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DEPARTMENT OF ENVIRONMENTAL PROTECTION

Bureau of Radiation Protection

PA's Radon Experiences

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CARST Meeting

April 23, 2018

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Overview of This Presentation

- Provide short history of radon in PA
- Review current PA Radon Program
- Note health effects
- Explain radon testing and mitigation
- Give an overview of several radon studies
- Describe a recently discovered very high radon area, and actions taken
- Note some needed initiatives
- Time for Q&A

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Radon – what is it?

Rn 86 (222)

Density 9.73 g/L

Boiling point -62°C

Melting point -71°C

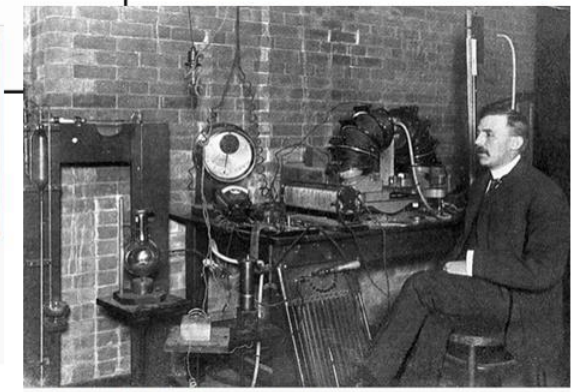
F.E. Dorn, 1900

Ernest Rutherford

(Xe) $4f^{14}$ $5d^{10}$ $6s^2$ $6p^6$

Emanation, Niton, Rn

Emission spectrum of radon, photographed by Ernest Rutherford in 1908. Numbers at the side of the spectrum are wavelengths. The middle spectrum is of radon, while the outer two are of helium (added to calibrate the wavelengths).



Rutherford at McGill University in 1905

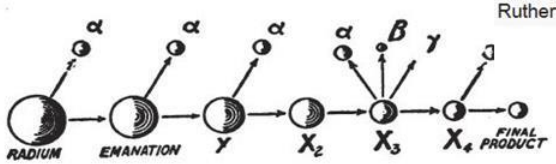


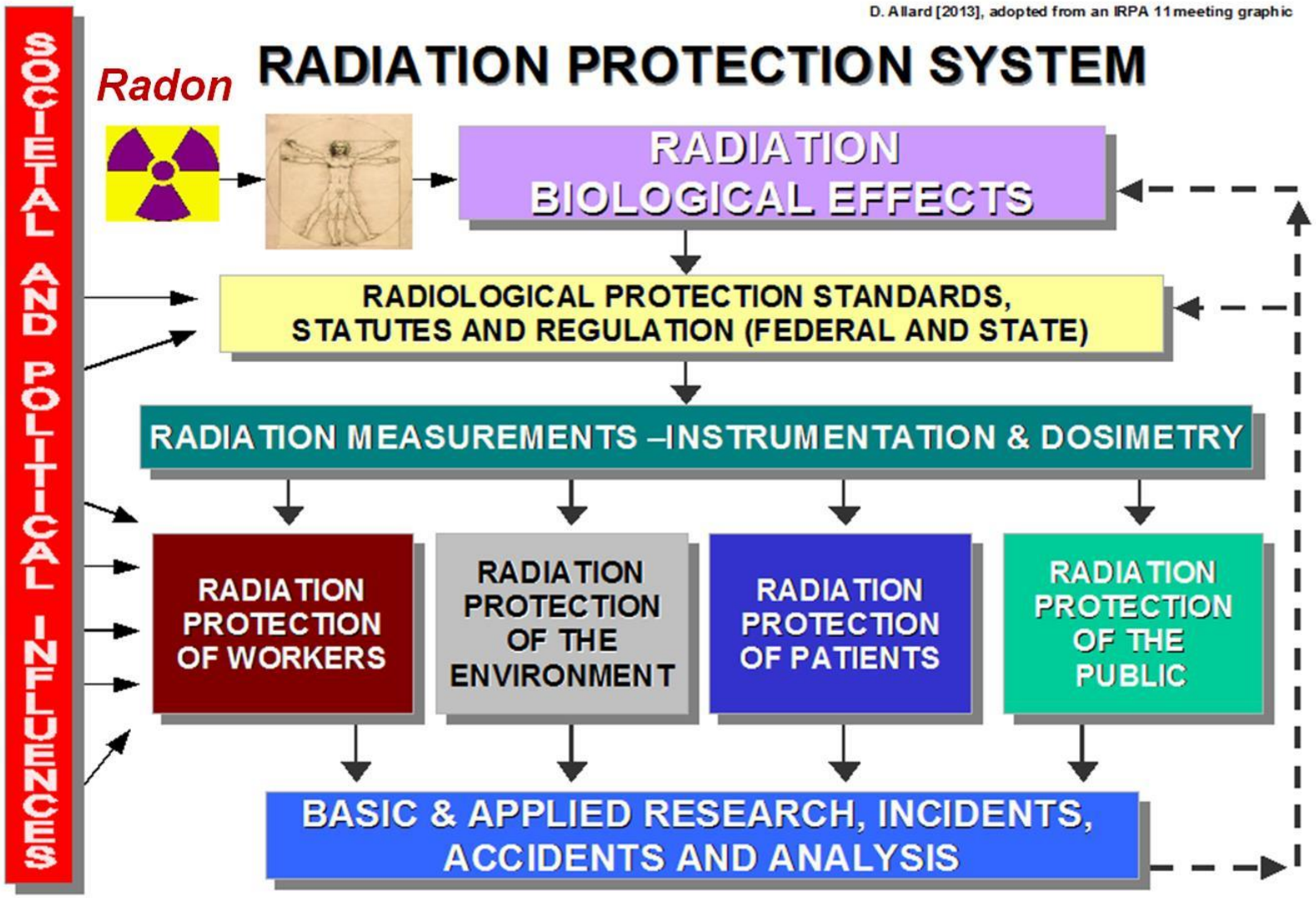
Fig. 48.—DIAGRAM TO REPRESENT THE DISINTEGRATION OF A RADIUM ATOM (AFTER RUTHERFORD)

