Carbon Monoxide Detection & Wireless Detection Technologies

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What is Carbon Monoxide?

Odorless, colorless, tasteless

Deadly
Carbon Monoxide Incidents

61,000
Number of Non-Fire Related CO Incidents in 2002

20,636
Number of People Treated for accidental CO Exposure from 2004-2006

439
Average Number of CO Deaths Per Year*

*Center for Disease Control and Prevention

**Approx 40 deaths per year in Canada
Carbon Monoxide Facts

More deaths occur in December and January than any other month

A two-pack a day smoker has ~40ppm of CO in their blood at any time

CO is essentially the same density as Air and diffuses equally throughout a room
Potential Sources of **Carbon Monoxide**?

- Camp Stove
- Generator
- Combustion Engine
- Furnace
- Gas Range
- Cook Top
- Clothes Dryer
Carbon monoxide poisonings are common when a community loses power because people put generators in partially opened or closed garages.

November 2, 2012 - Carbon monoxide poisoning has sickened dozens and killed at least 10 people as powerless residents have cranked up generators throughout the storm-struck East Coast.
How CO Affects the Human Body

From Lungs → Oxygen ($O_2$) → Hemoglobin (Hb) → Blood Vessel → To Organs and Tissues

From Lungs → Carbon Monoxide (CO) → Blood Vessel → To Organs and Tissues

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Carbon Monoxide Symptoms

- **Lethal**: 400 ppm
- **Collapse**: 150 ppm
- **Drowsy**: 70 ppm
- **No Effect**: 0 ppm

Graph showing the progression of carbon monoxide levels from start to 4 hours, with different symptoms at various ppm levels.
## CO Alarm Thresholds

<table>
<thead>
<tr>
<th>Parts Per Million</th>
<th>Detector response time, min.</th>
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<tbody>
<tr>
<td>30 ±3ppm</td>
<td>No alarm within 30 days</td>
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<tr>
<td>70 ±5ppm</td>
<td>60-240</td>
</tr>
<tr>
<td>150 ±5ppm</td>
<td>10-50</td>
</tr>
<tr>
<td>400 ±10ppm</td>
<td>4-15</td>
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</table>
Types of Carbon Monoxide Sensors

- Biomimetic
  Effective but costly.

- Semiconductor
  Prone to nuisance issues.

- Electrochemical
  Cost effective and reliable.
CO is attracted to synthetic hemoglobin, which is monitored by infrared light that passes through it.

When CO is present, the light changes and the alarm sounds.
When tin oxide reaches 250 degrees Celsius, oxygen atoms in the air bond to it.

When CO mixes with the oxygen atoms, the semiconductor’s current increases, causing the alarm to sound.
**Electrochemical CO Sensor**

Electrochemical sensing technology provides the most accurate CO detection available.

These devices detect low levels of CO that may be harmful over long periods of time and high concentrations that pose an immediate danger.
Testing of CO Detectors usually falls into the category of “As per manufacturers instructions”

Detectors should incorporate an electrical test button and there are CO Test Gases available in the marketplace to perform functional testing.
All CO detectors include a limited-life CO cell that must be replaced at the end of life.

The minimum operating life is 3 years and most devices are designed to last between 5 years.

This date of replacement is required to be clearly marked on the unit or the unit must be capable of generating an End-of-life signal.
Installation Locations

- Smoke alarms for minimum protection
- Smoke alarms for more protection and required in new construction
- Carbon monoxide alarm location for multi-level residence

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Wireless networks

• What are the different kinds of wireless networks?
  – Ring
  – Star
  – Hub & Spoke
  – Mesh
  – Etc, etc...
Hub and Spoke
Mesh Network
Mesh Network
Wireless Detection Applications

- Museums
- Historical buildings
- High Ceiling
- Atriums
- Remote buildings
- Trailers
Residential vs. Commercial

- Residential wireless devices exist today in the form of
  - Smoke
  - Thermal
  - CO Sensors

  – Plus other peripherals devices
Residential vs. Commercial

- Commercial systems require different ULC approvals
- At present the ULC standards do not properly address wireless systems
- An effort is being made to update the standards
CAN/ULC-S527 Standard for Control Units for Fire Alarm Systems

- Does not specifically address wireless components
- The expectation is that any wireless device would work to the same standard as hardwired devices
4.6 SHORT-RANGE RADIO FREQUENCY EQUIPMENT (WIRELESS) **NEW**

4.6.1 Short-range radio frequency (wireless) devices shall comply with the Standards listed in Clause 4.1.3.

4.6.3 Short-range radio frequency devices shall be installed in accordance with the manufacturer’s published installation instructions including, but not limited to:

A Distance from device to transceiver;

B Quantity of devices per transceiver;

C Compatible with other short-range radio frequency devices communicating on the same short range radio frequency device link; and

D Primary and secondary power supplies (see Appendix A (Informative) Explanatory Materials, Clause A4.6.3-D)
4.1.3 Devices and equipment used in a fire alarm system, and the interconnection to the fire signal receiving centre, shall comply with the following Standards:

CAN/ULC-S525, Audible Signal Devices for Fire Alarm Systems, Including Accessories;
CAN/ULC-S526, Visible Signal Devices for Fire Alarm Systems, Including Accessories;
CAN/ULC-S527, Standard for Control Units for Fire Alarm Systems;
CAN/ULC-S528, Manual Stations for Fire Alarm Systems, Including Accessories;

**CAN/ULC-S529, Smoke Detectors for Fire Alarm Systems**;

CAN/ULC-S530, Heat Actuated Fire Detectors for Fire Alarm Systems;
This standard **does not** cover the following:

- **g)** Control units that are covered by the Standard for Control Units for Fire Alarm Systems, ULC-S527;
- **h)** Self-contained single and multiple station smoke alarms that are covered by the Standard For Smoke-Alarms, CAN/ULC-S531;
- **i)** A heat detector incorporated as a part of a smoke detector assembly, and covered by the Standard For Heat Actuated Fire Detectors for Fire Alarm Systems, CAN/ULC-S530;
- **j)** Fire tests for smoke detectors integral with combination door closers and holders that are covered by the ULC/ORD-C228, Door Closers and Holders;
- **k)** Detectors for monitoring the smoke density within flues or stacks; and

**l)** **Wireless Smoke Detectors.**
Summary

• Wireless detection technology is becoming more accepted
• ULC Standards are being updated to formally address wireless devices
• Residential wireless systems are leading the way towards Commercial wireless systems
Thank you!

Questions?