



# **BUILDING A FRAMEWORK FOR HEALTHY HOUSING**

*2008 National Healthy Homes Conference*

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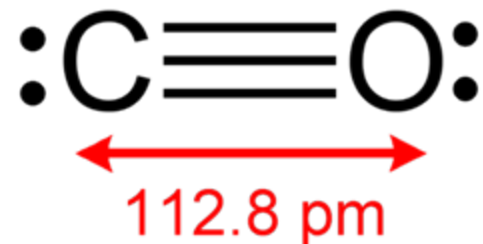
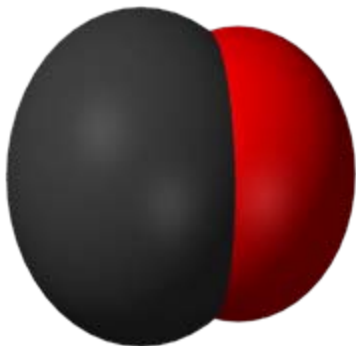
## **Carbon Monoxide - - Surveillance, Regulation & Response**

Sarah Norman, MPP  
Director, Residential Health Services  
Baltimore City Health Department

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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

Cause of Death	2003	2004	2005	2006
Accidental	21	5	9	7
Suicide	24	19	8	7
Undetermined	3	1	-	1
<b>TOTAL</b>	<b>48</b>	<b>25</b>	<b>17</b>	<b>15</b>