Rutherford

URANIUM 238 (U238) RADIOACTIVE DECAY

type of radiation	nuclide	half-life
	uranium-238	4.47 billion years
α	thorium-234	24.1 days
β	protactinium-234m	1.17 minutes
β	uranium-234	245000 years
α	thorium-230	8000 years
α	radium-226	1600 years
α	radon-222	3.823 days
α	polonium-218	3.05 minutes
α	lead-214	26.8 minutes
β	bismuth-214	19.7 minutes
β	polonium-214	0.000164 seconds
α	lead-210	22.3 years
β	bismuth-210	5.01 days
β	polonium-210	138.4 days
α	lead-206	stable

Radiation Protection



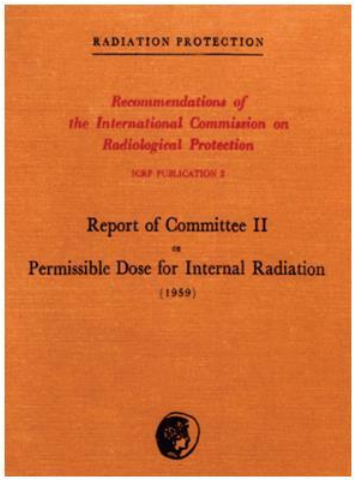
ICRP RP Recommendations

- Justification
- Optimization [ALARA]
- Limitation

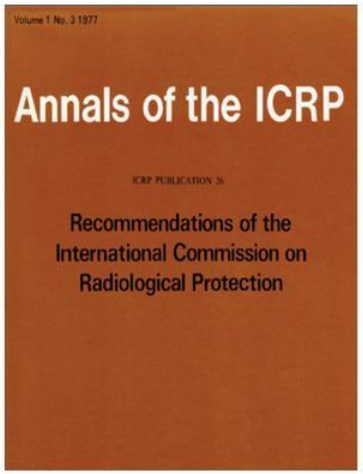
> Existing Conditions

> Planned Scenarios

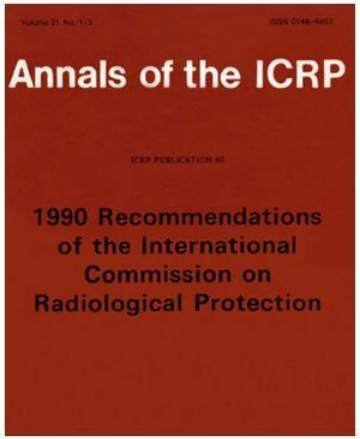
> Emergencies



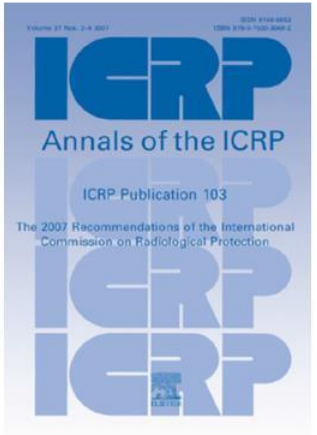
ICRP 2



ICRP 26/30

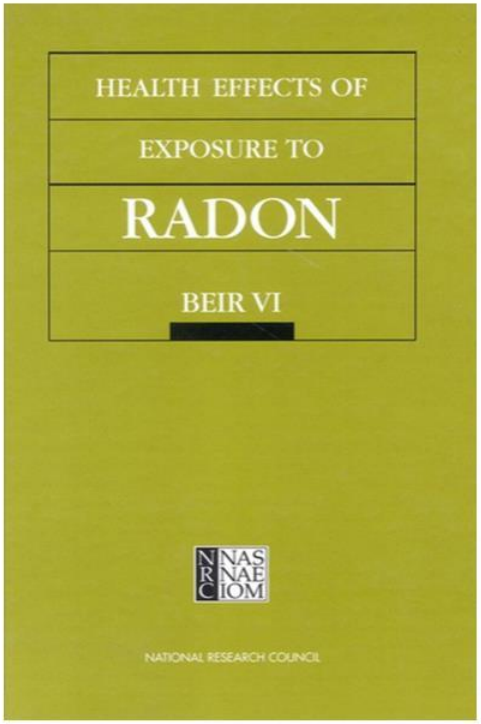


ICRP 60

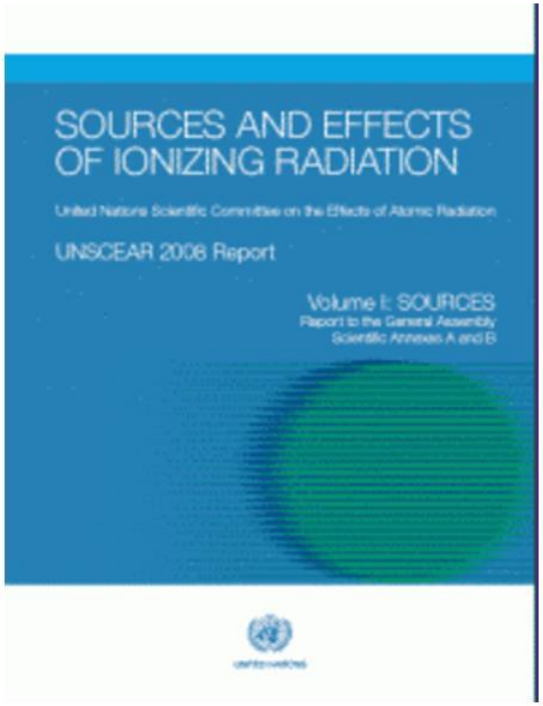


ICRP 103

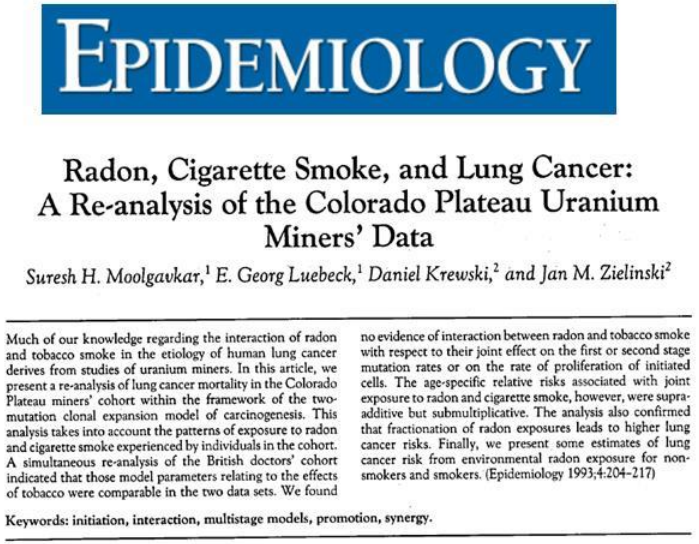
Radon Studies, Reports and Papers



NAS - BEIR VI Report



UNSCEAR 2008 Vol. 1, Annex B



EPIDEMIOLOGY

Radon, Cigarette Smoke, and Lung Cancer: A Re-analysis of the Colorado Plateau Uranium Miners' Data

Suresh H. Moolgavkar,[1] E. Georg Luebeck,[1] Daniel Krewski,[2] and Jan M. Zielinski[2]

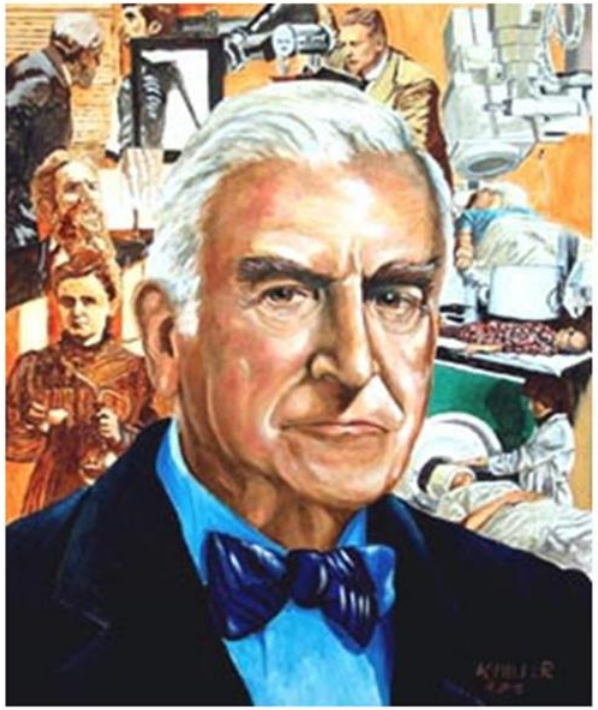
