

Lung Cancer Prevention Through Radon Mitigation -Affordable Approaches

Dr. Daniel Steck



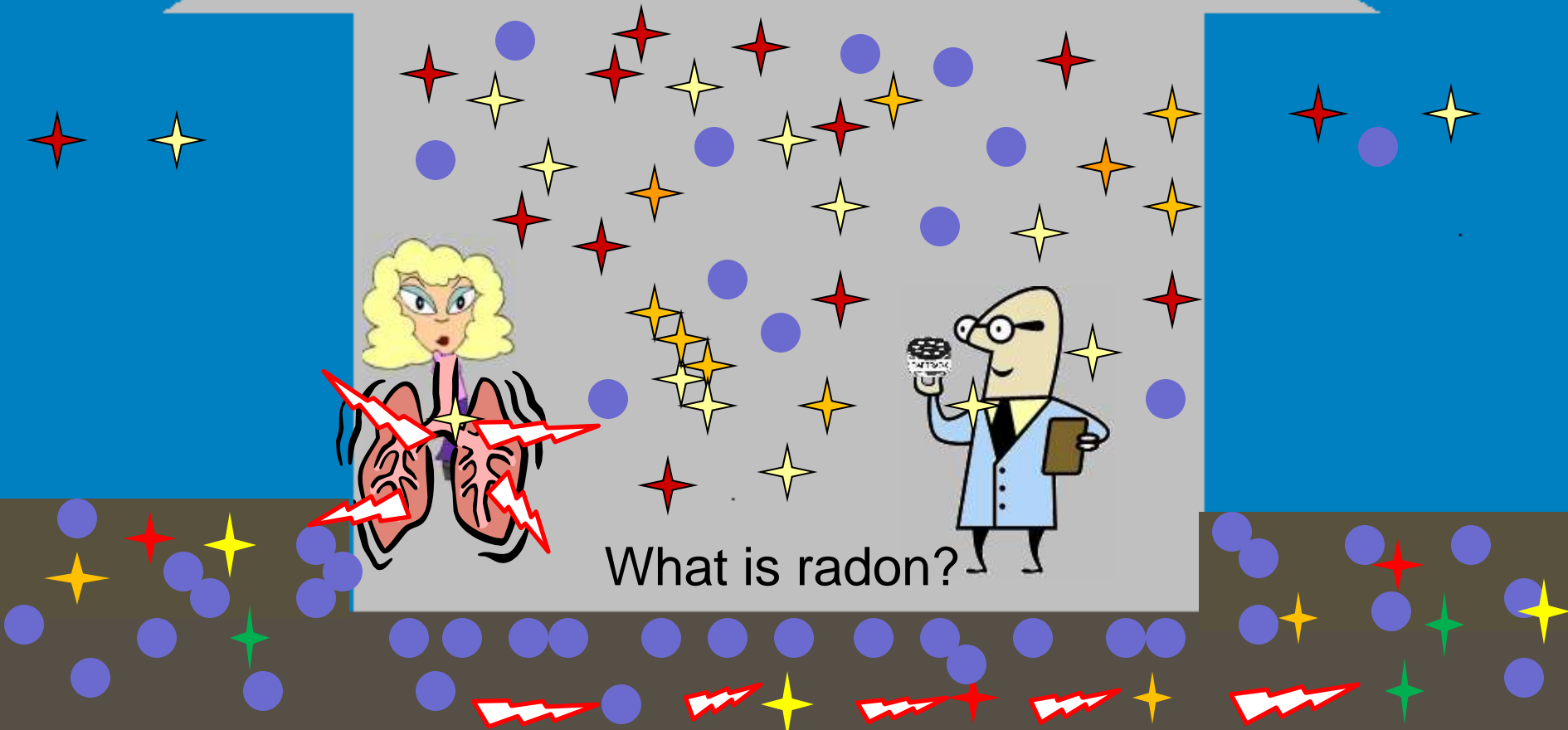
Questions

- What is radon?
- What is the risk from radon?
- How much radon are you exposed to?
- How do you reduce radon exposure?
- Is radon reduction worthwhile?

0.4 pCi/L
outdoors

1.0 pCi/L typical house

How much radon are you exposed to?
What is the risk from radon exposure?



What is radon?

Uranium_Radium _ Radon_ Polonium_ Lead_ Bi+Polonium_ Lead

What is the risk of radon exposure?

