RADON in your Home Sweet Home

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Oncology Outreach Nurse Coordinator
Good Samaritan Cancer Center
Radon causes lung cancer

- Second leading cause after smoking
- Leading cause among non-smokers
- 21,000 deaths/year (EPA estimates)

What is RADON and why should we care?
Radon

- Radioactive gas
- Occurs naturally
- “Miners sickness” recognized in the 1500s
- 1950-1960 – Alpha Particles recognized
Radium

Uranium

Radon

Gas
Predicting Geologic Radon Levels
Predicting Geologic Radon Levels

Predicting Geologic Radon Levels

- Complex
- Uranium exists in all rock
- Level depends upon:
  - Existing bedrock
  - Where bedrock was transported by glaciers
  - Soil composition, permeability and moisture
Dissipation vs. Accumulation
Once Radon Gas Is In Your Home…
Circulating Alpha Particles (solid)

Radon Gas ➔ Alpha Particles (solid)
Attach to surfaces
Attach to air particles (aerosols, dust, smoke)
- Inhaled
- Direct radiation exposure
- Damage DNA in cells

Primary source of radon exposure – Inhalation
Indoor Smoking

More circulating air particles

More air particles contaminated by Alpha Particles

More Alpha Particles inhaled
Smokers exposed to high concentrations of radon in homes have greater risk of developing lung cancer than being exposed to either substance individually.

Antonio Neri
Medical Epidemiologist at the CDC

Radon-related deaths:
• 90% smokers
• 10% non-smokers
Radon Entry into Homes
Radon Entry into Homes

Air often flows toward a home’s foundation:

• Pressure differences between soil and house
• Openings in the foundation
• ↑ permeability around foundation
  • Disturbed zone (backfill)
  • Gravel bed
Radon Entry into Homes

- Cracks - concrete slabs, floors, walls
- Crawl spaces
- Sump pumps
- Construction joints
- Gaps around service pipes or plumbing
- Gaps in suspended floors
- Cavities inside walls
- Water supply
Radon Measurement

Picocuries per liter of air (pCi/L)

No indoor level is “safe” – any exposure carries risk

Highest level of radon – lowest level of home

EPA recommends action if 4.0 pCi/L or greater
Indoor Radon Levels in Nebraska

- All homes at risk
- Exposure at HOME presents our greatest risk
- Greatest indoor risk from rock & soil, not water
- Radon levels generally more concentrated in:
  - Basements
  - Ground floor rooms with contact with soil
Indoor Radon Levels in Nebraska

- NE has “very high” incidence
- Half of the NE homes tested \( \geq 4 \text{ pCi/L} \)
- All areas of the state
- Levels can vary widely - same neighborhood
- Neighbor’s level not your level
<table>
<thead>
<tr>
<th>City</th>
<th>Zip code</th>
<th>County</th>
<th>Homes Tested above 4.0 pCi/L</th>
<th>Total Number of Homes Tested</th>
<th>Average radon level (pCi/L)</th>
<th>Highest result (pCi/L)</th>
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</thead>
<tbody>
<tr>
<td>Kearney</td>
<td>68845</td>
<td>Buffalo</td>
<td>248</td>
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<td>Sarpy</td>
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<td>21.0</td>
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<tr>
<td>Kimball</td>
<td>69145</td>
<td>Kimball</td>
<td>19</td>
<td>49</td>
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<td>6.3</td>
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<tr>
<td>Laurel</td>
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<tr>
<td>Keystone</td>
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<td>Keith</td>
<td>1</td>
<td>4</td>
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**Kearney**

- 510 homes tested
- 870 homes tested above 4.0 pCi/L
- Average radon level: 5.2 pCi/L
- Highest result: 25.5 pCi/L
Buffalo County:
Zone 2 = 2 - 4 pCi/L
“Moderate Risk”

Buffalo County:
Zone 1 = ≥ 4 pCi/L
Indoor Radon Testing

Testing only way to ID indoor radon level
Testing easy and inexpensive
Recommended by EPA and Surgeon General
Test lowest living level

Two testing options:
- Do-it-yourself kits (often used as an initial test)
- Professional testing
Do-it-yourself kits:

- Home stores
- Health departments:
  - Short term test  2-90 days  $5
  - Long term test  91-365 days  $15

Follow directions
- Test on lowest living level
- Maintain “closed home” conditions
- Ø utility, laundry, bathrooms, kitchens

• Not recommended for real estate transactions
Radon Test Report #6119380
January 23, 2013 5:17 PM

01/23/13 ACTIVATED CHARCOAL RADON TEST #6119380

* Radon Test Result = 3.4 pCi/L
Professional testing:

- Radon Measurement Specialist
  - In NE: Licensure required
  - 3 Buffalo C0 (1/2014)

- $85 - $150

- Short term or long term

- Track variations

- Monitor conditions carefully
  - Post ventilation notice
  - Note weather variations
How often to test?