# 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.

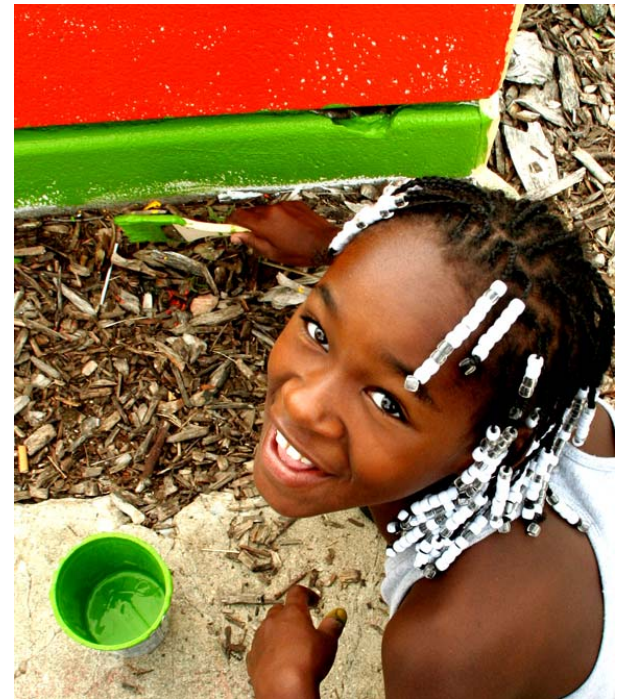




# Carbon monoxide surveillance

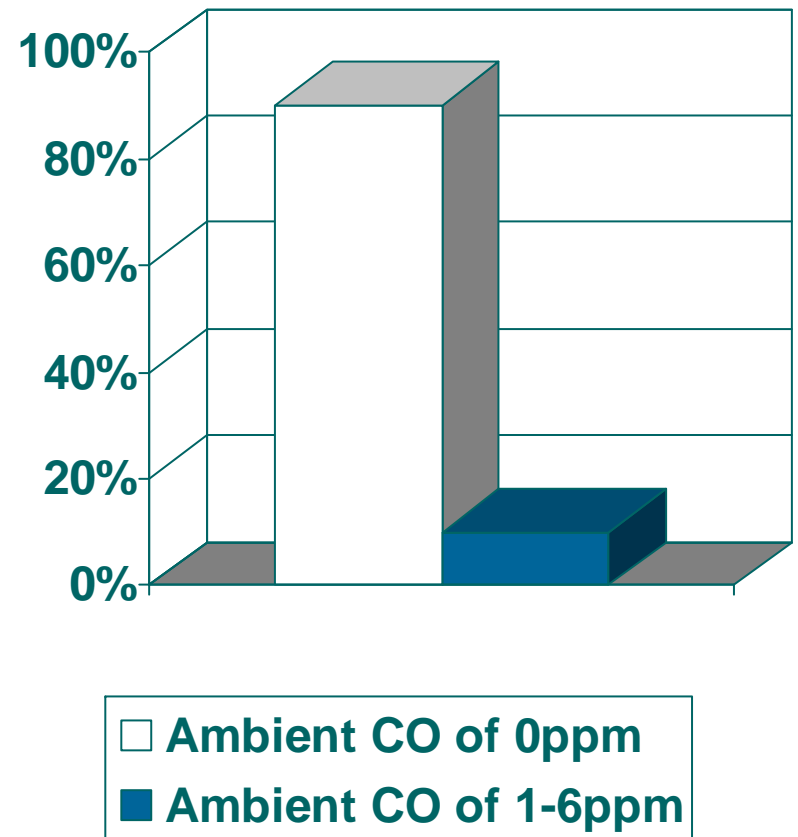
Surveillance conducted in high-risk, under-served homes since November, 2007.

- 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.



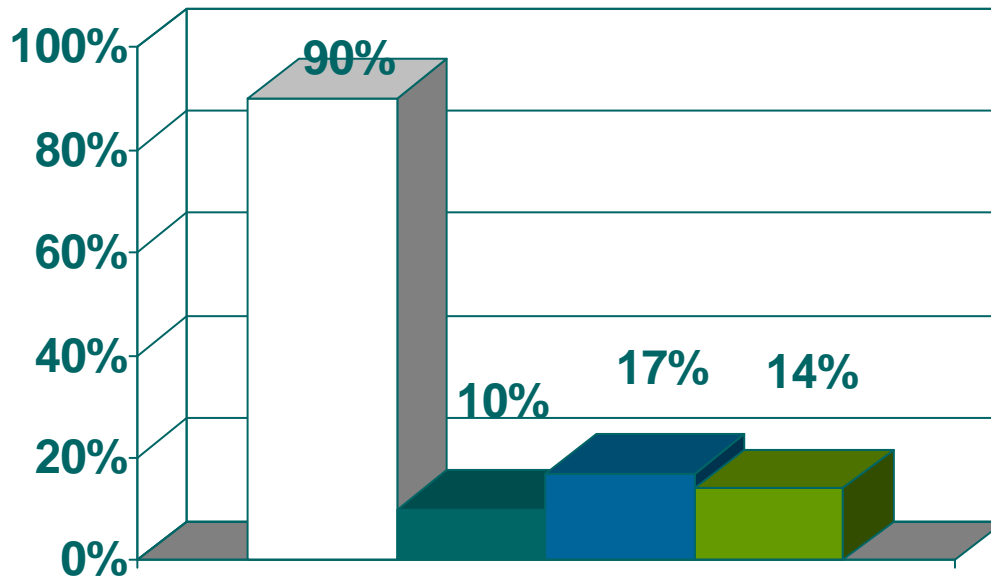
# Results

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





# Results



- Homes with gas range/oven
- Families reporting use of oven to heat home
- Gas stoves with CO levels >34ppm
- Gas ovens with readings > 34

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-NO<sub>2</sub> exposure
- Education: CO advisory at onset of winter; CO advisory at start of CO law

## Policy

- Consideration of regulatory changes



# Potential Regulations

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## Regulation #1: *Requiring CO monitors*



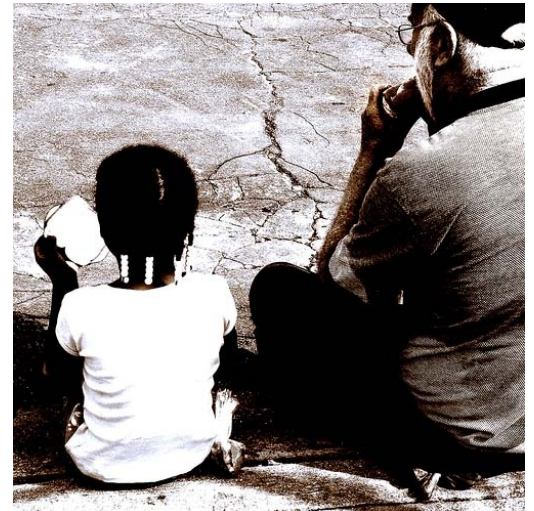
# Precedents

## 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

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- **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.