Much of our knowledge regarding the interaction of radon and tobacco smoke in the etiology of human lung cancer derives from studies of uranium miners. In this article, we present a re-analysis of lung cancer mortality in the Colorado Plateau miners' cohort within the framework of the two-mutation clonal expansion model of carcinogenesis. This analysis takes into account the patterns of exposure to radon and cigarette smoke experienced by individuals in the cohort. A simultaneous re-analysis of the British doctors' cohort indicated that those model parameters relating to the effects of tobacco were comparable in the two data sets. We found no evidence of interaction between radon and tobacco smoke with respect to their joint effect on the first or second stage mutation rates or on the rate of proliferation of initiated cells. The age-specific relative risks associated with joint exposure to radon and cigarette smoke, however, were supra-additive but submultiplicative. The analysis also confirmed that fractionation of radon exposures leads to higher lung cancer risks. Finally, we present some estimates of lung cancer risk from environmental radon exposure for non-smokers and smokers. (Epidemiology 1993;4:204-217)

Keywords: initiation, interaction, multistage models, promotion, synergy.

EXAMPLE

Uranium Miner Studies

NCRP - Lauriston S. Taylor



Taylor painting by Ken Miller

"Radiation protection is not only a matter of science. It is a problem of philosophy, and morality, and the utmost wisdom."

