Laborer Dies of Carbon Monoxide Poisoning During Sandblasting Operations in Virginia

SUMMARY

A 46-year-old male laborer at an antique dealership was overcome by carbon monoxide while **sandblasting wrought iron chairs**. The victim had begun **sandblasting** the chairs the previous afternoon; he was working outdoors and was wearing an abrasive-blasting airline respirator. Air was supplied by a diesel-fueled air compressor which was later found to be defective. At some point during that preceding afternoon, the victim told the shop foreman that the air inside the hood smelled stale and that he was going to change the filter in the air filtration unit. The victim drove to a supplier, purchased a new filter, returned to the dealership, and changed the filter. At 8:00 a.m. on the following morning, the victim renewed his work on the chairs. At 9:00 a.m., a co-worker found him lying on the ground-unconscious but breathing. The emergency medical service (EMS) transported the victim to the hospital, where he was pronounced dead. NIOSH investigators concluded that, in order to prevent similar occurrences, employers should:

- ***establish and maintain a comprehensive respiratory protection program when such equipment is necessary to protect the health of the worker(s)***
- ***perform scheduled, periodic inspections and maintenance by qualified persons on all equipment and machinery used by workers to ensure that it is continuously maintained in safe operating condition***
- ***ensure that safety features incorporated into the design of machinery are in proper working order***
- ***develop, implement, and enforce a written safety policy and safe work procedures designed to enable workers to recognize, understand, and control hazards.***

INTRODUCTION

On August 31, 1991, a 46-year-old laborer died of carbon monoxide poisoning while sandblasting wrought iron chairs. On September 13, 1991, officials of the Virginia Occupational Safety and Health Administration (VAOSHA) notified the Division of Safety Research (DSR) of this fatality, and requested technical assistance. On September 19, 1991, a DSR safety specialist traveled to the incident site to conduct an investigation. The investigator reviewed the incident with employer representatives, the medical examiner, the sheriff's department, the VAOSHA regional supervisor, and the industrial hygienist assigned to the case. Photographs of the incident site and the equipment used were obtained during the investigation. Samples of residue taken from the air filtration unit were obtained from the Virginia Department of Agriculture laboratories and returned to DSR for further analysis.

The employer in this incident was an antique dealership that had been in operation for 21 years and employed 14 workers. The employer was engaged in the sale of antiques, marble cutting, sandblasting, and furniture refinishing. The employer had no written safety policy or safety program. Workers were trained on the job.

INVESTIGATION

The victim had been assigned the task of sandblasting two wrought iron chairs the day before the incident. The victim performed the sandblasting operations at the dealership as necessary, but not on a daily basis. The sandblasting unit consisted of a diesel-powered air compressor, two 1-inch-diameter air discharge lines (one to the air-blasting nozzle, one to the air-filtration unit), the air-filtration unit, a vortex/control valve (to control air flow and cool the air), and the abrasive-blasting airline respirator (a continuous flow airline Type "CE" respirator, with a hood and facepiece that covered the wearer's head, neck, and shoulders to protect against rebounding abrasive) (Figure). The air compressor had been purchased by the dealership 5 years before the incident.

Early that afternoon, the victim told the shop foreman that the filter in the filtration unit needed to be changed because the supplied air smelled stale. No filters were available at the dealership, so the victim drove to a supplier and obtained the filter, then returned to the dealership and changed it. The victim told the shop foreman that he would finish sandblasting the chairs early the following morning before the sun got hot.

The victim began sandblasting the chairs at 8:00 a.m. the following morning. At 9:00 a.m., the victim was found lying on the ground unconscious, but breathing, still wearing the abrasive-blasting respirator.

Investigation of the air compressor unit revealed several factors that might have contributed to this fatality:

- the vanes of the compressor's radiator were clogged
- the engine of the air compressor was extremely low on oil to the point where it had seized and could not be started at the time of the investigation
- evidence of combustion or extreme heat was present at the back end of the compressor (opposite the two discharge lines)
- the main discharge line was broken in an area located underneath the evidence of combustion or extreme heat
- three electrical safety relays-that would detect high ambient, oil, or discharged air temperature and automatically shut the compressor down-had been bypassed
- the filter in the filtration unit offered no protection against toxic gases; it could only filter out solid particulates and liquid aerosols.
- a black, oil-like residue was present in both discharge lines and, to a greater extent, in the air filtration unit.