Md. Code Ann., Pub. Safety § 12-1101 to 1106 – Carbon Monoxide Alarms  
HB 401



# Baltimore City proposed regulation

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- 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

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Low level CO exposure

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



# Questions?

## Sarah Norman

Director, Residential Health Services  
Bureau

Healthy Homes Division

Baltimore City Health Department

[Sarah.Norman@baltimorecity.gov](mailto:Sarah.Norman@baltimorecity.gov)



# Radon/CO Regulations in Minnesota Buildings

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## 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

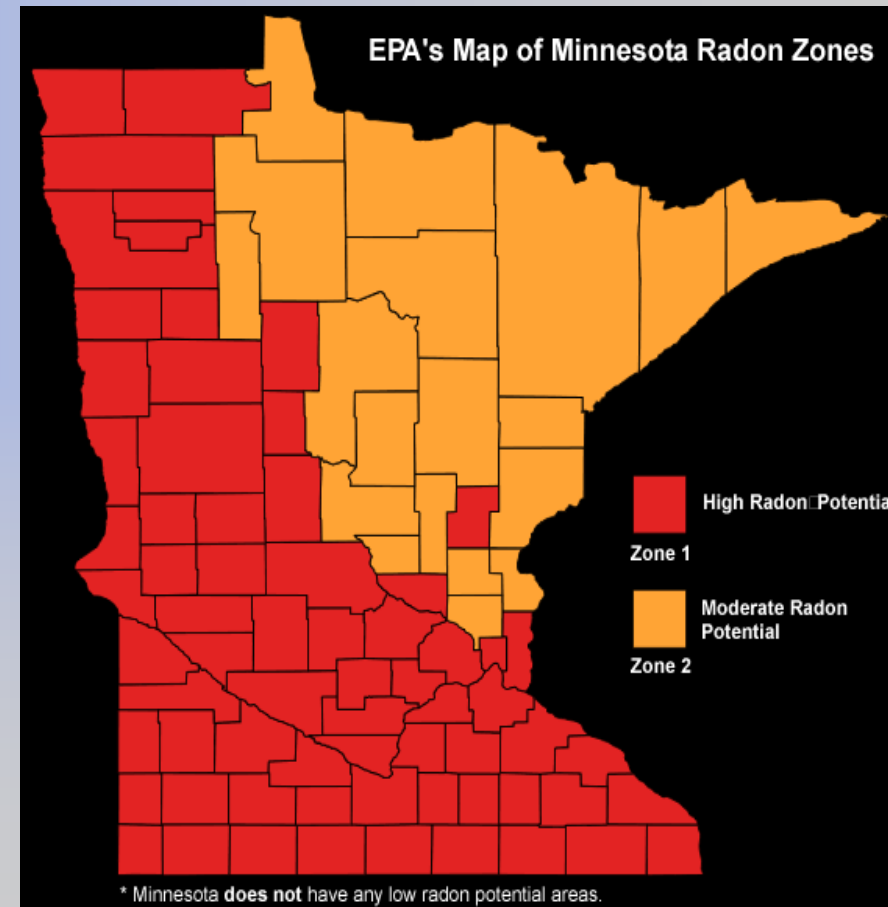
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- Define radon problem in MN
- Identify Resources and Priorities
- Identify stakeholders and valuable partners
- Influence policy change through Stakeholders

# 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...

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- 2005 - St. Paul/Minneapolis Metro Area Ranked 11<sup>th</sup> 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

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- 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

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- 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

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- 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

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- 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

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- 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

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- 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

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- **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?