- Prolonged exposure to radon can cause lung cancer
 - Risks are known from human exposure studies as well as animal and cellular studies
 - Human studies of both industrial and residential exposure show roughly the same risk per unit radon exposure
 - Pooled residential exposure studies from across the globe suggest a risk as low as 3 pCi/L
- Lifetime risk at EPA radon action level is about 2%
 - 2,000 radon related lung cancer deaths in a population of 100,000
 - About 1 death per 100,000 is all that is tolerated for most other toxins

Public health recommendations

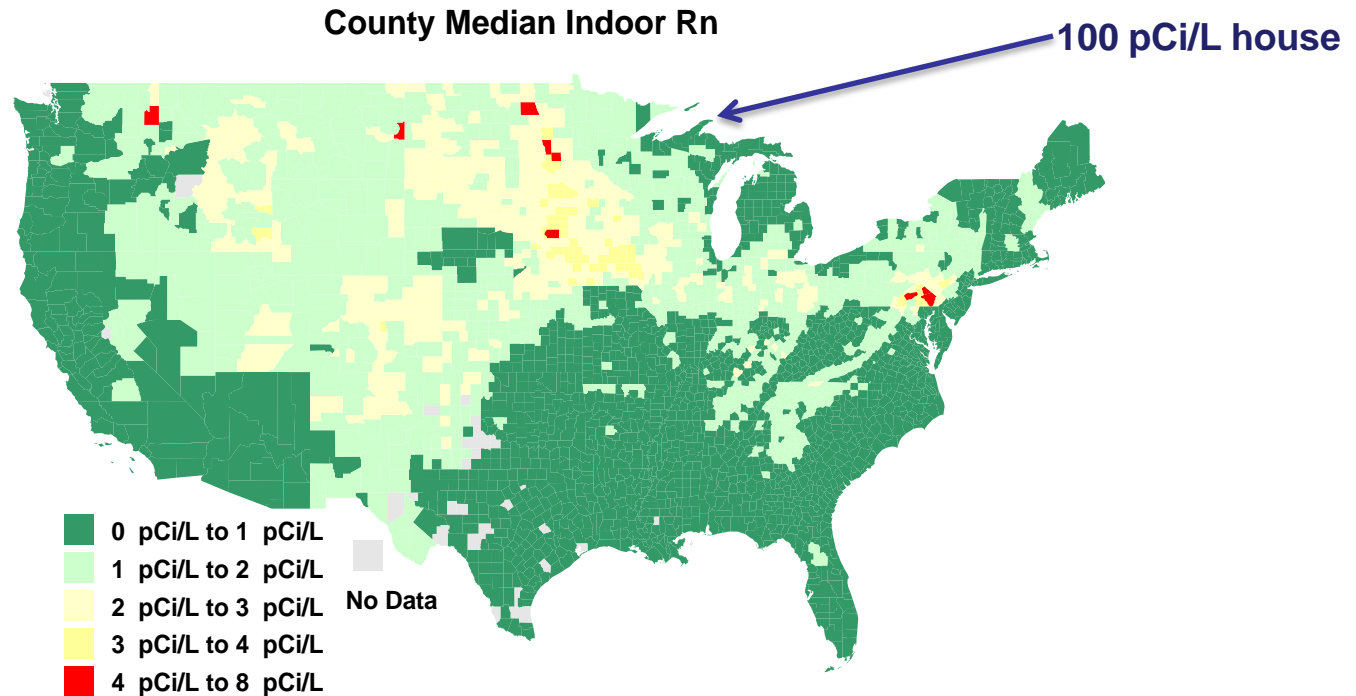
- The following organizations are among those who believe radon poses a serious health risk
 - World Health Organization
 - USEPA , CDC, Surgeons General
 - American Lung Association, Health Physics Society
- Remedial action (radon mitigation) recommendations
 - USEPA: if $R_n \geq 4.0$ pCi/L
 - consider action between 2 and 4 pCi/L
 - WHO: if $R_n \geq 2.7$ pCi/L

What is my radon exposure?

