

California Department of Public Health
Occupational Health Branch

**FATALITY ASSESSMENT AND CONTROL EVALUATION
PROGRAM (CA/FACE)**

**Laborer Dies of Carbon Monoxide Poisoning
When He Operates a Gasoline-Powered Concrete Saw Indoors
Case Report: 17CA001**

SUMMARY

A laborer, working alone in a vacant store in a shopping mall, died of carbon monoxide poisoning as a result of operating a gasoline-powered, walk-behind concrete saw in an enclosed space. The saw was being used to cut through the concrete floor in order to dig new plumbing trenches. At the time of the incident, the space was not mechanically ventilated and had no natural ventilation. The victim was working with an unlicensed plumbing contractor, who was working for a licensed general contractor. The California Fatality Assessment Control Evaluation (CA/FACE) program concluded that the following steps should be taken to prevent similar incidents:

- Only electric-powered concrete saws should be used in enclosed spaces. If a generator powers the electric saw, the generator must be placed outdoors, well away from the enclosed space.
- Employers should train employees to understand that all fuel-powered tools emit carbon monoxide and represent a potentially fatal hazard when used in enclosed spaces. Employees should also be trained to recognize the signs and symptoms of carbon monoxide poisoning, and the limitations of respiratory protection.
- Concrete saw manufacturers should label fuel-powered concrete saws with a clear warning. For example: *WARNING -- DO NOT USE INDOORS OR IN ENCLOSED SPACES -- CARBON MONOXIDE PRODUCED DURING USE CAN KILL*. Equipment rental companies should also attach such warning labels to all fuel-powered concrete saws.

INTRODUCTION

On February 3, 2017, at approximately 4:15 pm, a 34-year-old Hispanic male laborer who had been working alone in a vacant store in a strip mall was found dead of carbon monoxide poisoning as a result of operating a gasoline-powered, walk-behind concrete saw. The CA/FACE program learned of the fatality from the Division of Occupational Safety and Health (Cal/OSHA) on February 6, 2017. The CA/FACE investigator conducted an onsite investigation on February 15, 2017. During the site visit the investigator interviewed the co-worker, the project manager for the general contractor, and Cal/OSHA enforcement staff. The investigator also visited the

location of the fatality, and took photographs. The county sheriff's and coroner's reports were also obtained.

EMPLOYER

The victim was brought on to the job by an acquaintance who had worked for seven years as an unlicensed plumber. The victim had worked on and off with the plumber for six months. He was the only individual working with the plumber on this job. A licensed general contractor that had been in business since 1980 hired the plumber. The plumber had done work for the general contractor from time to time over the past two years.

WRITTEN SAFETY PROGRAMS, TRAINING, EXPERIENCE, AND KNOWLEDGE

The general contractor had a written Injury and Illness Prevention Program. However, it was an old document and there was no evidence that the program had ever been implemented. The general contractor's project manager reported that he had not provided any health and safety training to the plumber or the victim. He reported that he had verbally instructed the victim to use a fan to ventilate the space when using the concrete saw. However, there was no written documentation of this.

The plumber reported that he had about seven years of experience using concrete saws and had always used gasoline-powered saws for indoor work. Eighteen months prior to the job, he purchased the used 13 HP gasoline-powered, walk-behind concrete saw that was involved in the incident (Exhibit 1). The plumber stated that he had been concerned about the exhaust fumes from the concrete saw. Sometimes the plumber experienced headaches when using the saw indoors. He reported always using a large fan to ventilate the space, and he owned a large pedestal fan for that purpose (approximately 3 ft. diameter).



Exhibit 1: The gasoline-powered concrete saw used by the victim.

The plumber had also purchased the air-purifying respirators with organic vapor cartridges that were used on this job. But he reported that he had not received any training in respiratory protection. He reported that he did not know that carbon monoxide was a hazard associated

with using a gasoline-powered concrete saw indoors. He also did not know that these respirators offer no protection against carbon monoxide exposure.

The victim had used the plumber's concrete saw on multiple indoor plumbing jobs over the past six months, sometimes working on his own. The plumber reported that the large pedestal fan was always used to ventilate the space. He also reported that the victim never complained about the exhaust fumes.

WORKER INFORMATION

The victim was a 34-year-old Hispanic male laborer who spoke only Spanish. He had lived in Mexico working as a carpenter and a 'jack of all trades' before moving to the United States approximately two years prior to the incident. He had been working with the plumber intermittently for six months. He was married with a wife and three children in Mexico; the third child was born the day before his death.

