

Five workers were interviewed on September 12, 1980. A non-directed questionnaire was used to assess worker exposure and health problems associated with repeated exposures to the solvent in a confined space.

V. EVALUATION CRITERIA

The material data safety sheet for "Soltrol 170" describes the solvent as a mixture of C₁₃-C₁₄ isoparaffins. The manufacturer, Phillips Petroleum Company, confirmed that description by referring to the solvent as a mixture of highly branched and thoroughly saturated C₁₃-C₁₄ aliphatic compounds. They stated that the mixture was quite pure and that there were no aromatics present.

The chemical content of "Soltrol 170" meets the definition of refined petroleum solvents as outlined in the NIOSH recommended standard.¹ The solvents considered in the standard have a total aromatic content of less than 20% and include petroleum ether, rubber solvent, varnish makers' and painters' naphtha, mineral spirits, Stoddard solvent and kerosene.

Skin exposure to refined petroleum solvents must be avoided. They have been shown to cause skin damage ranging from mild erythema to blister formation. Kerosene has also been shown to augment the toxicity of skin-sensitizing agents. High vapor concentrations of refined petroleum solvents cause eye, nose, and throat irritation. Aerosol exposure at 500-12,000 mg/M³ of "unpurified" kerosene (5-20% aromatics) has caused leukocytosis, tracheitis, bronchitis, and pneumonia. Similar aerosol exposures to "purified" kerosene (<4% aromatics) did not produce signs of toxicity. Benzene content in some petroleum solvents has been related to cases of aplastic anemia and other blood changes. Also, hexane has been associated with polyneuropathy and may be present in some refined petroleum solvents.

NIOSH recommends that occupational exposure to airborne concentrations of petroleum ether, rubber solvent, varnish makers' and painters' naphtha, mineral spirits, and Stoddard solvents be controlled so that no employee is exposed at a concentration greater than 350 mg/M³ of air, determined as a time-weighted average (TWA) concentration for up to a 10-hour work shift, 40-hour workweek. In addition, no employee should be exposed to any of the above solvents at a ceiling concentration greater than 1800 mg/M³ as determined by a sampling time of 15 minutes. Because kerosene is less volatile than the other refined petroleum solvents, hydrocarbon mists are more likely at a specific concentration than the other solvents. Therefore, 100 mg/M³ as a TWA concentration is recommended for kerosene. No ceiling limit is believed needed for kerosene.

The American Conference of Governmental Industrial Hygienists (ACGIH) recommended 2000 mg/M³ as a TWA concentration for petroleum naphthas. The current OSHA standard for Stoddard solvents is 2950 mg/M³ as a TWA concentration.

Since "Soltrol 170" consisted of higher-chain aliphatics with little or no aromatic content, it could be considered most similar to "purified" kerosene.

VI. RESULTS

A. Medical

All five cable splicers that reported health effects were men ranging in age from 27 to 32. The time range of employment as cable splicers was 2-4 years. The men were assigned to work with new equipment requiring the use "Soltrol 170". Each of the five had worked previously with a number of different solvents and reported no associated health problems. The results of the interviews are listed in Table I. In three of the five cases, the findings were not suggestive of solvent exposure.

Five episodes the Company temporarily suspended the use of this solvent. The workers reported no subsequent health problems.

B. Environmental

All four of the personal breathing zone samples contained concentrations that were below the limits of detection (approximately 20 mg/M³). The area sample that was taken at the opening of the manhole for the entire 45-minute simulation period contained about 20 mg/M³.

Ventilation measurements showed that about 450 CFM of air was being supplied to the manhole.

VII. CONCLUSIONS AND RECOMMENDATIONS

The results of the employee interviews revealed two possible cases of solvent-related skin problems. Solvent resistance gloves should be worn to protect the hands and wrists. Also, the aerosol produced by the spray bottle may have caused additional skin contact. No respiratory symptoms were reported during the aerosol exposure, which is compatible with prior observations that purified kerosene does not produce any significant signs of inhalation toxicity. However, skin contact with "Soltrol 170" should be avoided by applying it with damp cloths instead of spray bottles.

The results of environmental sampling showed very low airborne solvent concentrations during the simulation. Solvent levels were 20 mg/M³ or less. When compared to the NIOSH recommended 15-minute ceiling exposure limit of 1800 mg/M³ for refined petroleum solvents, except for kerosene which has no ceiling limit, it would appear that inhalation toxicity would not be of major concern under these conditions.

Nevertheless, due to the potential for rapid environmental changes and other hazards associated with working in confined spaces, NIOSH recommended that potentially toxic substances should not be introduced into the manholes unless absolutely necessary. During the simulation, it was noted that the cable splicing head detached simply and quickly from the rest of the machine. Therefore, it is recommended that any solvent degreasing could and should be done outside the manholes.

In addition, the guidelines set forth in the NIOSH publication 80-106, "Criteria for a Recommended Standard - Working in Confined Spaces," should be closely followed with special attention to: the permit system, atmospheric testing, monitoring, medical surveillance, training of personnel, labeling and posting, purging and ventilating, rescue procedures, rescue equipment, safety equipment and record keeping of exposures.

VIII. AUTHORSHIP AND ACKNOWLEDGEMENTS

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IX. DISTRIBUTION AND AVAILABILITY OF DETERMINATION REPORT

Copies of this report are currently available, upon request, from NIOSH, Division of Technical Services, Publication Dissemination, 4676 Columbia Parkway, Cincinnati, Ohio 45226. After 90 days, the report will be available through the National Technical Information Service (NTIS), Springfield, Virginia 22161.

Copies of the report have been sent to:

1. Chesapeake and Potomac Telephone Company
2. Communication Workers of America - Local 2323
3. U.S. Department of Labor, Region III
4. NIOSH, Region III

For the purpose of informing the 250 "affected employees," the employer shall promptly post the Determination Report for a period of 30 days in a prominent place where exposed employees work.

X. REFERENCES

1. Criteria for a Recommended Standard, Occupational Exposure to Refined Petroleum Solvents, U.S. Department of Health and Human Services, 1977. 247 pp.
2. Criteria for a Recommended Standard, Working in Confined Spaces, U.S. Department of Health and Human Services, 1979. 68 pp.

TABLE I

Health Problems Reportedly Associated with "Soltrol" Solvent

Chesapeake and Potomac Telephone Company
 September 12, 1980
 HE 80-204

<u>Worker</u>	<u>Length of exposure</u>	<u>Signs/Symptoms</u>	<u>Treatment</u>	<u>Resolved in</u>
<u>Worker 1</u>	1-1/2 days	Blisters and callouses on hands	Anti-inflammatory Cortisone Cream	2-1/2 weeks
<u>Worker 2</u>	3 months	(a) Sore itching blisters-callous on hands (b) Swollen lymph gland	Valisone	2-3 months
<u>Worker 3</u>	2 months	One episode of cut finger, developed swollen joint, rash on shoulders and arms, tender armpits	Penicillin	2 days
<u>Worker 4</u>	3 months	Raised red rash progressed up legs and arms. Itched and became crusty	Medication prescribed by M.D. Didn't know name.	3 days
<u>Worker 5</u>	4 months	Developed 2 pimple-like bumps. Possibly associated with solvent but uncertain.		

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