- Radon varies from place to place
 - Your exposure depends on the radon in your living and working spaces
- Radon varies from hour-to-hour, day-to-day, season-to-season...
 - Your exposure depends on the time you spend in your living and working spaces

National indoor radon variation

Maps are good for showing general “spatial variation” but not good for predicting radon in individual homes

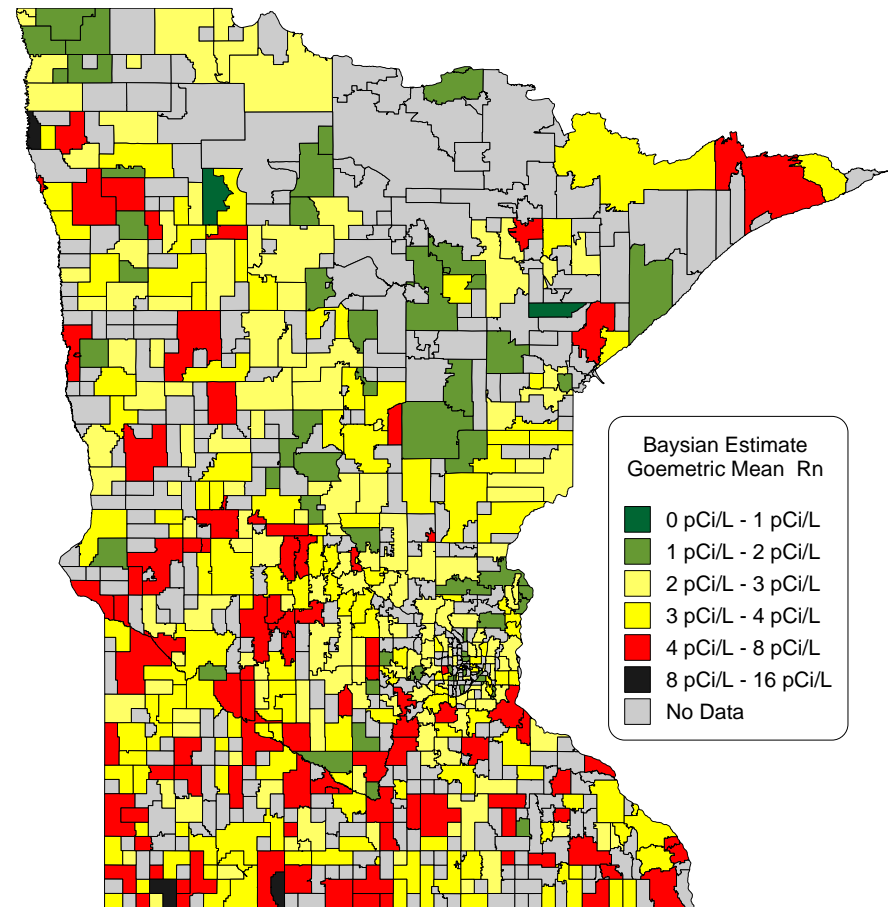


Best nationwide estimate for living space radon from random sampling and modeling

