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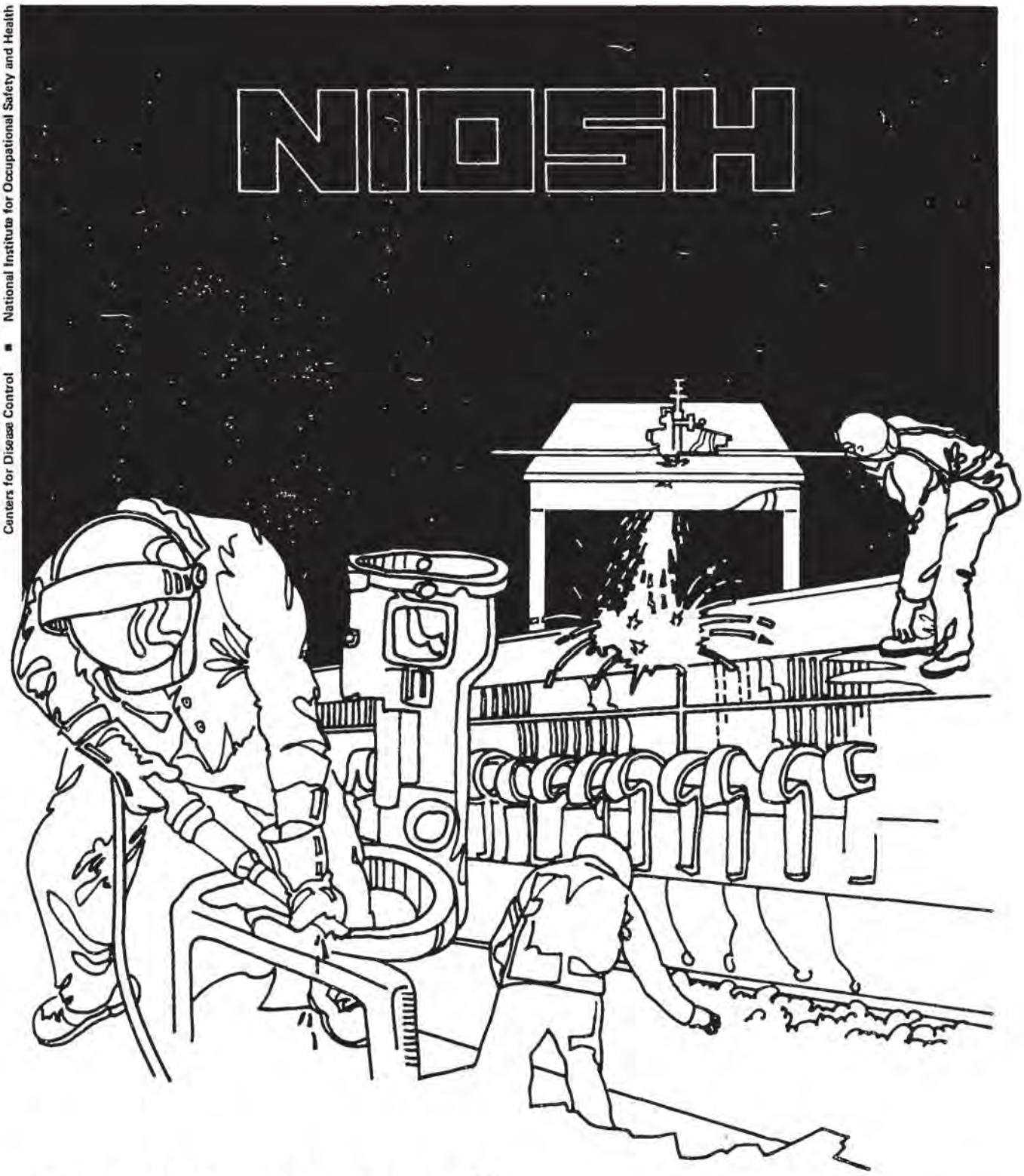

Health Hazard Evaluation Report

HETA 81-300-939
LUCIDOL DIVISION, PENWALT CORPORATION
CROSBY, 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.

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

HETA 81-300-939
AUGUST 1981
LUCIDOL DIVISION, PENNWALT CORP.
CROSBY, TEXAS

NIOSH INVESTIGATORS:
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I. SUMMARY

In October 1980 NIOSH began an investigation of industrial exposure to Lucel-7, a foaming agent used in the reinforced plastic manufacturing industry. This followed a health hazard evaluation study at a plant where neurologic damage occurred in several workers who had been exposed to this chemical (HETA 80-041).

