Understanding Radon . . .

UNDERSTANDING RADON . . .

AN INTRODUCTION

Presented by Matt Loehr, Nebraska Radon Program

What is Radon?

Radon is a radioactive, "Noble" gas.

It does not react with other elements.

It's dangerous when it degenerates into its natural "daughter products".
The “Noble Gases” are a group of chemical elements with similar properties. Under standard temperature and pressure (STP), all are odorless, colorless, monatomic gases with very low chemical reactivity.

Radon, and the other Noble Gases, are shown in Orange.

Characteristics of Radon

- Odorless
- Colorless
- Tasteless
Understanding Radon . . .

Characteristics of Radon

- Naturally-occurring
- Radioactive
- Chemically Inert (Monatomic)

The Radioactive Decay of Radon

- Occurs spontaneously.
- Radon has a “half-life” of 3.8 days.
- An atom changes identity and releases energy.
- Radiation is released in the process.

\[\text{Rn-222} \rightarrow \text{Po-218} + \text{alpha radiation} + \text{gamma radiation}\]

As time passes, ionizing radiation is emitted from the natural decay of Radon.
Alpha Particles are created as the radon atoms decay. These particles strike the cells lining the lung, causing damage to the DNA.

Radon Decay

SURGEON GENERAL’S WARNING: Radon causes lung cancer.

U.S. Surgeon General Richard H. Carmona
January 13, 2005
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Radon is recognized as a serious national health problem by the following organizations:

- U.S. Surgeon General
- World Health Organization
- American Lung Association
- American Medical Association
- National Academy of Sciences
- [http://www.nationalacademies.org/](http://www.nationalacademies.org/)
- Environmental Protection Agency
- [http://www.epa.gov/iaq/radon/healthrisks.html](http://www.epa.gov/iaq/radon/healthrisks.html)
- Centers for Disease Control & Prevention

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Lung Cancer Survivor Story

DENNIE EDWARDS, ELYRIA, OHIO (WWW.CANSAR.ORG)

"In 2004, I had a very bad cold, so my doctor performed a chest x-ray to check for pneumonia. I've never smoked, so you can imagine how shocked I was that he found a 4.5 centimeter mass in my left lung.

Even though I've been a real estate agent for thirty-one years, I had never bothered to test my house for radon. I always informed my clients that radon testing prior to purchase was an option to protect my liability, but truly, I really didn't care if they tested or not.

Now I had to wonder whether my lung cancer had been caused by radon exposure. While the doctor scheduled my surgery, I scheduled a radon test. The result was 10 pCi/L. I had lived in the home for twelve years. Needless to say, I called a contractor to have a mitigation system installed.

Two days later I had surgery. I thought I was surely going to die. When I woke up I was choking with tubes in my throat, panic set in. They had removed my entire left lung. I'm getting better. I can walk up to a mile; but I can no longer dance, lift things, or exert myself.

"My clients now get a very personal testimonial about the importance of testing for radon."

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Radon Causes Lung Cancer

Radon is inhaled with each breath.

Radon is then exhaled, leaves the body, but . . .

If the Radon decays in your lungs, energy is released and "daughter products" are created.

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The Health Effects of Radon

- Classified scientifically as a (Class A) "known human carcinogen''.
- Second leading cause of lung cancer after tobacco smoke.
- 21,000 lung cancer deaths are attributed to radon annually.

Environmental Risk Comparisons

<table>
<thead>
<tr>
<th>Exposure Risks</th>
<th>Annual Cancer Deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticide Application</td>
<td>100</td>
</tr>
<tr>
<td>Hazardous Waste Sites</td>
<td>1,100</td>
</tr>
<tr>
<td>Toxic Outdoor Pollutants</td>
<td>2,000</td>
</tr>
<tr>
<td>Pesticide Residue on Food</td>
<td>6,000</td>
</tr>
<tr>
<td>Asbestos</td>
<td>12,000</td>
</tr>
<tr>
<td>Radon</td>
<td>21,000</td>
</tr>
</tbody>
</table>

Radon is the leading cause of lung cancer among non-smokers.
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Radon is the leading cancer killer in both men and women in the United States.

The lung cancer five-year survival rate (16.6%) is lower than many other leading cancers.

Over half of people with lung cancer die within one year of being diagnosed.

Lung cancer causes more deaths than the next three most common cancers combined (colon, breast, and pancreatic).

An effort is being made to investigate a possible correlation between radon and other diseases such as Alzheimer’s, Parkinson’s, leukemia, and breast cancer.
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SURGEON GENERAL’S WARNING

Radon Causes Lung Cancer.
You Should Test Your Home.

