Carbon Monoxide - - Surveillance, Regulation& Response

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Carbon Monoxide

Background

- **What is it?** Odorless, colorless gas produced by incomplete combustion
- **Sources:** Unvented gas space heaters; leaking chimneys and furnaces; back-drafting from furnaces, gas water heaters, and fireplaces; gas stoves; generators and other gasoline powered equipment; automobile exhaust from attached garages; and tobacco smoke.
Health Effects of Carbon Monoxide

At low concentrations: fatigue in healthy people and chest pain in people with heart disease.

At higher concentrations: impaired vision and coordination; headaches; dizziness; confusion; nausea; angina. Can cause flu-like symptoms that clear up after leaving home.

Fatal at very high concentrations. Acute effects due to the formation of carboxyhemoglobin in the blood, which inhibits oxygen intake.

At risk populations: individuals with anemia, chronic cardiopulmonary diseases, the elderly, and pregnant women.
Carbon monoxide Data

- “An estimated 10 000/40 000 people each year will seek medical attention or miss work due to CO poisoning in the United States” (Schaplowsky et al., 1974; Hampson, 1998; Omaye, 2002).

- “Carbon monoxide (CO) may be the cause of more than one-half of the fatal poisonings reported in many countries: fatal cases also are grossly under-reported or mis-diagnosed by medical professionals.” (Raub, Toxicology, 2000).
## Carbon Monoxide in Maryland

<table>
<thead>
<tr>
<th>Cause of Death</th>
<th>2003</th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
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<tbody>
<tr>
<td>Accidental</td>
<td>21</td>
<td>5</td>
<td>9</td>
<td>7</td>
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<tr>
<td>Suicide</td>
<td>24</td>
<td>19</td>
<td>8</td>
<td>7</td>
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<tr>
<td>Undetermined</td>
<td>3</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>48</strong></td>
<td><strong>25</strong></td>
<td><strong>17</strong></td>
<td><strong>15</strong></td>
</tr>
</tbody>
</table>
Carbon Monoxide in Baltimore: Data

- **Mortality Reporting:**
  20 deaths due to accidental exposure to carbon monoxide between 2000 and 2006.

- **Maryland Poison Control Center:** 45 calls in 2 years.
Carbon monoxide surveillance

Surveillance conducted in high-risk, under-served homes since November, 2007.

- Toxipro CO detector used to check and record the maximum ambient CO level in every room of the house.
- Combustion appliances assessed.
- Residents educated about the health hazards of CO and how they can minimize the risks.
- Referrals made to the Baltimore City Fire Department, Baltimore Gas & Electric Company, and Baltimore City Housing.
- Families have purchased new stoves on their own.
- **Coming soon**: CO detectors installed.
Results

- Mean ambient level of CO in the kitchen was 0.25ppm (adjusted by the exterior CO level)
Results

Ranges that had a steady state >10ppm were no more likely to have food encrusted on them than ranges that tested high.
Policy and Programmatic Responses to CO in Baltimore

**Programmatic**
- Pursued funding for CO alarms
- Applied with Hopkins for a HUD technical studies grant on CO-NO2 exposure
- Education: CO advisory at onset of winter; CO advisory at start of CO law

**Policy**
- Consideration of regulatory changes
Potential Regulations

Regulation #1: *Requiring CO monitors*
Precedents

STATES:
- 12 states require carbon monoxide detectors in homes, including: Alaska, Illinois, Minnesota, Maryland, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Vermont, Texas and Florida.
- Five states require that all dwellings – both old and new construction -- have carbon monoxide detection devices installed. (Alaska, Illinois, Minnesota, Massachusetts and Rhode Island)

CITIES:
- 58 plus cities including: Chicago, IL, St. Louis, MO and Charlotte, NC.
Evidence Basis

- **Study of CO deaths using media clippings:** Cities with CO detector ordinances have **lower reported case fatality rates** than in cities without ordinances (Clifton et al.)

- **Study of CO calls to 911:** The mean CO concentration in homes with detectors was **18.6 ppm**, compared with **96.6 ppm** when no detector was available; 63.4% of the victims with no alarm were symptomatic, compared with 13.3% of victims with alarms.
Different Regulatory Approaches

**Question:** Do we only target properties with identified CO risks (such as gas appliances)?

**Example:** Mecklenberg, NC. *What happens when there is a power outage?*
- 9 days; 124 cases of symptomatic CO poisoning.
- 96.2% of severe poisonings occurred in homes with no working CO alarm.
Maryland’s Requirements

• Installation of carbon monoxide alarms outside of each sleeping area or within a certain distance of carbon monoxide-producing equipment.

• Only applies to buildings constructed after January 1, 2008 which rely on fossil fuel combustion for heat, ventilation, hot water or clothes dryers.

• Local entities can be more stringent.