On March 11, 1981, a NIOSH physician conducted a walk-through evaluation and employee interviews and examinations at the Lucidol plant in Crosby, Texas, where Lucel-7 was manufactured.

The enclosed production of Lucel-7 and other products at the Lucidol plant and use of protective equipment during packaging probably resulted in relatively low-level exposure of employees. Quality control testing of small amounts of finished product in the laboratory involves minimal employee exposure. Only one employee reported developing relatively mild neurologic symptoms during his work with Lucel-7; his neurologic examination twelve months later was normal. It is not clear whether his symptoms were related to an occupational exposure. The results of the NIOSH investigation did not indicate that there was a health hazard involved in the production of Lucel-7.

KEYWORDS: SIC 2869 Industrial Organic Chemicals, Not Elsewhere Classified, 2-t-butylazo-2-hydroxy-5-methylhexane, Lucel-7, reinforced plastic, fibrous glass, neurotoxin, neurologic symptoms.

II. INTRODUCTION

In October 1980, NIOSH responded to a request for a health hazard evaluation at a reinforced plastic bathtub manufacturing plant in Lancaster, Texas. NIOSH was asked to evaluate working conditions in which several employees had developed symptoms of central and peripheral nervous system dysfunction following exposure to Lucel-7 (2-t-butylazo- 2-hydroxy-5-methylhexane), an azo foaming agent. Subsequently, NIOSH instituted a broader investigation to evaluate the effects of Lucel-7 exposure in other situations. On March 11, 1981, a NIOSH physician conducted a walk-through evaluation and employee interviews and examinations at the Lucidol plant in Crosby, Texas, where Lucel-7 was manufactured.

III. BACKGROUND

The Lucidol plant in Crosby, Texas manufactures chemicals for industrial use and has been in operation for about 13 years. The Azo Production Unit, which started production in 1974, has manufactured only two series of chemicals, Luazos and Lucels.

The Luazos are cyanide-based azo products which serve as reaction initiators and catalysts. Three Luazo products are currently manufactured, Luazo-79, -82, and -96. During the site visit Luazo-79 (2-t-butylazo- 2-cyanopropane) was being produced.

The Lucels were produced to serve as foaming agents in the manufacture of reinforced plastic structures. They decompose at room temperature in the presence of acidic polyester resin to produce free radicals that cross-link the resin and gaseous nitrogen that causes foaming.

Lucel-4 (2-t-butylazo-2-hydroxybutane) was produced from November 1974 to July 1979. Production was discontinued following an incident at a reinforced plastic manufacturing plant in Minnesota where several workers developed medical problems (including one episode of permanent neurologic damage) following exposure to the chemical.

Lucel-6 (1-t-butylazo-1-hydroxycyclohexane) was produced in November 1976. It was never marketed because it was inefficient in its proposed use as an azo foaming agent.

Lucel-7 (2-t-butylazo-2-hydroxy-5-methylhexane) was produced from July 1978 to March 1980. Production was discontinued following the reports of nervous system damage at the plastic bathtub manufacturing plant in Texas. Subsequently, Lucidol supplied NIOSH with samples of Lucel-7 for toxicity testing.

From July 1978 to January 1980, production of Lucel-7 ranged from 400 to 2,400 pounds per month. In February and March 1980 production totaled 13,000 pounds. This substantial increase was primarily in response to an order from Lasco Industries, which anticipated using the Lucel-7 at all four of its bathtub manufacturing plants. The order was cancelled after the employees at the Lasco plant in Lancaster, Texas developed neurologic damage.

The chemical manufacturing process in the Azo Production Unit is a closed process operated by remote control. Chemicals are produced in batches in response to customer orders. Control operators regulate the processes at a control panel which is separated from the reactor units by a cement block wall. They have potential exposure to the finished product during the packaging process. After a batch is completed, the product is dispensed into one-gallon jugs from a wall faucet. One operator fills the jugs, controlling the flow by a spigot on the faucet. He routinely wears gloves and a full-face supplied-air respirator during this process, which takes from 30 minutes to 2 hours. There is generally not more than one batch packaged per shift. The gallon jugs are sealed in cardboard cartons (four to a carton) and placed in refrigerated storage until they are shipped by refrigerated truck to customers.

A filter in the pipe supplying the wall faucet requires periodic changing during the packaging process. This procedure is performed with gloves and supplied-air respirator. When the filter is changed it is common for small amounts of the finished product to spill from the line. During the packaging of Lucel-7 there were occasions in which the filter had to be changed as frequently as three times per batch.