INCIDENT SCENE

The incident scene was a store in an outdoor shopping mall. It was vacant and being prepared for the new tenant business – a nail salon. The store had a front door and no openable windows. The store was narrow and deep – it measured 24 feet wide by 57 feet deep; the ceiling was 12 feet high. There was no rear door but, given the dimensions of the store and the occupancy level, this was not required by local fire code. At the time of the incident, there was a mechanical ventilation system but it was not operating. The plumber reported that he did not know how the ventilation could be turned on.

The stores on both sides were also vacant. Nonetheless, there was concern that the saw noise would disturb the operation of the nearby business tenants. For this reason, the plumber decided to begin the job after store hours.

As part of the remodel, two drainpipes had to be installed beneath the store's concrete slab floor. The general contractor hired the plumber to do this work, and the plumber brought the victim on as a helper. Each drainpipe was to run the entire length of the store, one running down each of the store's two side walls. Before digging each drainpipe trench, an 18 inch-wide strip of the overlying concrete slab floor had to be removed. Digging each trench first involved using the concrete saw to make two parallel cuts, 18 inches apart, running the entire length of the trench. The two lengthwise cuts were then joined by crosscuts every 18 inches. This sectioning of the slab would later allow it to be removed by jackhammer.

INVESTIGATION

The plumber and the victim began work cutting the concrete slab floor at 10 pm on February 2nd. They worked with the front door open and set the fan in the door opening, blowing air

out. They were wearing air-purifying respirators with organic vapor cartridges. They took turns operating the saw and the wet vacuum. The vacuum kept the water generated by the saw from wetting the sheetrock walls. They took breaks outside approximately every 40 minutes to get away from the exhaust fumes. The plumber was experiencing headaches but, according to the plumber, the victim did not mention feeling poorly. They worked together like this until 3 AM, at which point they went home.

At 10:30 am later that same morning, the victim was dropped off at the jobsite to finish the saw work on his own. He got an early lunch at the nearby sub shop and started work around 11:30 am. The plumber estimated that the remaining work consisted of 30 minutes of saw work and 30 minutes of vacuuming. Working alone meant switching back and forth between operating the saw and operating the vacuum.

The victim wore his respirator but did not open the front door or turn on the pedestal fan. It is possible that he was concerned that the saw noise would disturb the neighboring businesses. He worked along one of the side walls, from the front of the store towards the rear corner. He was supposed to call the plumber when he was done with the job. The plumber called the victim on his cell phone around 2 pm, but there was no answer.

At 4:15 pm an employee of the general contractor arrived at the worksite to pick up the victim. He opened the door and found the victim lying face up in the rear left corner of the store (Exhibit 2). He was wearing his respirator and had fallen backwards while operating the vacuum. The vacuum was running, but the concrete saw had been turned off. The employee called 911.



Exhibit 2: The rear left corner of the store space where the victim died.
Note: The trenches were dug after the fatality.

The fire department paramedics pronounced the victim dead at 5 pm. The coroner's office later reported that the victim's carboxyhemoglobin level was 69% -- a very elevated level which confirmed carbon monoxide poisoning as the cause of death.

CONTRIBUTING FACTORS

Occupational injuries and fatalities are often the result of one or more contributing factors or key events in a larger sequence of events that ultimately result in an injury or fatality. The CA/FACE team identified the following contributing factors in this incident that ultimately led to the fatality:

- Using fuel-powered tools in an unventilated indoor space causes carbon monoxide to accumulate over time to lethal levels.
- Using air-purifying respirators which do not protect against carbon monoxide exposure.
- Working alone, the victim could not be immediately removed from the dangerous atmosphere when he lost consciousness.

CAUSE OF DEATH

The cause of death, according to the death certificate, was carbon monoxide poisoning.

RECOMMENDATIONS

Carbon monoxide poisoning from the indoor use of fuel-powered equipment is a major cause of work-related deaths. A 2013 study found that workplace exposure to carbon monoxide killed 727 workers in the US between 1992 and 2008, and that this was the most frequent cause of workplace deaths due to short-term chemical exposure.

The CA/FACE program concluded that the following steps should be taken to prevent similar incidents:

Recommendation #1: Only electric-powered concrete saws should be used in enclosed spaces. If a generator powers the electric saw, the generator must be placed outdoors, well away from the enclosed space.

Discussion: In this incident, the use of a fuel-powered concrete saw indoors was the primary cause of the fatality. The lack of ventilation, the misuse of respiratory protection, the lack of training and awareness, and the increased vulnerability of working alone were all secondary factors.

