OR-FACE
OREGON FATALITY ASSESSMENT AND CONTROL EVALUATION
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Center for Research on Occupational & Environmental Toxicology
OHSU OREGON HEALTH & SCIENCE UNIVERSITY
Fatality Investigation Report
OR 2004-37-1

Janitor using propane buffer killed by carbon monoxide

SUMMARY

On November 13, 2004, a 50-year-old male janitor was found dead at a job site where he was cleaning floors with a propane buffer. The janitor had completed all but one room of the 1,500-2,000 sq. ft office building. He was found collapsed and unresponsive about 6 ft from the buffer, which was still running in the idle position. No external doors or windows had been opened to allow ventilation. The janitor was a temporary worker, hired through an agency, and had worked with his current employer for 2½ weeks. The medical examiner discovered a 62% carbon-monoxide saturation level in the victim's blood.

The propane-powered buffer used in this incident produced high levels of carbon monoxide.

CAUSE OF DEATH: Asphyxiation by inhalation of carbon monoxide and propane exhaust

RECOMMENDATIONS

- **Propane-powered equipment used indoors should be replaced with electric-powered equipment.**
- **Propane-powered equipment should only be used indoors when adequate ventilation and carbon-monoxide detectors and alarms are available.**
- **Equipment should be properly maintained in safe working condition.**
- **Employers should ensure a safe work environment for their employees, including temporary employees.**

INTRODUCTION

On November 13, 2004, a 50-year-old male janitor was found dead at a job site where he was cleaning floors with a propane buffer. OR-FACE received notification of the incident on November 29. This report is based on information obtained from OR-OSHA, law enforcement, and medical examiner reports.

The employer was a small business providing janitorial services. The business was registered as a corporation, employing nine people, including family members of the owner. Other workers were leased from a temporary employment agency as needed. The janitor had worked for the employer for 2½ weeks as a temporary employee. He was trained by another employee, and had used the propane buffer on several other jobs prior to the incident. No training was offered on the hazards of carbon monoxide, or the symptoms of carbon monoxide poisoning.

The buffer, a Pioneer Eclipse propane buffer, Model CV11ST, had been owned by the employer for about 3 years, and was serviced within the past year. The buffer is started by plugging it into an electrical outlet, and is then powered by propane gas.

INVESTIGATION

On the day of the incident, the janitor arrived at the building to be cleaned at 11:45 a.m. He swept the floors, and was observed bringing the propane buffer into the building at 12:30 p.m. The building was 1,500- 2,000 sq. ft, requiring an estimated 1-1½ hours to polish the floors.

About 8 p.m. the wife of the janitor called the employer after being unable to locate her husband. The employer arrived at the job site at 8:30 p.m., and found the janitor collapsed and unresponsive on the floor about 6 ft from the buffer, which was still running in idle mode. All floors in the building had been polished, except for the room where the janitor was found. The work performed indicates he probably collapsed about 1:30 p.m., about 1 hour after beginning to use the buffer.

Emergency responders described the victim as extremely pink, especially in the head. Results of the blood test by the medical examiner discovered a 62% carbon-monoxide saturation level in the victim's blood, indicating death by carbon-monoxide poisoning. Initial speculation focused on individual susceptibility to the exhaust of the buffer, due to age, weight, and medications used; but the high concentration in the blood indicated extreme hazard for any individual.

The employer stated that he "usually" uses the buffer with an outside door open to allow ventilation. No external door or window was open at the job site when he arrived on the scene. The temperature outside that day was an average of 43 degrees.

RECOMMENDATIONS/DISCUSSION

Recommendation #1. Propane-powered equipment used indoors should be replaced with electric-powered equipment.

Carbon monoxide is a leading cause of fatal poisonings. The extreme risk of using fuel-powered engines, heaters, or other equipment indoors is not widely recognized. Electric powered floor buffers are commonly available and their use would eliminate the equipment as a source of carbon monoxide.

Recommendation #2. Propane-powered equipment should only be used indoors when adequate ventilation and carbon-monoxide detectors and alarms are available.

Any equipment with the potential to produce carbon monoxide presents a significant hazard when used indoors. They must be used with great caution. Opening a door or window, or running an exhaust fan will not necessarily supply adequate ventilation. A carbon-monoxide detector and alarm should be available to alert workers of emissions. In addition, workers should be trained to recognize the hazards of carbon monoxide and the early symptoms of carbon-monoxide poisoning.