The reactor vessels require maintenance repair work infrequently and are cleaned before the maintenance men enter them. The maintenance men usually wear gloves and goggles and sometimes organic vapor respirators for this repair work.

The lab technicians, or shift analysts, assay a sample from each batch of the chemicals made in the Azo Unit. A two-ounce specimen is delivered to the lab from the completed batch to be measured against a standard sample of the chemical. The assay is performed by gas chromatography on a 1.0 microliter sample. The lab personnel routinely wear safety glasses and no other protective equipment.

IV. MATERIALS AND METHODS

On March 11, 1981, a NIOSH physician interviewed and examined current employees whose work involved exposure to Lucel chemicals. (A total of 34 workers had been involved in production of Lucel-7 during the 21 months it was manufactured. Production of Lucel-7 had ceased one year prior to the NIOSH site visit; and most of those workers were no longer employed by the plant.) Prior to the interview and exam, each employee read and signed a consent form by which he voluntarily agreed to partcipate in the study. Interviews were conducted using a

standarized questionnaire which included open-ended questions about work history and both directed and open-ended questions about past medical history and neurologic symptoms. Neurologic examination included physical testing of cranial nerves, muscle strength, gait, deep tendon reflexes, and sensory modalities of vibration, pain, light touch, and two-point discrimination.

V. RESULTS

Nine employees were interviewed and examined; seven of them were current or former control operators in the Azo Unit, two were current or former laboratory shift analysts.

One of the employees reported weight loss, impaired mentation, and some subtle motor and sensory symptoms which developed after he started work as an Azo Unit Operator. His neurologic examination was normal twelve months after his last exposure to Lucel-7, and his exposure to the chemicals was not significantly different from that of the other Azo Unit Operators. The other employees did not report any neurologic symptoms; and, except for two who had slightly decreased reflexes, their neurologic examinations were unremarkable.

The NIOSH physician also conducted a telephone interview with a former employee who had worked as an Azo Unit Operator during the entire time that the Lucel chemicals were manufactured. He did not report developing any neurologic symptoms during his employment.

VI. DISCUSSION

The closed production process in the Azo Unit and the use of protective equipment during packaging probably resulted in relatively low levels of exposure for control operators to Lucel-7 and to the other products manufactured there. The testing of small amounts of finished product in the laboratory involves minimal employee exposure.

The symptoms reported by one Azo Unit operator are similar to mild symptoms noted by several employees at one of the reinforced plastic plants where Lucel-7 was used. It is not clear whether the development of these subtle symptoms is related to an occupational exposure.

Lucel-7 is a hexane, structurally similar to n-hexane and methyl n-butyl ketone (MBK), two known neurotoxins. Evaluations of workers exposed to n-hexane[1] and to MBK[2] have demonstrated electrodiagnostic evidence of peripheral neuropathy in some workers without clinical evidence of neurologic disease. This suggests that there may be a problem of subclinical neurologic damage in industrial hexacarbon exposure. Serious toxic exposures have not been reported in the manufacture or packaging of these chemicals, probably because these processes are usually totally enclosed.

NIOSH has conducted surveys of former users of Lucel-7 and the other Lucel products. These indicate that Lucel-7 was used in much greater quantities at the Lancaster, Texas plant where neurologic symptoms were reported than at any other plant. The use of protective equipment at that plant was inconsistent, and supplied air respirators were never used. These conditions of large-scale use of Lucel-7 without adequate protection may explain why severe neurologic disease developed in employees there but apparently did not occur elsewhere.

VII. RECOMMENDATIONS

1. Routine, in-depth review of the toxicology of newly manufactured chemicals may serve to alert the company to the potential for neurologic or other problems resulting from industrial exposures. There is extensive literature on the well-documented neurologic damage resulting from occupational exposure to aliphatic hexacarbons; and this information could have been used to anticipate and protect against the possibility of neurologic damage resulting from exposure to Lucel-7.

VIII. REFERENCES

1. Buiatti, Cecchini, et al, "Relationship Between Clinical and Electromyographic Findings and Exposure to Solvents, in Shoe and Leather Workers." Br J Ind Med, 35, 169, 1978.

2. Allen, Mendell, et al, "Toxic Polyneuropathy Due to Methyl-n-butyl ketone. An Industrial Outbreak." Arch Neurol (Chicago), 32, 209, 1975.

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Copies of this report have been sent to:

1. Lucidol Division, Pennwalt Corp.
2. Texas State Labor Department
3. Texas State Health Department
4. OSHA, Region VI
5. NIOSH, Region VI

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