(L.S. Taylor, 1956)

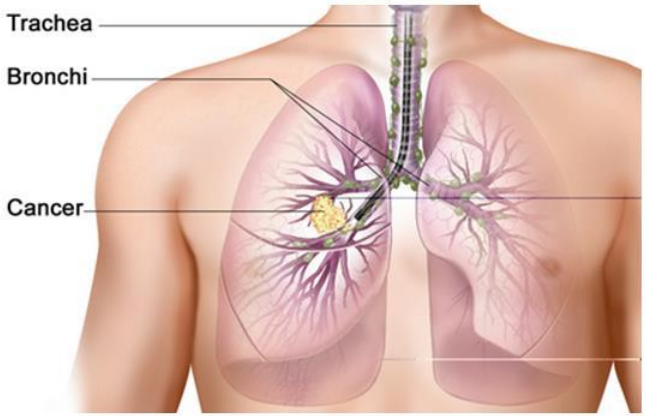
NCRP
National Council on Radiation Protection & Measurements

Radiation & Radon Exposure

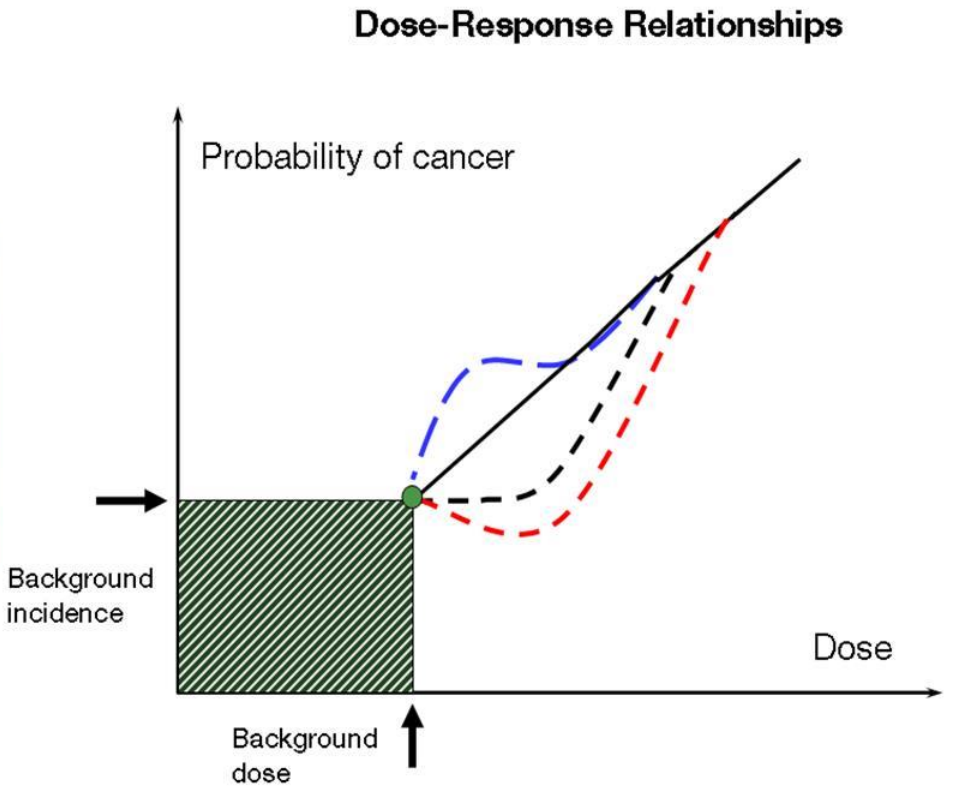
Biological Effects

Cancer – assume a linear no threshold (LNT) model

Radon is a lung cancer risk.



EPA estimates ~21,000 lung cancers per year from radon; smokers have highest risk.



See NCRP Report No. 136 (2001) for a detailed description of the contrasting types of dose-response relationships.

Radiation Dose & Control Limits

*** **Radon** ***

EPA: 4 pCi/L (148 Bq/m^3) public 'action level'

NRC: 30 pCi/L workers [10CFR20]

OSHA: 100 pCi/L workers [29CFR1910.1096

ICRP: 300 Bq/m^3 (8.1 pCi/L) public 'reference level'

Canada: 200 Bq/m^3 (5.4 pCi/L) public ref. level

MSHA: 4 WLM/yr workers [30CFR57.5038]