Radon Measurement

Radon is measured in picocuries per liter (pCi/L).

Measuring Radon

“P” Pico = Trillionth
“Ci” Curie = A Measurement of Energy
“L” Per Liter of Air
The Occurrence of Radon in Nebraska

- Nationally, one in every fifteen (1 in 15) homes exceeds the 4.0 pCi/L action level for indoor radon.

- In Nebraska, one in every two (1 in 2) homes exceeds the 4.0 pCi/L action level for indoor radon.

The Occurrence of Radon in Nebraska

- The average indoor radon concentration in US homes is 1.3 pCi/L.

- The average indoor radon concentration in Nebraska homes is 6.0 pCi/L.
The Occurrence of Radon in Nebraska

- Nationally, one in every one thousand (1 in 1,000) homes has greater than 20.0 pCi/L of indoor radon.

- In Nebraska, nearly three in every one hundred (3 in 100) homes has greater than 20.0 pCi/L of indoor radon.

Uranium Mine

- Uranium is commercially extracted at the Crow Butte mine three miles east of Crawford in northeast Nebraska.

Radon Measurement Devices

- Multiple Devices Available
  - Activated charcoal devices, charcoal liquid scintillation devices, electret ion chambers, grab radon devices, and continuous radon monitors.

- Two most commonly used in Nebraska
  1. Activated Charcoal Devices
  2. Continuous Radon Monitor
Activated Charcoal Devices

Pros
- Easy to use, and used by professionals and homeowners.
- Requires no power to operate.
- Very economical choice.

Cons
- Limited to short term sampling.
- Doesn’t track hourly variations of measurements.
- Results are not instant, must be sent to a lab for analysis.

Placement of Your Testing Device

Does Your Home Have:
- A Basement
- No Basement
- A Crawlspace?

Never Test in a Crawlspace

Lowest lived in

Test Placement Within A Room

- 3 feet from windows or exterior doors
- At least 20 inches above floor
- 4 inches from other objects
- Where it won’t be disturbed
A.C. Device Results
Protocol for Test Results
- If your results are between 4 and 7 pCi/L, conduct a long term measurement (3 months to 1 year).
- If your results are 8 pCi/L or higher, conduct another short term measurement.

Continuous Radon Monitors
Pros
- Can track hourly variations of measurements.
- Provides instant results.

Cons
- Expensive, usually only cost effective during real estate transactions.
- Requires power.

Test reports provided to buyer’s may come in different forms.
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Where does Radon come from?

The Uranium Decay Sequence . . .
The Origin of the Element Radon (Rn)

Radon Entry Into Your Home

Radon gas enters buildings as part of the soil air that is pulled into structures as they "breathe". It enters through any available openings.
Contributing factors for the concentration of radon

2. Transport of radon, which includes pathways and driving forces.
3. Ventilation rate of the building.
Five things to minimize radon entry into your home...

1. Open air supply registers in the basement.
2. Ensure return air ducts in the basement are completely sealed.
3. Fill any cracks, joints, and other openings in your basement floor.
4. Fill any openings around pipe penetrations through the first floor.
5. If you have a sump pit, take steps to make it air-tight to prevent intrusion of soil air.

Radon measurement still high?

It’s time to mitigate if you want your home below the action level of 4.0 pCi/L.
- Homeowners can install their own radon mitigation system.
- With the exception of homeowners, only licensed radon mitigation companies should be used to install a radon mitigation system.
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The Department of Health & Human Services administers the Nebraska Radon Program pursuant to Article 35 of the Radiation Control Act (71-3501).

Nebraska Radon Program Homepage

Nebraska Radon Program Activities

1. License measurement/mitigation businesses and individuals.
2. Educate the public.
3. Fund programs to support testing.
4. Conduct free radon mitigation system inspections.
As of June 2016, there are 100 licensed Radon Measurement Businesses in Nebraska. These businesses employ 199 Radon Measurement Specialists, licensed by the Department of Health and Human Services.

As of June 2016, there are 47 licensed Radon Mitigation Businesses in Nebraska. These businesses employ 84 Radon Mitigation Specialists, licensed by the Department of Health and Human Services.

Free or Low Cost Test Kits

- Nebraska Radon Program
- Test Kits

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Free or Low Cost Test Kit Availability

2015 Free or Low Cost Test Kit Statistics

- 3,831 Test Kits Purchased
- 3,671 Distributed (96%)
- 1,773 Tested and Sent to the Lab (48%)
- 848 Tests were above 4.0 pCi/L

Free Radon Mitigation System Inspections