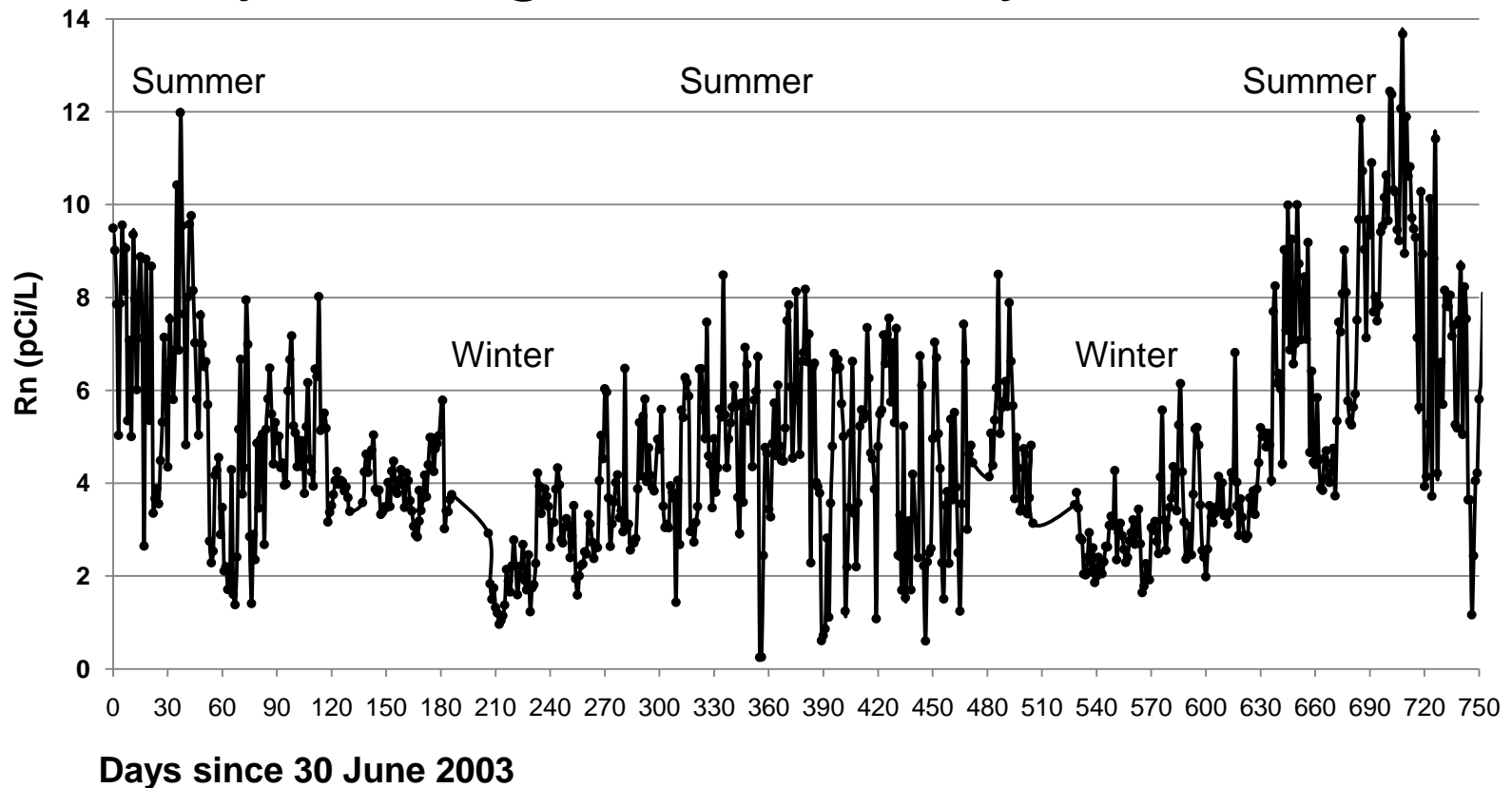
<http://eetd.lbl.gov/iep/high-radon/USgm.htm>

Regional variation in a radon prone state

- Each town color coded by “typical house” radon
 - Map based on long-term measurements in randomly-sampled living spaces
- There is about as much variation from house to house within a town as from town to town within Minnesota
- You need to measure your house to be sure



Temporal radon variation at one location: Daily average radon in my bedroom



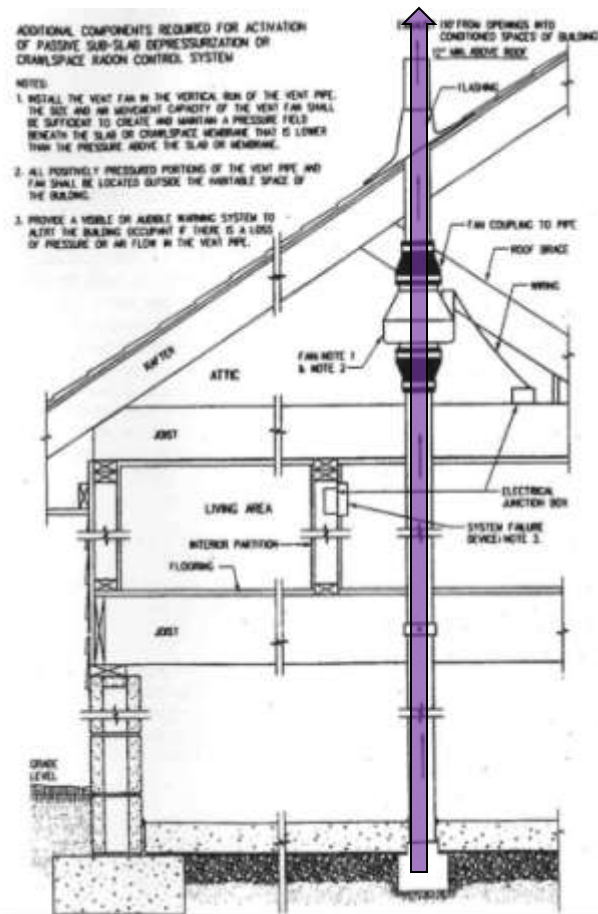
What's the best way to measure radon in my living spaces?