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- 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

# MN RRNC Legislation

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## S.F. No. 1735, 1st Engrossment - 85th Legislative Session (2007-2008)

Posted on Apr 13, 2007

1.1A bill for an act

1.2relating to building codes; requiring adoption of certain provisions relating to

1.3radon control; amending Minnesota Statutes 2006, section 16B.61, by adding a

1.4subdivision.

1.5BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF MINNESOTA:

1.6 Section 1. Minnesota Statutes 2006, section 16B.61, is amended by adding a

1.7subdivision to read:

1.8 Subd. 3b. **Radon code.** The commissioner of labor and industry shall adopt rules for

1.9radon control as part of the State Building Code for all new residential buildings. These

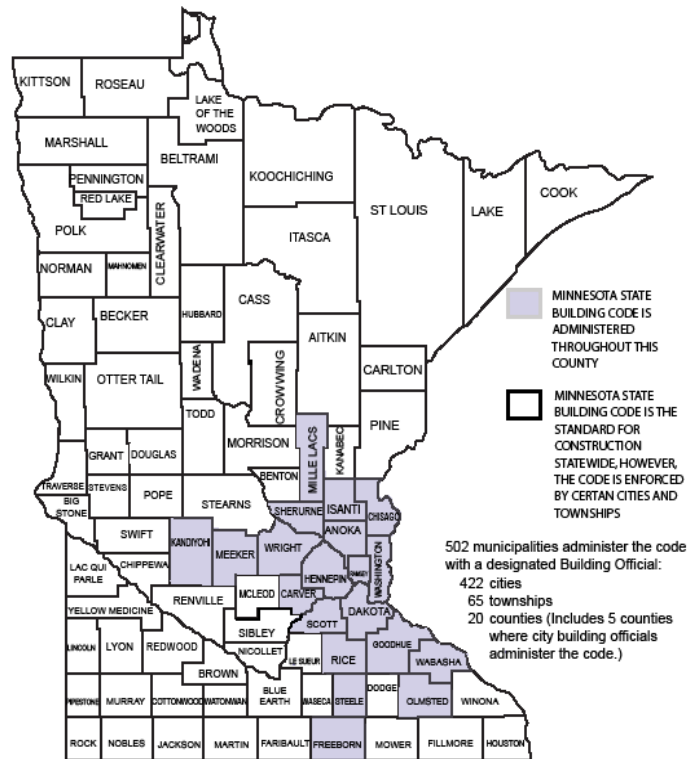
1.10rules shall incorporate the radon control methods found in the International Residential

1.11Code appendix as the model language, with necessary amendments to coordinate with  
the

1.12other adopted construction codes in Minnesota.

# MN State Building Code Jurisdiction

Minnesota State Building Code



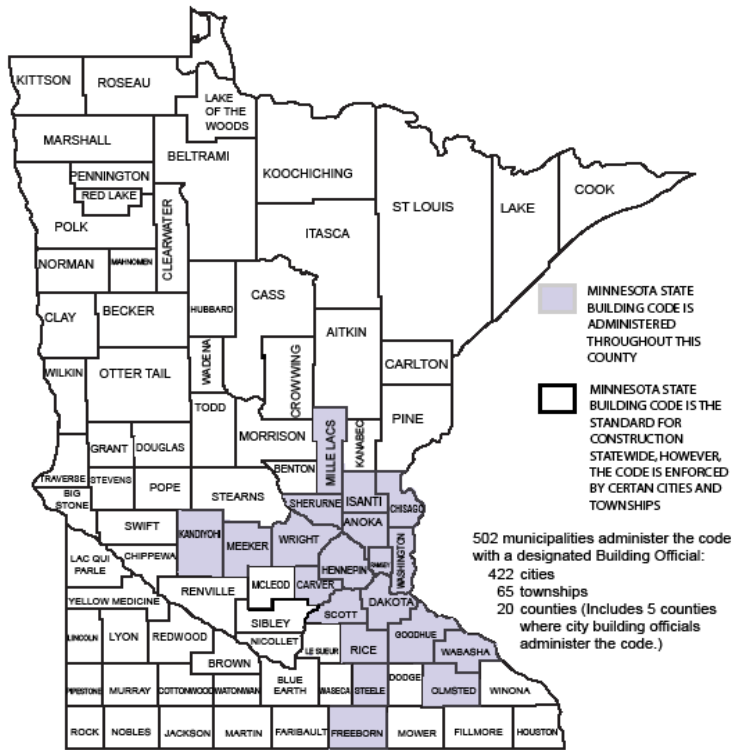
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- **502** municipalities administer the code with a designated Building Official:
- **422** cities
- **65** townships
- **20** counties (Includes 5 counties where city building officials administer the code.)