Note: 1 pCi/L = 37 Bq/m^3

ICRP

NCRP National Council on Radiation Protection & Measurements

UNITED STATES DEPARTMENT OF LABOR

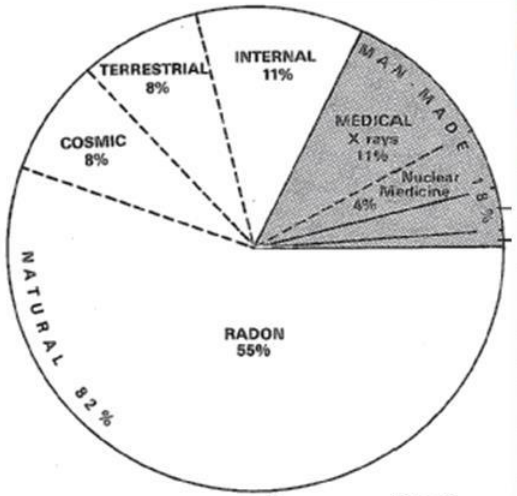
Average Radiation Dose - USA

All Exposure Categories
Collective Effective Dose (percent), 2006

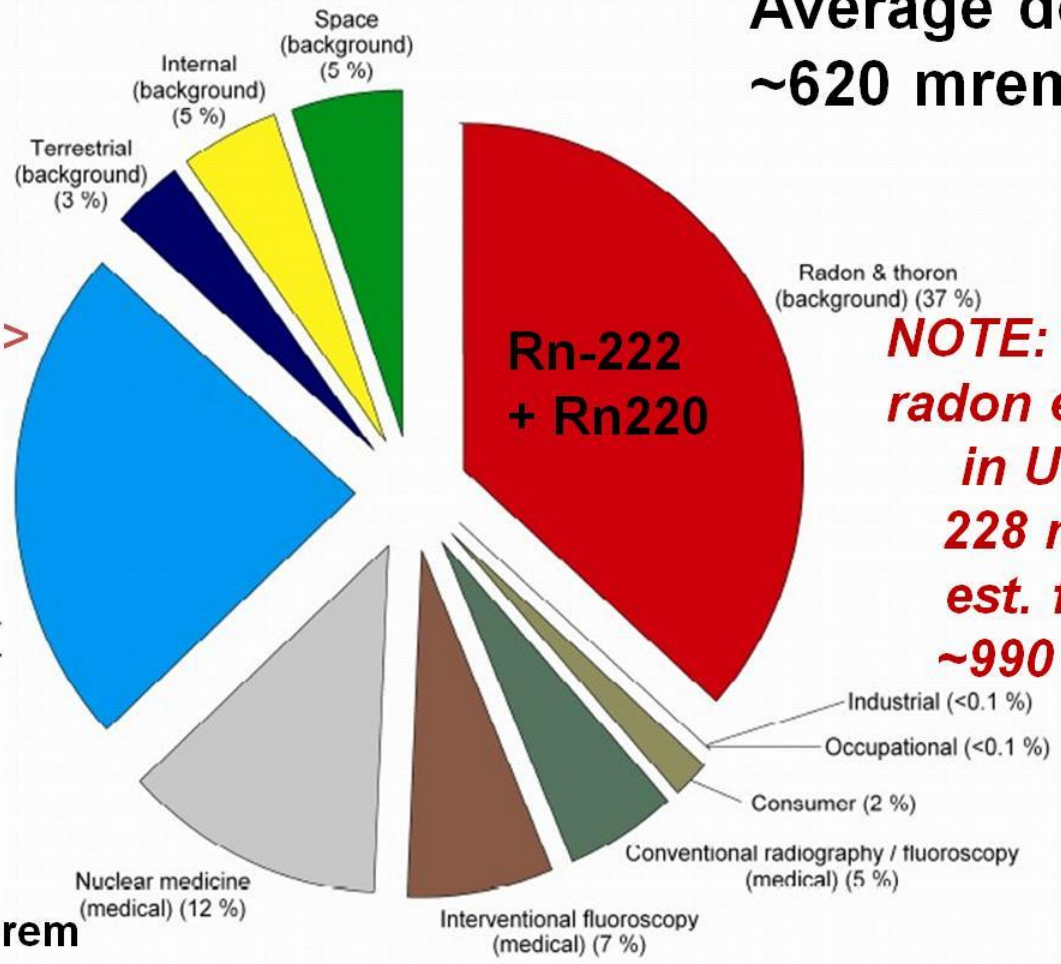
NCRP Rpt. 160

Average dose ~620 mrem/yr