Carbon monoxide is a colorless, odorless, poisonous gas produced by incomplete combustion. Carbon-monoxide emissions are of particular concern for gasoline-powered engines, but any exhaust from a flame can produce carbon monoxide, and fuel sources that are usually less toxic, such as propane or natural gas, may also emit carbon monoxide if dirty filters or other impediments disrupt the supply of oxygen at the point of combustion.

Carbon monoxide is particularly hazardous because it can accumulate rapidly in enclosed or semi-enclosed spaces and can overcome a person without warning, possibly within minutes. Even outdoors, concentrated exposure to carbon monoxide from automobile, tractor, forklift, or boat exhaust can cause injury. Hazardous exposure is also possible from handheld engines, such as a chainsaw or leaf blower. A worker may acquire a false sense of security by using equipment on several occasions without experiencing ill effects.

As in this incident, most cases of carbon-monoxide poisoning occur during the colder months of the year. Use of fuel-powered equipment in closed buildings may occur during colder months. Combustion engines require more fuel to start and operate less efficiently in cold weather, producing increased carbon-monoxide emissions.

Recommendation #3. Equipment should be properly maintained in safe working condition.

Proper equipment maintenance includes frequent and regular replacement or cleaning of engine air filters to ensure that equipment is operating efficiently, with a minimum of toxic exhaust. Inspection of the buffer in this incident discovered the air filter was clogged, which contributes to poor combustion and increased emission of carbon monoxide. The manufacturer's standard allowed a carbon-monoxide emission of 700 ppm at full throttle. When tested the buffer

produced carbon monoxide at a concentration over 85,000 ppm at full throttle. The buildup of carbon monoxide in the enclosed building was estimated to have reached a dangerous level of 1,461 ppm within 5 minutes, and 12,342 ppm within 60 minutes.

The OSHA standard for worker exposure to carbon monoxide is 50 ppm (parts per million) averaged over an 8-hour period, and not to exceed 200 ppm at any one time. The American Conference for Governmental Industrial Hygienists has adopted a threshold limit for carbon monoxide at 25 ppm averaged over an 8-hour period. A concentration of carbon monoxide at 1,200 ppm is considered immediately dangerous to life and health.

Recommendation #4. Employers should ensure a safe work environment for their employees, including temporary employees.

The employer in this incident believed that temporary workers were not technically his employees, because they were leased through a temporary employment agency. In terms of safety, however, the direct day-to-day supervisor of an employee is responsible for specific safety training and maintaining a safe work environment, according to OSHA. Responsability for providing safe employment applies to temporary employees as well as directly hired employees.

Employers should also recognize that significant additional risks may exist for lone workers. Employers should consider adopting accountability measures during the work day, such as "check-ins" provided by radio or phone during or after shift duty.

REFERENCES

Canada Safety Council. (2005). *Carbon monoxide.* Available online: www.safety-council.org/info/OSH/carbon.htm

Centers for Disease Control and Prevention. (2005, Jan 21). Unintentional nonfire-related carbon monoxide exposures – United States 2001-2003. MMWR, 54(02), 36-39. Available online: www.cdc.gov/mmwr/preview/mmwrhtml/mm5402a2.htm

Centers for Disease Control and Prevention. (1993, Sep 24). Carbon monoxide poisoning associated with a propane-powered floor burnisher – Vermont 1992. *MMWR*, *42*(37), 726-728. Available online: www.cdc.gov/mmwr/preview/mmwrhtml/00021872.htm

National Institute for Occupational Safety and Health. (1996). *Preventing carbon monoxide poisoning from small gasoline-powered engines and tools* [Pub 96-118]. Available online: www.cdc.gov/niosh/pdfs/96-118asum.pdf

National Institute for Occupational Safety and Health. (1995). *Documentation for Immediately Dangerous to Life or Health concentrations (IDLH): NIOSH chemical listing and documentation of revised IDLH values.* Online resource: http://www.cdc.gov/niosh/idlh/intridl4.html

FOR MORE INFORMATION

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CROET at OHSU performs OR-FACE investigations through a cooperative agreement with the National Institute for Occupational Safety and Health (NIOSH), Division of Safety Research. The goal of these evaluations is to prevent fatal work injuries in the future by studying the work environment, the worker, the task, the tools, the fatal energy exchange, and the role of management in controlling how these factors interact.

Oregon FACE reports are for information, research, or occupational injury control only. Safety and health practices may have changed since the investigation was conducted and the report was completed. Persons needing regulatory compliance information should consult the appropriate regulatory agency.