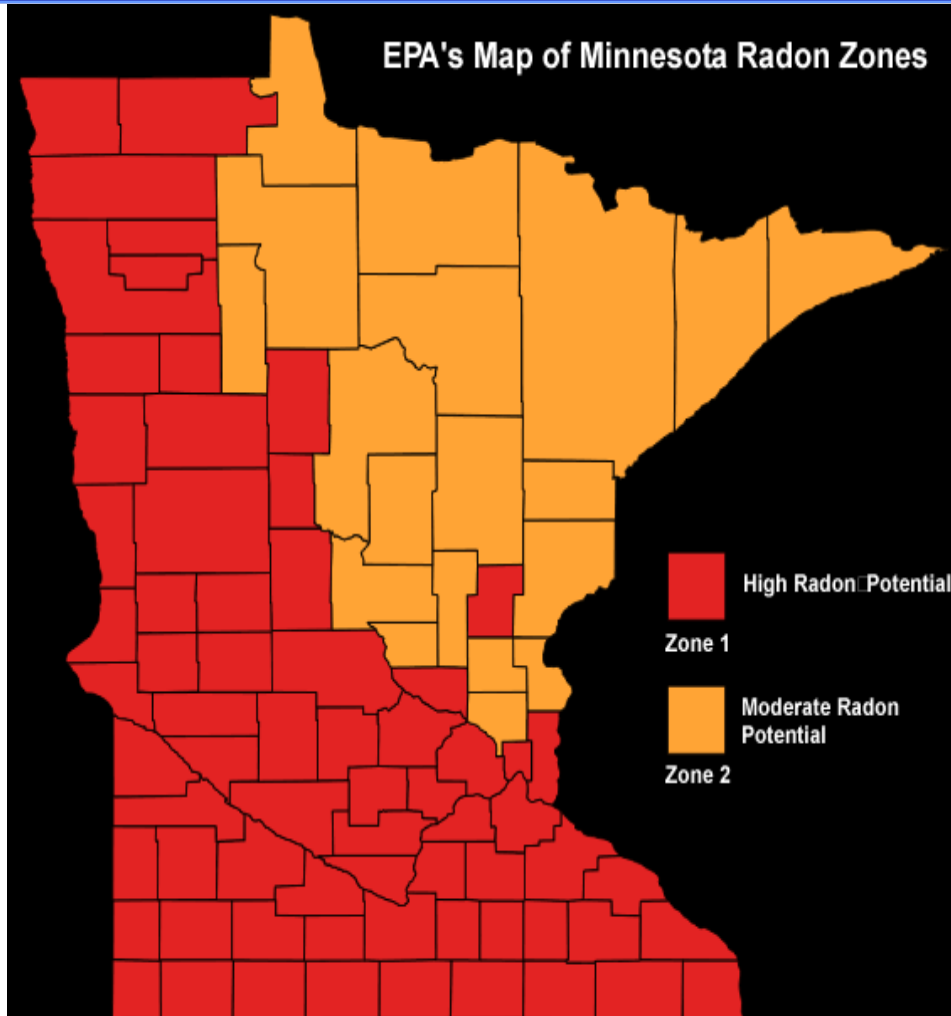
# Comparison of RRNC Building Code and MN Radon Potential

Minnesota State Building Code



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EPA's Map of Minnesota Radon Zones



\* Minnesota does not have any low radon potential areas.

