

Title

Modeling the Effects of Outdoor Use of Gasoline Powered Generators on Indoor Carbon Monoxide Levels

Authors

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Background

The U.S. Centers for Disease Control and Prevention (CDC) has reported that half of non-fatal CO poisoning incidents during the hurricane season in 2005 involved generators operated outdoors but within 2.1 m (7 ft) of the home. The guidance provided on the safe operating distance of a generator is often neither specific nor consistent. Furthermore, some generator manufacturers recommend the use of extension cords to be "as short as possible, preferably less than 15 feet long, to prevent voltage drop and possible overheating of wires." However, the use of short extension cords may result in placement of the generator too close to the home to avoid the entry of CO into the living space.

Methods

Multiple scenarios of a portable generator operated outdoors were modeled using the CONTAM indoor air quality model with a computational fluid dynamics (CFD) model to predict CO concentrations near and within a home. The simulation cases included both human-controllable factors (e.g., the generator location and exhaust direction and window opening size) and non-controllable factors (e.g., wind, temperature, and house dimensions). During a simulation run, CFD predicted a distribution of CO levels at the house surface. Through a link of CFD and CONTAM, the surface CO levels were provided as inputs for predictions of transient CO profiles in different rooms of the house.

Results

For the house modeled in this study, a generator positioned 4.6 m (15 ft) away from open windows may not be far enough away to limit CO entry into the house. A wind perpendicular to the open window caused more CO infiltration than wind at a different angle. Lower wind speed generally caused more CO entry when indoor to outdoor temperature difference is relatively small. When the buoyancy effect was significant, CO infiltration was determined by the combination of wind and buoyancy effects. To reduce CO entry, the generator should ideally be positioned outside of the airflow recirculation region near the open windows.

Implications

Significant CO entry into a house may occur when a portable generator is operated inside the airflow recirculation zone near the house.

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