



## Case Studies: Workplace Fatality Related to Perchloroethylene Exposures

Dawn Tharr Column Editor , Jane Mccammon & Lyle Mckenzie

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Dawn Tharr, Column Editor

Reported by Jane McCammon and Lyle McKenzie

## Introduction

This case study reports on the fatality of a 17-year-old laborer who was overexposed to perchloroethylene at a plastic products manufacturing plant. The work-site investigation was conducted by the Colorado Department of Public Health and Environment (CDPHE) as part of an interagency agreement with the National Institute for Occupational Safety and Health (NIOSH) to conduct Fatality Assessment and Control Evaluation (FACE) surveillance. This report highlights the contributing factors that led to the fatality, including chemical exposure, lack of adequate equipment to perform the job task, lack of air sampling, lack of personal protective equipment, and lack of written safety rules and procedures.

## Background

CDPHE performs investigations of occupational fatalities under the authority of Colorado Revised Statutes and Board of Health Regulations. The goal of the workplace investigation is to prevent future work-related injuries by studying the work environment, the worker, the task the worker was performing, the tools the worker was using, and management's role in controlling how these factors interact.

This fatality was reported to CDPHE by the Occupational Safety and Health Administration (OSHA) Area Office in accordance with OSHA Instruction CPL 2.96, dated March 23, 1992 (OSHA Support for NIOSH FACE Program). The CDPHE investigation included interviews with the company owner and other investigating officials. Investigators obtained records from the county sheriff, the responding ambulance team, the hospital, and the coroner.

## Description of the Incident

On February 3, 1994, a 17-year-old laborer began work at 4 p.m. His assigned

task was to clean the inside of metal molds used to form plastic containers. This task involved applying perchloroethylene to a cloth rag, which was then used to wipe the interior surface of the mold. The mold in which the body of the laborer was found formed a 40-gallon container and measured 19.5 inches in diameter and 32 inches deep. Evidence at the scene indicated that the employee had propped the mold in an upright position and leaned into the mold to clean the bottom. He was overcome by perchloroethylene vapors in this enclosed space and died. The deceased worker was discovered at midnight when a co-worker arrived on the scene.

## Investigation Results

CDPHE was notified of the incident 8 hours after the fatality occurred, and visited the workplace 2 days after notification.

The company employed three people. The company did not have a safety officer or a written safety program. The company had been in business for 20 years, and the deceased employee had worked for the company 3 weeks. The company had no training program, and no personal protective equipment was in use by the worker on the day of the incident. A material safety data sheet for perchloroethylene was available at the workplace at the time of the CDPHE investigation.

Perchloroethylene (also known as tetrachloroethylene) is heavier than air and highly volatile. The use of 4 ounces of this substance in the 40-gallon space in the mold being cleaned would have generated an airborne concentration of 92,000 parts per million (ppm) of perchloroethylene inside the mold. (No air samples could be taken to substantiate this calculation.) OSHA requires that perchloroethylene exposures not exceed 300 ppm for a 5-minute period during any 3 hours of the work shift.<sup>(1)</sup> The perchloroethylene short-term exposure limit for any 15-minute period as established by the American Conference of Governmental Industrial Hygienists

(ACGIH) is 100 ppm.<sup>(2)</sup> Acute exposure to perchloroethylene primarily affects the central nervous system. Exposures of 100 to 300 ppm can result in dizziness, headache, sleepiness, confusion, nausea, and difficulty speaking and walking. Higher exposure concentrations can cause unconsciousness.<sup>(3)</sup>

The employee was using a rag to clean the inside of the mold. The depth of the mold was greater than his arm length, which meant that to reach the bottom he had to bend over the rim and place his head inside the mold. The space was not ventilated and atmospheric testing was not performed prior to entry. There was no designated stand-by person. The employee was not wearing a respirator while performing the task.

The autopsy report listed the cause of death as consistent with asphyxiation due to exposure to toxic vapors. A toxicologic screen of postmortem blood showed that the perchloroethylene concentration was 23.24 mg/L. The ACGIH biological exposure index for perchloroethylene in blood is 1 mg/L.<sup>(2)</sup>

## Conclusions

This fatality occurred primarily because the employer and employee did not recognize the potential hazard posed by the cleaning task, and the employer failed to adequately protect the health of the employee performing the task.

## Recommendations

The CDPHE investigator concluded that to prevent similar occurrences, this employer and other employers with similar operations should:

- Provide workers with tools that enable them to reach areas to be cleaned without the need to have their head inside the vessel to be cleaned. The use of a cleaning brush or swab attached to a handle would have allowed this worker to reach the bottom without being partially inside the vessel.
- Provide air testing equipment and train employees on the proper use

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and maintenance of the equipment. Air testing would have shown the excessive concentration of perchloroethylene within the vessel, indicating the hazard of entering the vessel and the need for ventilation and/or respiratory protection if the vessel must be entered.

- Designate a stand-by person when the task is being performed if entry into the vessel is required.
- Conduct a worksite survey to assess the potential safety hazards. The employer should then develop, implement, and enforce written safety rules and procedures.

CDPHE recommendations were contained in the written investigation report that was forwarded to the employer, the family of the deceased worker, NIOSH, OSHA, and a number of other public health agencies and individuals interested in occupational fatalities.

#### Comment

Analysis of NIOSH National Traumatic Occupational Fatality and Bureau of Labor Statistics Census of Fatal Occupational Injuries data indicated that from

1980 through 1994, 20 youths 16 and 17 years of age died from work injuries in Colorado. Data from Colorado Worker's Compensation First Reports of Injury and Illness revealed that 393 reports were filed for workers under 18 years of age in 1994.

The employer in the incident reported here was cited for violation of child labor provisions of the Fair Labor Standards Act. As inexperienced workers, adolescents (persons under the age of 18) are often unable to recognize workplace hazards. Further, teens are often searching for increased challenge and responsibility, and thus are reluctant to ask questions or make demands on their employers. This places teens at increased risk in the workplace.

There are two excellent recent publications that deal with working teens. NIOSH recently published an Alert, *Preventing Deaths and Injuries of Adolescent Workers* (Pub. No. 95-125). Call (800) 356-4674 to order the NIOSH publication. The Children's Safety Network, the Occupational Health Surveillance Program of the Massachusetts Department of Public Health, and the U.S. Department

of Health and Human Services Maternal and Child Health Bureau have joined to publish a document, *Protecting Working Teens: A Public Health Resource Guide*. Call (617) 969-7100, ext. 2207 for more information about this publication.

#### References

1. U.S. Department of Labor, Occupational Safety and Health Administration: 29 CFR 1910.1000, Table Z-2.
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3. Agency for Toxic Substances and Disease Registry: Case Studies in Environmental Medicine (#9—Tetrachloroethylene Toxicity). ATSDR, Atlanta, GA (June 1990).

**EDITORIAL NOTE:** Jane McCammon is a NIOSH employee detailed to the Colorado Department of Public Health and Environment, where she manages the Occupational Epidemiology Program. Lyle McKenzie is the CDPHE FACE investigator responsible for developing occupational fatality surveillance and prevention efforts in Colorado. Call either of them at (303) 692-2700 for more information about this fatality or the Colorado FACE program.