Medical Dose from CT >



^ **1986** **Ave: ~360 mrem**



NOTE: average radon eff. dose in USA is 228 mrem; est. for PA ~990 mrem

Rev 10-14-2015

Radon in Soil & Groundwater

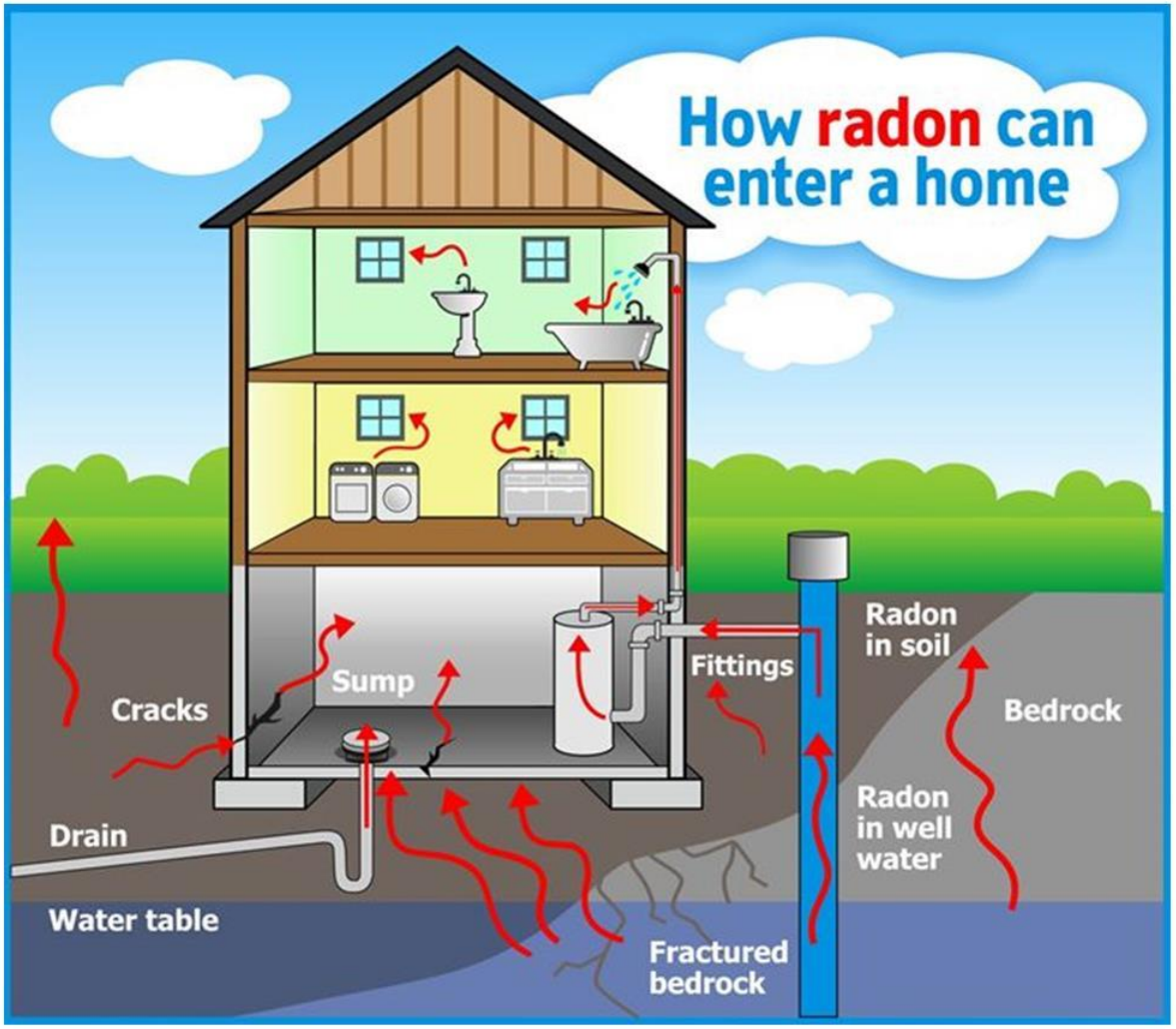


Figure by PA DEP

In PA, the main route of entry for radon is from penetrations and cracks in the basement floor and walls.