HB 401
Baltimore City proposed regulation

- Requires CO detectors in all homes (new and old) that have a CO risk
- Lead sponsor: City counselor Jim Kraft
- Testimony in support: Baltimore City Fire Department, Baltimore City Health Department
Challenges in developing regulations

No clear standard.

- “No standards for CO have been agreed upon for indoor air. The U.S. National Ambient Air Quality Standards for outdoor air are 9 ppm (40,000 micrograms per meter cubed) for 8 hours, and 35 ppm for 1 hour.” -- EPA

- “Average levels in homes without gas stoves vary from 0.5 to 5 parts per million (ppm). Levels near properly adjusted gas stoves are often 5 to 15 ppm and those near poorly adjusted stoves may be 30 ppm or higher.” – EPA
Challenges in developing regulations

Low level CO exposure

- Evidence that low level CO exposure causes health concerns
- What is the appropriate response? Regulatory, education, or programmatic?
Questions?

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Radon/CO Regulations in Minnesota Buildings

Minnesota Department of Health
Division of Environmental Health
Indoor Air Unit
Dale F. Dorschner
651-201-4601
800-798-9050
Steps to getting RRNC Law in MN

- Define radon problem in MN
- Identify Resources and Priorities
- Identify stakeholders and valuable partners
- Influence policy change through Stakeholders
Defining RADON problem in Minnesota

- 68 “Zone 1” and 19 “Zone” 2 Counties
  - Over 80% population lives in Zone 1
  - 1 in 3 MN homes have Long-Term living space averages over 4.0 PCi/L
Defining RADON problem in Minnesota Cont...

- 2005 - St. Paul/Minneapolis Metro Area Ranked 11th among the nations largest Metro Areas in housing production per capita
- 30% of all new residential construction occurring in developed areas
- 60% in Developing Suburbs
- 10% in Rural Towns
- 2005 - 9,000 Single Family Units built in 7 county Metro Area (Estimated 2970 Homes with elevated radon levels)
MN Radon Resources

- Minnesota’s Radon Program housed at the MN Dept. of Health – Indoor Air Unit
- General Fund Budget Approx. $500K
  - MCIAA
  - Enclosed Rules
  - SIRG Match
  - School IAQ and other IEQ Issues
- Federally funded program
  - U.S. EPA State Indoor Radon Grant (SIRG)
    - Approx. $300-400K 1-1 matching dollars
MDH Radon Program Priorities

- Funded by USEPA SIRG – EPA Region V

- Established RRNC as standard building practice
  - Large number of homes being built
  - Large number of New Homes w/high radon levels
  - Compelling evidence that RRNC building practices benefits IEQ
  - Need to get ahead of the problem

- Increase Homes Tested

- Increase mitigations of homes w/ elevated radon
MDH “Business Plan” for radon risk reduction

- Establish measurable outcomes and priorities to increase the number:
  - homes built radon resistant
  - homes tested and;
  - homes mitigated

- Support research and activities that influence public policy for radon risk reduction

- Establish effective partnerships

- Capitalize on social marketing opportunities
MDH RRNC Priority Activities

- MDH Goal is to have “RRNC” building practices incorporated in all newly constructed homes
  - Recruit Builders to use RRNC practices
  - Support Research relating to RRNC
  - Market/Promote the benefits of RRNC
  - Get RRNC into the State Building Codes
Stakeholders and valuable partners

- MDH made RRNC a top priority both internally and externally
- MDH got a seat on the MN Energy Code Advisory Committee
- Promoted Builders that championed RRNC residential construction
- Identified barriers/concerns of builders to use RRNC building practices and addressed them
- Publicly promoted RRNC, H&G Shows, Builders CEU courses, News media, Etc.
Results: Builder Partnerships

- College City Homes – MDH Partner
  - Building all of their new homes RRNC with ASD
  - 150 - 200 new homes each year
  - “For the greater good”
  - LT kits left in home during closing walkthrough
  - Retrieved at 1 year walk through
Local Public Health Support-Partnership

- USEPA SIRG Monies used to support Local Public Health Agencies Outreach Activities

- MDH Establishes three priority areas annually

- MDH Publishes an RFP to local public health agencies (LPHA’s), nonprofit organizations, or universities to assist us address our priorities

- Grantees need to demonstrate how they plan to help us meet our goals and demonstrate they have a plan/process to measure their outcomes
Proposed RRNC Legislation
Who was responsible?

