Four Hotel Maintenance Workers Exposed to Excessive Levels of Carbon Monoxide in Boiler Room- Massachusetts

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SUMMARY

On September 17, 2003, four hotel maintenance department employees were exposed to excessive levels of carbon monoxide (CO). During an early afternoon check of a hotel boiler room by two maintenance department employees, it was discovered that the temperature inside the boiler room was elevated and that a power venter belt, which had been replaced earlier that same day, was slipping. During the repair of the power venter, one of the two maintenance department employees started to feel ill. The ill employee's condition was reported to management and a call was placed for emergency medical services (EMS). Two other maintenance department employees went to check on the ill employee and all four employees stayed inside the boiler room until EMS arrived. The two employees who were originally performing the repair were immediately transported to a local hospital and then were moved to a larger hospital where they received treatment in a hyperbaric oxygen chamber. The other two employees, who went to check on the employees performing the repair, drove themselves to a local hospital approximately one hour after the arrival of EMS. The Massachusetts FACE Program concluded that to prevent similar occurrences in the future, employers should:

- **Provide employees training in hazard recognition including, but not limited to, carbon monoxide and its associated health effects;**

- **Conduct workplace surveys to identify all potential sources of carbon monoxide and locations where carbon monoxide poisonings could occur; and**

- **Ensure that at a minimum carbon monoxide detectors are installed and operating properly within areas where fuel burning appliances are located, such as boiler rooms.**

Employers of 911 call takers and dispatchers should:

- **Encourage the collection of all available information, such as exact location of incident, when answering an emergency call to help identify the exact nature of the emergency.**

Employers of emergency first responders should:

- **Ensure that when responders are dispatched to locations where the potential exists for toxic atmospheres, such as boiler rooms, that the atmosphere is tested by trained personnel prior to entering.**

In addition, manufacturers of power venting equipment should:

- **Consider providing warning labels about the carbon monoxide hazard that could develop if power venters are not operating properly.**

INTRODUCTION

On September 22, 2003, the Massachusetts FACE Program was alerted by the local media, that on September 17, 2003, four hotel workers were taken to local area hospitals due to carbon monoxide (CO) exposure in a boiler room. An investigation was immediately initiated. The Massachusetts FACE Program Director and a coworker traveled to the hotel involved in the incident. During this visit the Director of Engineering and the Director of Human Resources were interviewed. In addition, personnel from the local fire department were interviewed during the investigation.

The employer was a large hotel located on 250 acres of land. The hotel consists of 367 sleeping rooms, two golf courses, tennis, racquetball and volleyball courts, indoor and outdoor pools, and conference facilities.

The hotel maintenance department had six employees. During this incident, four of these employees were exposed to excessive levels of carbon monoxide. Three of the four exposed employees held the job title maintenance engineer and their work experience ranged from two to four years. The fourth exposed employee held the job title director of engineering and this employee had ten years of work experience. The employer had a health and safety program that included employee training. The training provided to the maintenance department employees by the hotel did not include the hazards and associated health effects of CO. The maintenance department employees did not have union representation.

INVESTIGATION

On September 17, 2003, hotel maintenance department employees had performed a daily morning check of the equipment inside the boiler room. The boiler room consisted of three natural gas boilers, hot water tanks, and one power venter. The power venter's function was to draw the boilers' exhaust out of the boiler room. The boiler room had been designed with a safety feature that would cut power to the boilers if the power venter fails. During the daily morning check, it was discovered that the water temperature in the hot water tank was below normal. Upon further investigation, the maintenance department employees found that there was no power going to the boilers, due to a broken belt on the power venter.

The boiler room was completely shutdown by the maintenance department employees to start the repair of the power venter. The broken belt on the power venter was replaced and the boiler room was returned back to full operation. During a boiler room check at 1:40 p.m., the third check of the boiler room after it had been returned to full operation, it was discovered that the air temperature in the boiler room had increased above normal conditions. The maintenance department again started to investigate the problem and found that the new power venter belt was slipping and resulting in inadequate ventilation of the boiler room. The boiler room was then completely shutdown for a second time.