Theoretically, the accumulation of carbon monoxide could be controlled with continuous, adequate ventilation of an enclosed space. However, ensuring an adequate, reliable level of control requires that employees wear calibrated and properly maintained real-time alarmed gas

monitors at all times. Gas monitors are not practicable for trades that customarily use concrete saws (such as plumbers), as monitors require a level of technical knowledge and expertise that are not typically available.

Therefore, electric concrete saws should only be used for all work in enclosed spaces. Some amount of prior planning is sufficient to overcome the barriers to their use. Electric saws are currently available for all applications, and are as powerful as fuel-powered saws. If adequate electrical power is not readily available onsite, an electrician can be brought in to wire a temporary circuit. If no electrical power is available, a generator can be brought in to power the tool. This generator should be located outdoors and at a sufficient distance so as to not contaminate the enclosed work area. If the victim had used an electric concrete saw, there would not have been the accumulation of carbon monoxide inside the enclosed space, thereby preventing his death.

Recommendation #2: Employers should train employees to understand that all fuel-powered tools emit carbon monoxide and represent a potentially fatal hazard when used in enclosed spaces. Employees should also be trained to recognize the signs and symptoms of carbon monoxide poisoning, and the limitations of respiratory protection.

Discussion: In this incident, the plumber and his helper (the victim) did not understand the hazards of the task they were directed to complete. Although they were aware of the irritant effects of the exhaust, they were not aware that carbon monoxide could be emitted and accumulate rapidly to lethal levels. Studies of emissions from fuel-powered equipment show that carbon monoxide levels can rapidly reach Immediately Dangerous to Life and Health (IDLH) levels inside an enclosed space. Carbon monoxide is odorless and colorless, acts rapidly in the body to block the delivery of oxygen to the tissues, and, at high levels, can cause loss of consciousness within minutes.

The general contractor did not provide any hazard recognition training to the plumber and the victim. If such training had been provided, the plumber and the victim may have recognized the plumber's headaches as a symptom of carbon monoxide poisoning. They would have understood that using a gasoline-powered concrete saw indoors, even with some ventilation, was dangerous, and that using the tool with no ventilation was likely to be fatal. Furthermore, they would have understood that air-purifying respirators offer no protection against carbon monoxide exposure. As a result of this training, they may have increased the ventilation of the space, which could possibly have prevented this fatality. Or they may have instead rented an electric saw for the job, which certainly would have prevented it.

Recommendation #3: Concrete saw manufacturers should label fuel-powered concrete saws with a clear warning. For example: *WARNING -- DO NOT USE INDOORS OR IN ENCLOSED SPACES -- CARBON MONOXIDE PRODUCED DURING USE CAN KILL.* Equipment rental companies should also attach such warning labels to all fuel-powered concrete saws.

Discussion: There was no label on this fuel-powered concrete saw warning of the hazards of fatal carbon monoxide exposure if operated in enclosed spaces. In the absence of such a label, the plumber and the victim were not alerted to the dangers of operating the saw. If warning labels were placed in a clearly visible location on the saw (both in English and Spanish), they may have avoided running the concrete saw in the enclosed space, thereby preventing this death.

REFERENCES

California Code of Regulations, Title 8, §1509, [Injury and Illness Prevention Program](http://www.dir.ca.gov/title8/1509.html):
www.dir.ca.gov/title8/1509.html

California Code of Regulations, Title 8, §5144, [Respiratory Protection](http://www.dir.ca.gov/title8/5144.html):
<http://www.dir.ca.gov/title8/5144.html>

California Code of Regulations, Title 8, §5194, [Hazard Communication](http://www.dir.ca.gov/title8/5194.html):
<http://www.dir.ca.gov/title8/5194.html>

[Occupational Carbon Monoxide Fatalities in the US from Unintentional Non-Fire Related Exposures, 1992 -2008](http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4552320/): (<http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4552320/>)

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The California Department of Public Health, in cooperation with the Public Health Institute and the National Institute for Occupational Safety and Health (NIOSH), conducts investigations of work-related fatalities. The goal of the CA/FACE program is to prevent fatal work injuries. CA/FACE aims to achieve this goal by studying the work environment, the worker, the task the worker was performing, the tools the worker was using, the energy exchange resulting in fatal injury, and the role of management in controlling how these factors interact. NIOSH-funded, state-based FACE programs include: California, Iowa, Kentucky, Massachusetts, Michigan, New Jersey, New York, Oregon, and Washington.

Additional information regarding the CA/FACE program is available from:

[California FACE Program](#)
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