# Defining CO problem In MN

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## 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

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- 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*, 2<sup>nd</sup> Edition,

Edited by Peter S. Spencer and Herbert H. Schaumburg

Copyright 2000 by Oxford University Press.

# Estimates from 2004-2006 Data

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- 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

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- 2006 Legislature passed New Carbon Monoxide Law
- MN Statute 299F.50
- Law requires all dwellings to have an **approved** and fully **operational** CO Alarms

# MN CO Alarm Law Requirements

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- ★ **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





# MN CO Alarm Law Requirements

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## 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

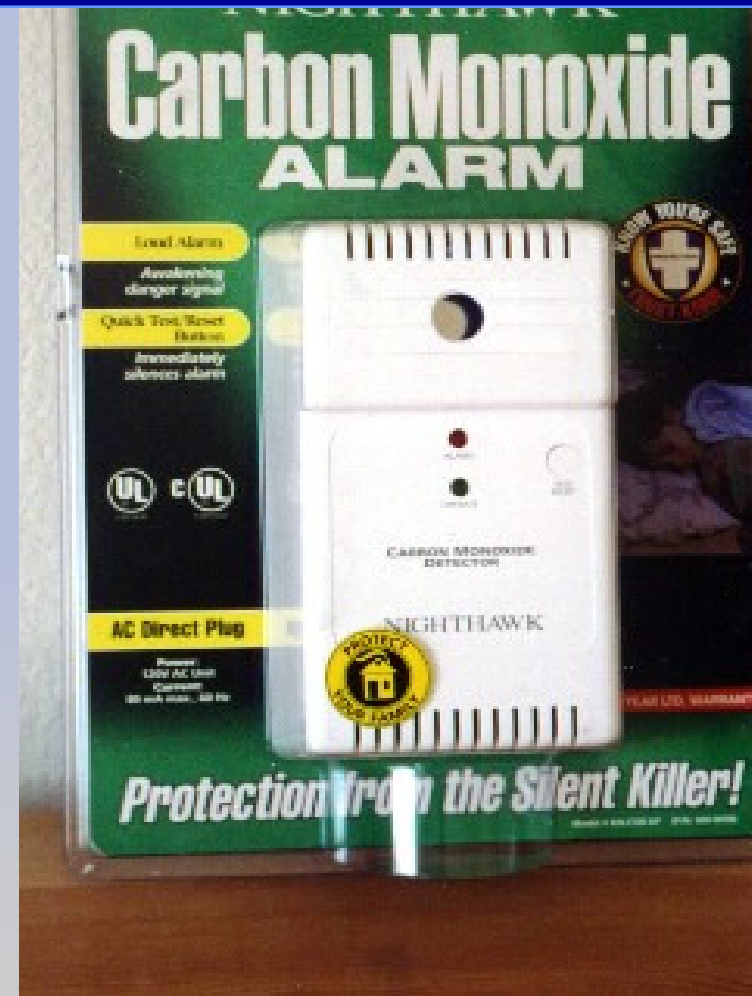
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- **January 1, 2007** all newly constructed single family homes and multifamily dwelling units shall be provided with an approved CO Alarm
- **Effective August 1, 2008** all existing single family homes shall be equipped with an approved CO alarm meeting 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

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- 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<sub>2</sub> Sampling
  - CO Sampling



# Enclosed Sports Arenas



- Facility Certificate required for enclosed sports arenas open to general public, that permit the operation of Internal combustion engine-powered equipment or vehicles for racing, competition, demonstration or other purposes.



# From This.....



# To This.....



# MN CO alarm law Information

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- 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

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- 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

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★ Call: Dale Dorschner 651-201-4603

★ Email: [dale.dorschner@state.mn.us](mailto:dale.dorschner@state.mn.us)

★ Website:

<http://www.health.state.mn.us/divs/eh/air/>