After shutting down the boiler room, the maintenance department employees left the boiler room to find another power venter belt, which took approximately one and half-hours. Once another belt was found, two maintenance department employees entered the boiler room to start this second repair. The two employees cut off the power venter belt and replaced it with another new belt. During the repair one of the two employees started to feel ill and had to sit down. His symptoms included a headache and feeling twitchy and dizzy.

The ill employee's condition was reported to the director of engineering and the director of human resources. A call was placed to the fire department requesting assistance for an “injured worker”. Two other maintenance department employees entered the boiler room to assist the ill co-worker. All four employees waited inside the boiler room for help to arrive. The power venter repair was complete, but the power venter remained off. At this time, the maintenance department employees thought the ill co-worker was having heat stroke.

Personnel from two local fire departments and emergency medical services (EMS) responded, and upon their arrival, one employee was seizing, one employee was unconscious and the other two employees were not feeling well. The two most seriously affected employees were removed from the boiler room and attended to first. Because at this point the cause of the illnesses, the excessive level of CO, was unknown the fire department personnel entered the boiler room without testing the boiler room’s atmosphere and donning the appropriate personal protective equipment.

After attending to the ill workers, fire department personnel requested that the CO meter be brought to the hotel. Once the CO meter was on site, the air inside the boiler room was tested and the reading was approximately 900 parts per million (ppm). The fire department then evacuated the entire hotel and brought in large fans to ventilate the area.

The two most seriously affected employees were immediately transported via ambulance to a local hospital and from there they were transported to a larger hospital to be treated in a hyperbaric oxygen chamber. The other two employees drove themselves to a local hospital approximately 50 minutes after the incident, but were not treated. Eight hours after the incident some of the responding fire fighters had their carboxyhemoglobin tested. All individuals involved in this incident survived.

Post incident, it was discovered that a mechanical flow sensor that was part of the power venter system had malfunctioned. This malfunction did not contribute to the initial power venter belt breaking, but did cause the new belt to start slipping. The day after the incident, the mechanical flow sensor was replaced and a second mechanical flow sensor was added to the system as a backup. In addition, a complete CO monitoring system, including detectors and an alarm, was installed in the boiler room.

The Occupational Safety and Health Administration (OSHA) sets enforceable permissible exposure limits (PELs) to protect workers against the health effects of exposure to hazardous substances, such as CO, in the workplace. OSHA's PELs regulate the concentration of a substance in the air that a worker can be exposed to over a usual 8-hour workday, a time weighted average (TWA). The OSHA PEL for CO is 50 parts per million (ppm). The National Institute for Occupational Safety and Health (NIOSH) has developed recommended exposure limits (RELs) based on a 10-hour TWA. NIOSH’s REL for CO is 35 ppm, with a ceiling of 200 ppm that should never be exceeded.

RECOMMENDATIONS/DISCUSSION

Recommendation #1: Employers should provide employees training in hazard recognition, including, but not limited to, carbon monoxide and its associated health effects.

Discussion: Carbon monoxide is an odorless, colorless, tasteless gas that is produced by the incomplete combustion of fossil fuels including, but not limited to, natural gas, coal, propane, and oil, and interferes with the delivery of oxygen in the blood. Some of the health effects of CO are headache, dizziness, nausea, convulsions and death. The effects of CO poisoning will depend on the length of exposure, concentration of CO in the atmosphere, the breathing rate and the physical condition of the victim. Atmospheres with extremely high concentrations of CO could cause incapacitation with a single unprotected breath.

Employers should provide training to maintenance staff that includes the sources and conditions that may result in CO poisoning, such as the possibility of excessive CO levels occurring inside boiler rooms and other areas where fossil fuels might be combusted. Also, training should address CO associated health effects, how to control excessive CO levels, and emergency response procedures for toxic atmospheres. In this case, the training provided by the employer did not include a section about CO. If the employees had training that included CO they might have immediately realized that there were being exposed to excessive CO levels, due to their location and the ill co-workers symptoms and had evacuated the boiler room to an area with fresh air.

Recommendation #2: Employers should conduct workplace surveys to identify all potential sources of carbon monoxide and locations where carbon monoxide poisonings could occur.

Discussion: As stated in Recommendation #1, CO is an odorless, colorless, tasteless gas. These properties make CO very difficult to be detected by the human senses. Therefore, employers should conduct a workplace survey to identify all the potential sources of CO and locations where CO poisoning could occur and map these locations. The survey will help with the appropriate placement of CO monitoring systems and CO detectors (Recommendation #3).