- By direct long-term measurements of radon concentrations in your highly-occupied spaces
 - Not with maps or short-term screening measurements
- Use one (or more) alpha track detectors (~\$25) to measure your bedroom(s) radon during a few months that includes a heating or cooling season and a transitional season.
- If you really want a rough estimate, and can afford the extra cost, make a 3 to 7 day screening measurement (~\$15) in addition to the long-term measurements

How do you reduce radon exposure?

- Mitigation by soil ventilation
 - Active Slab Depressurization
- Proved very effective in an independent evaluation of Minnesota mitigators
 - 1 pCi/L was a typical post-mitigation radon while pre-mitigation radon was about 7 pCi/L

Architectural Drawing
Active Sub-Slab Depressurization System
Uses fan to mechanically draw air from beneath the slab (or membrane) through the vent pipe.



Is radon reduction worthwhile?

- Can a significant number of lives be saved or extended by radon reduction?
- Is radon mitigation cost-effective compared to alternative actions?

Can a significant number of lives be saved or extended by radon reduction

- in the US? Yes in 1992
 - around 3,000 lung cancers could be prevented per year according to an national analysis (USEPA 92) for mitigation when $Rn \geq 4$ pCi/L with typical reduction to ~ 2 pCi/L
- in a radon prone region? YES in 2010
 - around 1,000 lung cancers could be prevented per year in the Upper Midwest according to a new, independent analysis when all houses with $Rn \geq 4$ pCi/L are mitigated
 - Improved risk models
 - Improved radon exposure estimates for the region
 - Improved radon reduction achieved by regional mitigators
 - Improved cost estimates

Is radon mitigation cost-effective compared to alternative actions

- across the US? Yes it was in the 1992 analysis
- in a radon prone region? YES it is in 2011
- Here is a summary of the 2011 analysis in the Upper Midwest
 - Details at http://www.aarst.org/proceedings/2010/08_RADON_RELATED_LUNG_CANCER_DEATHS_AND_MITIGATION_COST_EFFECTIVENESS_IN_A_RADON-PRONE_REGION.pdf

Public Health Cost Comparisons: Cost of lung cancers cured or prevented

Action	Cost (\$/life saved)
Toxin reduction in food, water, air based on value of statistical life saved (USEPA)	~\$7,000,000
Direct medical treatment costs for lung cancer	~\$900,000
Radon mitigation in Upper Midwest if $Rn \geq 4pCi/L$	~\$200,000

Public Health Cost Comparisons: Cost per year of life extension

Treatment	Cost (\$/yr extended)
Provenge for prostate cancer	~\$270,000
Direct medical treatment costs for lung cancer	~\$150,000
Colonoscopy screening age > 40+	~\$150,000
Dialysis(Medicare)	~\$130,000
Insurance “standard” limit for treatment	~\$ 50,000
Radon mitigation in Upper Midwest if Rn \geq4pCi/L	~\$15,000

Homeowner's cost perspective

- Willingness to pay to extend a year of life?
 - Individuals use different values and characteristics to decide
 - No consensus in many studies: range from \$25,000 to \$400,000
- Mitigation costs in the Upper Midwest
 - ~\$15,000 per YEAR OF LIFE EXTENDED
 - Installation about \$1000 to \$2000
 - About the same as replacing a glass patio door
 - Less than upgrading kitchen counters to stone
 - Much less than bring septic system up to code
 - Operating costs ~\$1.50 /day; covers all occupants
 - About the same as an incandescent light
 - Less in more temperate climates than the Upper Midwest

Conclusions

Is radon reduction worthwhile?

- Yes because radon mitigation could prevent a substantial number of lung cancers
- Yes because radon mitigation is more cost-effective than curing the cancer through medical treatment
- Yes because widespread radon measurement and mitigation provide an affordable way to extend lives compared to many other preventive public health actions.

Contact and resources

- Dr. Dan Steck 800-820-3209 dsteck@csbsju.edu
 - Supporting documents at AARST
 - http://www.aarst.org/radon_research_papers.shtml
- Other sources
 - WHO : www.who.int/ionizing_radiation/env/radon/en/index1.html
 - EPA 92 <http://nepis.epa.gov/Exe/ZyPURL.cgi?Dockey=000001L3.txt>
 - Hirth HA, Chernew ME, Miller E, Fendrick M,. Weissert WG, Willingness to Pay for a Quality-adjusted Life Year: In Search of a Standard (Med Decis Making 2000;20:332-342)