LEVELS OF CO AND CO_2 ON CONSTRUCTION SITES RESULTING FROM DIRECT-FIRED CONSTRUCTION-HEATER EMISSIONS

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Introduction

During winter months, construction projects operating in cold climates use temporary heaters. Many of the heaters are direct-fired, and fueled by propane or natural gas. Direct-fired construction heaters are used to keep workers warm and also to make certain construction activities possible.

All workers on jobsites that use direct-fired construction heaters are exposed to carbon monoxide (CO) and carbon dioxide (CO_2).

Research Questions

What are the levels of CO and CO_2 on heated construction sites?

CO and CO_2 concentrations were measured on construction sites to determine whether the ventilation practices used on the site were adequate.

Methods

Heated construction sites using propane or natural-gas direct-fired heaters were randomly visited and monitored for levels of CO, CO_2 and O_2 during the winter of 2003/2004.

The sites sampled included residential, institutional, and industrial construction sites.

At each test site, site-specific information was collected:

- Building tightness (the researchers' assessment of the number and size of openings to the outdoors)
- Heater description and location
- Fuel type
- Outdoor conditions

- "Grab samples" of the ambient air, taken at a worker's breathing zone (approximately five feet above the floor level), at ceiling height, and on other floors

- Flue gas sampled from each heater
- Other sources of CO and CO_2.

Findings

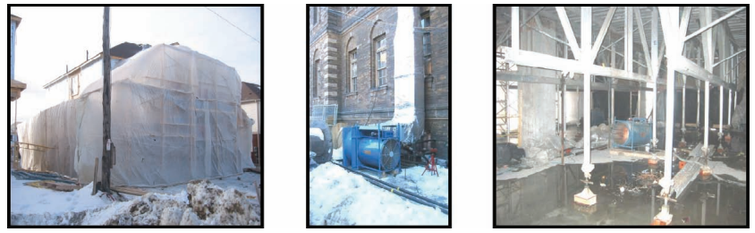
Based on grab samples,

- -> five heaters out of the 84 tested produced ambient readings above the CO time-weighted average exposure value (TWAEV) of 25 ppm, reaching up to 95 ppm
- -> 11 heaters out of the 84 tested produced ambient readings at or above the CO_2 TWAEV of 0.5%, reaching up to 1.2%
- -> infrared heaters averaged 10 times higher emission levels of CO than did the salamander-type heaters, based on the limited number of study samples
- -> ambient readings of CO and CO_2 were higher in tighter buildings
- -> CO and CO_2 levels were generally higher at ceiling level.

Conclusions

The sampling suggests that

- CO levels above the TWAEV of 25 ppm and CO_2 levels above the TWAEV of 5,000 ppm can and do exist on heated construction sites
- building tightness was an indicator of higher levels of CO and CO_2 ambient readings
- large industrial and tarped-in sites did not show these higher concentrations.



Key Messages

1. CO and CO_2 levels from heater emissions can exceed their time weighted average exposure values (TWAEVs) in tight buildings. This is especially important for workers who are pregnant or have heart conditions.
2. Direct-fired heaters require ventilation to support combustion requirements **and** to remove emission gases.
3. Workers must keep openings for ventilation clear so that emission gases do not build up.
4. CO and CO_2 levels could be higher at ceiling height.

A blocked stairway traps CO from a heater that is running in the basement