- Baseline & every two years
- During different seasons
- Before:
  - Renovation
  - Changing living patterns
- After:
  - Mitigation system installed
  - Foundation settling
  - Changes to HVAC system
Real Estate Transactions

If Selling a Home

- If previously tested, seller *must* disclose results

If Buying a Home

- If previously tested, ask
  - By whom & when?
  - Alterations done?
  - Retest

- If not previously tested
  - Ask for professional test
  - Add contract details
Removing Radon in Existing Home

Mitigation:

- concentration of radon

Action level = 4 pCi/l or above

Most homes can be reduced to 2 pCi/l or below

Components of mitigation:

- ✓ Suction point (perhaps > 1)
- ✓ Ventilation pipe
- ✓ Fan
- ✓ Sealants
Suction Points
INTERIOR SYSTEM

Roof vent

Attic fan

Ventilation pipe

Suction point
EXTERIOR SYSTEM

Exterior fan & ventilation pipe

Suction point
Sealant
Selecting a Mitigation Specialist

- Owner may mitigate own home
- Radon Mitigation Specialist
  - In NE: Licensure required
  - 3 in Buffalo Co (1/2014)
  - 32 in NE (1/2014)
- Obtain estimates
- Ask how system will blend in with home
# Pre & Post Mitigation Testing

20-year old ranch-style home - NW Kearney, NE

<table>
<thead>
<tr>
<th>Date</th>
<th>Description</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>November 2, 2011</td>
<td>Original Test</td>
<td>18.0 pCi/l</td>
</tr>
<tr>
<td>November 13, 2011</td>
<td>Mitigation Installation</td>
<td></td>
</tr>
<tr>
<td>November 19, 2011</td>
<td>Post Test</td>
<td>1.7 pCi/l</td>
</tr>
</tbody>
</table>
Radon Resistant New Construction (RRNC) features include either:

- Active ventilation system
- Passive ventilation system
  - Vertical pipe that passively removes soil gas by natural convection – warm air moving up
  - Fan can be added later if necessary
Radon Resistant New Construction (RRNC)

- Install an electrical junction box in the attic to permit the installation of a fan to activate the system, if needed.

- A 3- or 4-inch diameter PVC ventilation pipe vertically through the building floors. The ventilation pipe should have a "T" fitting bedded in the aggregate below the plastic sheeting and should terminate at least 12 inches above the surface of the roof.

- Seal all joints, cracks, or other openings around all penetrations of both exterior and interior surfaces, below grade, with an elastomeric sealant to provide an air-tight seal.

- Install 6-mil (or 3-mil cross laminated) polyethylene sheeting material on top of the aggregate material. The sheeting should cover the entire floor area and separate pieces of sheeting should be overlapped at least 12 inches. The sheeting should fit closely around any pipe or other penetrations of the material. Where practical, punctures or tears in the material should be sealed or covered with additional sheeting.

- Install a 4" thick layer of clean, ¼ to 2-inch size aggregate to create a permeable layer (for soil gas collection below the basement slab) and a "capillary break" from the soil beneath it.
Are RRNC techniques required in all new home construction in NE?

No

- Codes determined by city councils
- Rural areas may have no codes
- Most communities adopt the International Residential Code (IRC) for local code
- Requires extensive education & buy-in
  - Community members (health investment)
  - Builders (selling point)
## NE Communities with RRNC requirements
(as of 10-2013)

<table>
<thead>
<tr>
<th>State of Nebraska</th>
<th>No statewide code for RRNC</th>
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<tbody>
<tr>
<td>Cities of Hastings, McCook, Caroll, Madison, Norfolk, Pender and Stanton</td>
<td>Enforces IRC Appendix F</td>
</tr>
<tr>
<td>City of Wayne</td>
<td>Enforces passive radon resistant new construction techniques as part of building code</td>
</tr>
</tbody>
</table>

[http://www.epa.gov/radon/rrnc/code_listing.html#Nebraska](http://www.epa.gov/radon/rrnc/code_listing.html#Nebraska)
Is Radon a Gimmick?

• Skepticism is good

• But what other warnings have gone unheeded?

  January 2014 - 50\textsuperscript{th} anniversary of the 1964 U.S. Surgeon General’s report on smoking
  • Historic turning point in fight against tobacco
  • Number one cause of preventable death
NE Bill would require RRNC

- Introduced 1/2013
- Passed first round 1/2014
- Krist said, “Nebraska has the third highest radon emission rate in the US, he said, and radon exposure is the number one cause of lung cancer in nonsmokers.”

http://update.legislature.ne.gov/?p=8259
Credible Radon Resources:

Nebraska Radon Program 800-334-9491
http://dhhs.ne.gov/publichealthh/Pages/radon

Two Rivers Public Health Department 308-995-4778
http://www.tworiverspublichealth.com/

State of Nebraska DHHS Licensure
http://www.nebraska.gov/LISSSearch/search.cgi

National Environmental Health Association
www.neha.org/index.shtml
Credible Radon Resources:

National Radon Safety Board [www.nrsb.org](http://www.nrsb.org)
American Association of Radon Scientists and Technologists [www.aarst.org](http://www.aarst.org)
Conference of Radiation Control Program Directors [www.crcpd.org](http://www.crcpd.org)
American Lung Association [www.lung.org](http://www.lung.org)
Environmental Protection Agency [www.epa.gov/radon](http://www.epa.gov/radon)
Colorectal Screening
Mammograms
HPV Vaccine (Human Papillomavirus)
HPV Vaccine  (Human Papillomavirus)

“This is a vaccine that protects against cancer; what could be better than that?”

Shannon Stokley
Centers for Disease Control and Prevention

CDC Recommendations:
✓ Three doses beginning at age 11 or 12
✓ Girls since 2006
✓ Boys since 2011
Future presentations

Cancer 101
Cancer & genetics
How to help someone with cancer
Panel discussion
Thank You

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