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Case Studies Reaches Landmark: 100 Columns in Applied

Dawn Tharr

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Case Studies

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Dawn Tharr, Column Editor

This issue offers the 100th consecutive publication of the "Case Studies" column. First published in the September 1990 issue, this column has been one of *Applied's* most popular features. Column Editor Dawn Tharr has exhibited outstanding leadership and organizational skills in shepherding each column through the editorial and production process. Her dedication has enabled *Applied* to supply the practical information needed by today's professionals.

Prior Topics

Over the course of 9 years and 100 columns, "Case Studies" has addressed a wide variety of issues and situations. The first column considered "PCBs/Ballast Burnout in Schools." Since then columns have brought guidance and information on the broad spectrum of industrial hygiene issues from Hand–Arm Vibration to Sick Building Syndrome to Electrical and Magnetic Fields.

Current Issue

Regular readers know they can never underestimate the significance of the information reported in "Case Studies." The "Case Study" in this issue identifies an unrecognized carbon monoxide (CO) hazard associated with surface blasting. The article describes three cases of poisoning in a manhole, including one fatality, from CO migrating through soil after nearby use of explosives. Based on the study findings, the National Institute for Occupational Safety and Health (NIOSH) issued the following "Hazard ID."

"Carbon Monoxide Poisoning and Death after the Use of Explosives in a Sewer Construction Project"[*]

Carbon monoxide (CO) is an odorless, colorless gas that can cause illness and death by asphyxiation. Although the toxicity of CO is understood, occupational CO exposure can occur from unrecognized sources. In a recent incident, three cases of CO poisoning in a confined space, including one fatality, were caused by CO migrating through soil after nearby use of explosives.

A municipal sewer project involved the installation of new pipes and manholes. Explosive blasts were used to break up rock layers 6 feet below the surface before excavating pipeline trenches and manhole pits. On the day of the fatality, a construction crew installed a 12-foot-deep manhole without incident. After the crew left the area, 265 pounds of nitroglycerin-based explosive in 20 boreholes, each 18 feet deep, were detonated 40–60 feet from the manhole. A worker who entered the manhole 45 minutes after the explosion collapsed within minutes, and two coworkers descended into the manhole to rescue him. One rescuer retrieved the unconscious worker before collapsing on the surface, and the other rescuer died in the manhole. All involved construction workers had elevated blood levels of carboxyhemoglobin—indicating they had inhaled air containing high CO concentrations.

An investigation determined that carbon monoxide released from the explosion had migrated through the soil into the manhole. CO concentrations in the bottom of the manhole 2 days after the incident were 1,905 parts per million (ppm), well above the immediately dangerous to life and health (IDLH) concentration of 1,200 ppm. Tests following ventilation of the manhole showed that high levels of CO reappeared as a result of continued diffusion from the surrounding soil. Subsequent monitoring of the manhole showed a decline in CO levels over the next 8 days.

This incident illustrates that CO from subsurface detonations of explosives can migrate underground and accumulate in confined spaces. This report is apparently the first occupational fatality from this type of CO exposure, though nonfatal CO poisonings have been reported in residential basements following nearby use of subsurface explosives.

This incident also involved a "chain-reaction" death, a well-known danger associated with confined space rescues. Chain-reaction deaths are so named because after the first victim is found in a confined space, a rescuer enters without proper precautions and is overcome, a subsequent rescuer enters and is likewise overcome, and so on. Chain-reaction rescuer fatalities have accounted for 36% of the deaths in confined spaces.

Recommendations for Prevention

CO from blasting explosives. Blasting contractors should collaborate with other contractors working in the

[*] The principal contributors to this publication are John A. Decker, Lon Santis, and Scott Deitchman.

FIGURE 1
Protecting workers from *histoplasma capsalatum.*

FIGURE 2
Ergonomics assessment of supermarket cashiers.

FIGURE 3
Heavy metals at a volivian smelter.

FIGURE 4
Lead abatement.

FIGURE 5
Aerosolized drug administration.

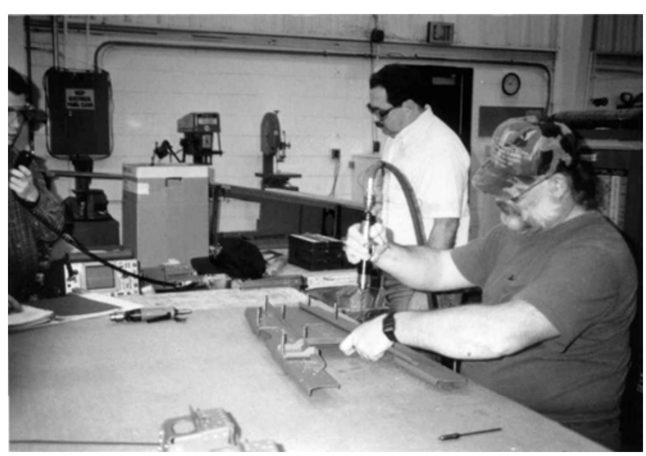

FIGURE 6
Hand-arm vibration from pneumatic tools.

FIGURE 7
Pesticides in a commercial greenhouse.

FIGURE 8
Exposures to volcanic emissions.

FIGURE 9
Abrasive blasting.

FIGURE 10
Fit testing respirators.

FIGURE 11
Laser emissions.

FIGURE 12
Noise assessment at a sawmill.

FIGURE 13
CO poisoning in a manhole.