The filter that had been replaced did not exhibit the black oily residue present on the new filter. Residue samples obtained by the DSR investigator were analyzed for evidence of combustion, but the analysis was inconclusive.

The event was not witnessed but it is assumed the following occurred. The compressor began to overheat either because of a low oil level or because of the clogged radiator vanes. The engine and engine oil became extremely hot, but the engine did not shut down because the safety relays were inoperable. The hot oil began to smoke and possibly burn. Smoke and carbon monoxide passed through the discharge line to the victim's abrasive-blasting respirator, and the victim was overcome. Although unconscious, the victim was still wearing the respirator and continued to inhale the carbon monoxide. The emergency medical service (EMS) was summoned and transported the victim to the hospital where he was pronounced dead by the attending physician.

CAUSE OF DEATH

The medical examiner listed acute toxic (carbon monoxide) poisoning as the cause of death.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should establish and maintain a comprehensive respiratory protection program when such equipment is necessary to protect the health of the worker(s).

Discussion: The air supply to airline respirators is required to meet the requirements for Type I gaseous air (Grade D or higher quality) set forth by the Compressed Gas Association Commodity Specification for Air, G-7.1-1966. Furthermore, OSHA regulation 29 CFR 1910.134 (d)(2)(ii) requires that a breathing air compressor have certain safety devices (high-temperature or carbon monoxide alarm, or both) to protect the air quality. A scrubber could be incorporated into the air filtration system to assist compliance with Grade D air requirements. Since the oil-lubricated compressor used in this incident was only equipped with a high temperature alarm, the air from the compressor should have been frequently tested for carbon monoxide and daily inspections for all contaminants should have been conducted. Had the compressor also been equipped with an operable carbon monoxide alarm, the possibility of exposure to the carbon monoxide hazard would have been decreased and worker safety enhanced.

Recommendation #2: Employers should perform scheduled, periodic inspections and maintenance by qualified persons on all equipment and machinery used by workers to ensure that it is continuously maintained in safe operating condition.

Discussion: Qualified persons should perform scheduled comprehensive inspections and maintenance on all equipment and machinery used by workers to ensure that it is functioning safely and properly. Additionally, workers operating this equipment or machinery should conduct daily visual inspections to identify potential hazards or problems. A list of daily routine inspection procedures should be posted at the compressor to assist workers conducting these inspections and to ensure compliance. If any potential hazards are identified, the equipment or machinery should be immediately repaired or removed from service until repaired.

Recommendation #3: Employers should ensure that safety features incorporated into the design of machinery are in proper working order.

Discussion: In this instance, electrical safety devices (relay switches) were incorporated into the design of the electrical system to alert users of existing problems. When the safety devices were bypassed, the safety features designed into this electrical system were eliminated. In this instance the air compressor became extremely hot and a toxic atmosphere resulted. Since this equipment was purchased used by the dealership, it was impossible to determine when or by whom the safety features were bypassed.

Recommendation #4: Employers should develop, implement, and enforce a written safety policy and safe work procedures designed to enable workers to recognize, understand, and control hazards.

Discussion: OSHA Standard 29 CFR 1926.21 (b)(2) states, "The employer shall instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury." Companies should evaluate the tasks performed by workers, identify potential hazards, develop and implement a safety program addressing these hazards, and provide worker training in safe work procedures. In this instance, the faulty air compressor led to the formation of a toxic atmosphere within the airline respirator. Additionally, due to the presence of solvents and other chemicals used in the furniture refinishing operations, the potential existed that an IDLH-immediately dangerous to human life and health-atmosphere could form. Identifying such hazards and training workers in their control will allow for a safe work environment.

REFERENCES

29 CFR 1926.20. Code of Federal Regulations, Washington, D.C.: U.S. Government Printing Office, Office of the Federal Register.

29 CFR 1910.134 (d)(2)(ii). Code of Federal Regulations, Washington, D.C.: U.S. Government Printing Office, Office of the Federal Register.

NIOSH [1987]--NIOSH Guide to Industrial Respiratory Protection, Cincinnati, Ohio. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, DHHS (NIOSH) Pub. No. 87-116.