Recommendation #3: Employers should ensure that carbon monoxide monitoring systems are installed and operating properly within areas where fuel burning appliances are located, such as boiler rooms.

Discussion: At the time of the incident the hotel boiler room did not have a CO monitoring system. Locations that contain fuel burning appliances should have CO monitoring systems, or at a minimum CO detectors, installed and operating properly. Routine maintenance schedules should be developed and implemented for the CO monitoring systems and/or detectors.

In this case, a CO monitoring system would have CO sensors inside the boiler room and a monitor and alarm in an area outside of the boiler room. After the incident the hotel installed a CO monitoring system. If this CO monitoring system had been installed and operating properly at the time of the incident, the employees would have been warned immediately when the CO levels began to rise, minimizing their exposure to CO.

Recommendation #4: Employers of 911 call takers and dispatchers should encourage the collection of all available information, such as exact location, when answering an emergency call to help identify the nature of the emergency.

Discussion: Encouraging 911 call takers and/or dispatchers to collect all available information, such as exact incident location, during the reporting of an emergency might enable 911 dispatchers to initially relay enough information to first responders to help them identify the exact nature of the emergency prior to arriving onsite. In this case, the hotel reported the emergency as an injured worker during the 911 call. If the location of the incident, a boiler room, was able to be collected and relayed to the first responders, the first responders might have considered that the worker was overcome by carbon monoxide enabling them to immediately take the necessary precautions.

In Massachusetts, all call takers and dispatchers are required to complete two days of enhanced 911 equipment use training provided by the Massachusetts Statewide Emergency Telecommunications Board. Training on appropriate collection of information when an incident is being reported is not required, but should be made available or provided by the employer. The Massachusetts Statewide Emergency Telecommunications Board offers a no-charge five week Public Safety Communications Academy. This five week Academy is divided into multiple training modules, which includes proper call handling and emergency medical dispatch (EMD). A specific section on carbon monoxide incidents is part of the EMD training. The individual training modules are also available to employers of 911 call takers and dispatchers if attendance at the five week Academy is not feasible. The Massachusetts Statewide Emergency Telecommunications Board can be contacted at www.mass.gov/e911 or 508-828-2911.

Recommendation #5: Employers of emergency first responders should ensure that when responders are dispatched to locations where the potential exists for toxic atmospheres, such as boiler rooms, that the atmosphere is tested by trained personnel prior to entering.

Discussion: It is important that first responders ensure scene safety for injured people, bystanders, and themselves. In this case, emergency first responders (fire fighters, police, and paramedics) were responding to what they were told was an injured employee at a hotel. Once on site, fire department personnel were directed to the victim's location inside a boiler room and entered the boiler room without respiratory protection and without testing the boiler room's atmosphere, which contained excessive levels of CO. After fire department personnel had entered the boiler room, the atmosphere testing equipment was requested to be on site.

In most Massachusetts cities and towns fire department personnel are the first responders who have access to atmosphere monitoring equipment and self contained breathing apparatuses and have been provided training to use the equipment. Immediate access to atmosphere monitoring equipment and self contained breathing apparatuses at incident sites that involve locations that have the potential to contain toxic atmospheres, such as boiler rooms, will help emergency first responders to safely handle to the situation.

Recommendation #6: Manufacturers of power venting equipment should consider providing warning labels about the carbon monoxide hazard that could develop if power venters are not operating properly.

Discussion: Power venters use motorized blowers to vent the products of combustion. Power venters are typically used to exhaust newer more efficient oil and gas fuel fired furnaces and fire places. These newer more efficient systems produce lower temperature exhaust, which will not rise as quickly as the warmer exhaust produce by older systems. The use of power venters can eliminate the need for masonry chimneys, which rely on the natural lifting action of the warm exhaust.

As is in this incident, the power venter was not operating properly leading to the excessive CO levels in the boiler room. Manufacturers should consider providing all new and existing power venters with warning labels that state a CO hazard could develop if power venters are not operating properly.

REFERENCES

Code of Federal Regulations, 29 CFR 1910.134 Respiratory Protection, Government Printing Office

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