FIGURE 14
Flood-related concerns.

FIGURE 15
Agricultural exposures.

FIGURE 16
Personal protective equipment.

FIGURE 17
Health care worker issues.

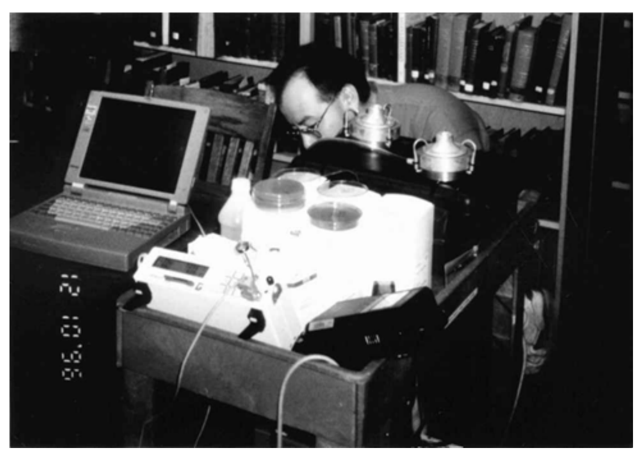

FIGURE 18
Bioaerosols.

FIGURE 19
Tuberculosis issues.

FIGURE 20
Construction.

FIGURE 21
Noise assessments.

FIGURE 22
Metal working fluids.

FIGURE 23
Carbon monoxide and noise exposures.

FIGURE 24
Indoor environmental quality.

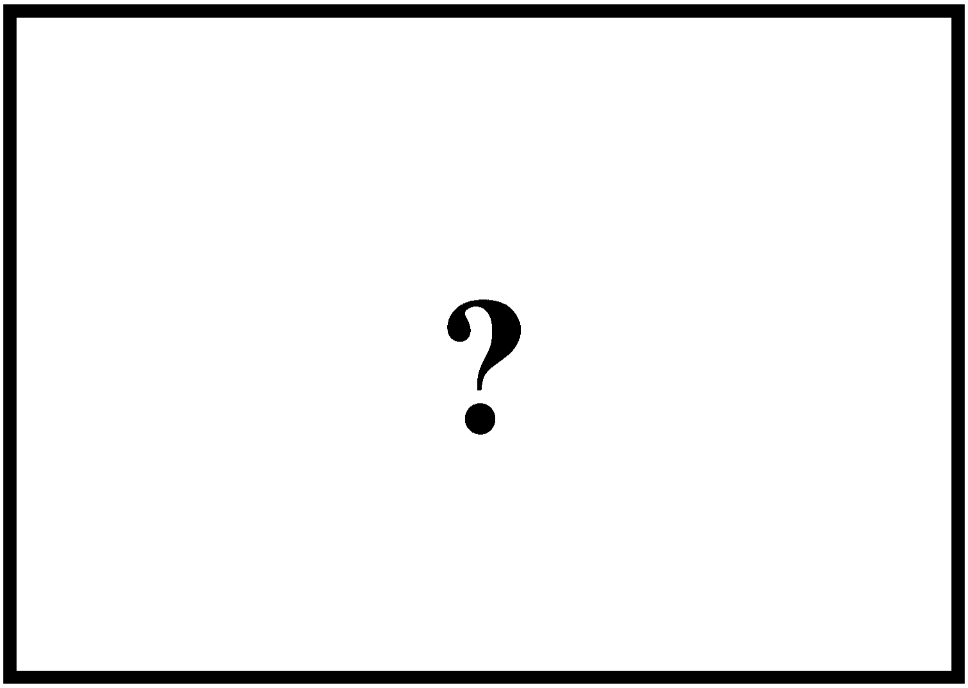

FIGURE 25
Your contribution.

job area to reduce the possibility of CO exposure to employees and surrounding residents. The blasting industry should develop materials to educate workers and managers about the possibility of CO exposures associated with surface blasting and precautions that can be taken to minimize CO exposures. Training should include discussions about the possibility of CO migration through soil. The material safety data sheets provided with explosives used in surface blasting should indicate that CO is among the hazardous gases produced by detonation.

Confined space hazards. Although this incident involved a previously unrecognized CO source, the death and hospitalizations might have been prevented by recognizing the hazards associated with confined spaces and by using appropriate control measures. Construction employers should ensure that proper confined space training is provided to employees, and that proper procedures are used before entry into any confined space. All manholes should be considered confined spaces with potentially hazardous atmospheres, and appropriate air monitoring should be conducted before each entry into a manhole, as well as during worker occupancy. Even if appropriate monitoring had been conducted earlier in the day, the fatality might have occurred if the manhole had not been monitored for CO after the blasting.

For more information. For more free information about carbon monoxide generation by explosives, call the National Institute for Occupational Safety and Health (NIOSH), Pittsburgh Research Laboratory at (412) 892-4213. To obtain more free information about the hazard of confined spaces and procedures to protect workers:

- Call NIOSH at 800-35-NIOSH (800-356-4674), or
- Visit the NIOSH homepage on the World Wide Web at http://www.cdc.gov/niosh/homepage.html

Upcoming Columns

Column Editor Dawn Tharr has already ensured that "Case Studies" will live on after 100. As in all previous columns, the emphasis will be on useful information. Topics will again cover the gamut as indicated in the photographs below. Readers are especially urged to accept the challenge in the last box—your contribution to "Case Studies" will be welcomed. You can be part of the tradition of excellence.