- State Representative – Kim Norton (Olmstead County)
- Olmstead County – Rich Peters (SIRG Grantee)
- MURC – Bill Angel (SIRG Grantee)
- St. Johns University - Dr. Dan Steck (SIRG Grantee)
- Builders Association of Minnesota (BAM)
  Opponent turned Proponent
A bill for an act relating to building codes; requiring adoption of certain provisions relating to radon control; amending Minnesota Statutes 2006, section 16B.61, by adding a subdivision.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF MINNESOTA:

Section 1. Minnesota Statutes 2006, section 16B.61, is amended by adding a subdivision to read:

Subd. 3b. Radon code. The commissioner of labor and industry shall adopt rules for radon control as part of the State Building Code for all new residential buildings. These rules shall incorporate the radon control methods found in the International Residential Code appendix as the model language, with necessary amendments to coordinate with the other adopted construction codes in Minnesota.
MN State Building Code Jurisdiction

- **502** municipalities administer the code with a designated Building Official:
- **422** cities
- **65** townships
- **20** counties (Includes 5 counties where city building officials administer the code.)
Comparison of RRNC Building Code and MN Radon Potential

Minnesota State Building Code

EPA's Map of Minnesota Radon Zones

High Radon Potential
Zone 1

Moderate Radon Potential
Zone 2

* Minnesota does not have any low radon potential areas.
Defining CO problem In MN

Current Estimates for MN

- Deaths attributed to CO poisoning during 2002-2006
  478 Minnesota-related CO deaths*

- Unintentional (accidental) non-fire related deaths attributed to CO in Minnesota
  - 89 Deaths in the past 5 years
  - estimated 18 per year

* Not only unintentional and includes non-residents who may have died in MN as well as Minnesotans who may have died in another state.
FACTS

- CO poisonings causes the most deaths of accidental poisoning in the United States

- If you live, 3-30% of people have permanent damage from CO poison

*Experimental and Clinical Neurotoxicology, 2nd Edition,*
Edited by Peter S. Spencer and Herbert H. Schaumburg
Copyright 2000 by Oxford University Press.
Estimates from 2004-2006 Data

- 20,636 people in US visit emergency departments for CO exposures
  - 14,127 CO Poisoning
  - 6,320 CO Exposures
  - 189 Possible CO Exposure

- Approximately 450 people die each year from CO poisoning (1999-2004 Data)

  – CDC MMWR, August 22, 2008
  Unintentional, non-fire related CO poisoning
MN CO Alarm Legislation

- 2006 Legislature passed New Carbon Monoxide Law
- MN Statute 299F.50
- Law requires all dwellings to have an approved and fully operational CO Alarms
**Generally:** Every single family dwelling and every unit within multifamily dwellings must have an approved and operational CO alarm installed within ten (10) feet of each room lawfully used for sleeping purposes.
Dwellings Include:

- Single-Family homes
- Multifamily Apartment units
Owners Duties

1) Must provide and install one (1) approved and operational CO alarm within ten (10) feet each room lawfully used for sleeping; and

2) Replace any required CO alarm that has been stolen, removed found missing, or rendered inoperable during prior occupancy where CO detector is missing
Effective Dates

- **January 1, 2007** all newly constructed single family homes and multifamily dwelling units shall be provided with an approved CO Alarm.

- **Effective August 1, 2008** all existing single family homes shall be equipped with an approved CO alarm meeting U/L specifications.

- **Effective August 1, 2009** all other multifamily or apartment dwelling units shall be provided with approved CO alarm.
Buy and install an Underwriters Laboratory (UL) approved CO detector

- Install a CO detector in your home or battery back-up alarm
- Replace battery as you would a smoke detector (when changing clocks in spring and fall)
- Follow manufacturer’s instructions
  - CO sensors are not good forever (5-7 years)
  - Buy new detector as per manufacturer’s instructions
Need CO and smoke alarms
Performance Regulations & Influences

- UL standard 2034 establishes performance standards
  - 30 PPM: Must not alarm
  - 70 PPM: No sooner than 60 and no later than 240 minutes
  - 150 PPM: No sooner than 10 and no later than 50 minutes
  - 400 PPM: no sooner than 4 and no later than 15 minutes
MN Enclosed Sports Arena Rule
MN Rule 4620

- Facility Certificate required for Ice arenas
- Air Quality Testing/Reporting
  - NO$_2$ Sampling
  - CO Sampling
Enclosed Sports Arenas

- Facility Certificate required for enclosed sports arenas open to general public, that permit the operation of Internet combustion engine-powered equipment or vehicles for racing, competition, demonstration or other purposes.
From This........
To This ......
DPS CO Information
http://www.fire.state.mn.us/CO/CO.htm

CSPC CO Response Guide
http://www.fire.state.mn.us/CO/CPSCCOAlarmResponseGuide.pdf

Owner Exemption
http://www.fire.state.mn.us/CO/COCertExempt.pdf

CPSC CO Q&A
http://www.cpsc.gov/CPSCPUB/PUBS/466.html
MN Enclosed Arena Laws

- Enclosed Sports arena Information
  http://www.health.state.mn.us/divs/eh/indoorair/arenas/enclosed.html

- Enclosed Ice Arena Information
  http://www.health.state.mn.us/divs/eh/indoorair/arenas/icearenas.html
Questions

★ Call:  Dale Dorschner 651-201-4603

★ Email:  dale.dorschner@state.mn.us

★ Website:
  http://www.health.state.mn.us/divs/eh/air/