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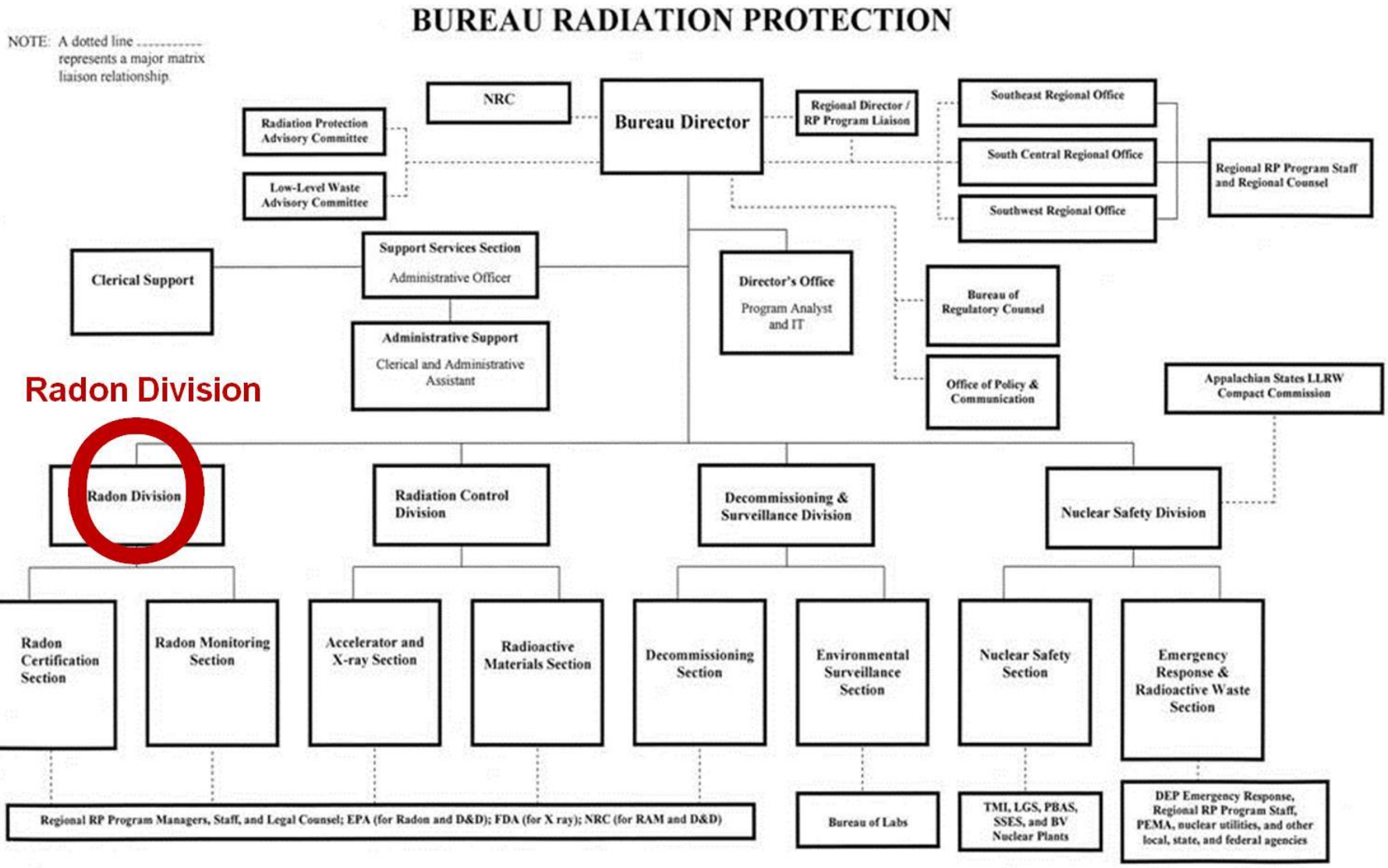
Radiation Control in USA

In PA

DEP: X rays, Accelerators, Radon, and Radioactive Materials & Emerg. Prep.

PA DEP - BRP


BUREAU RADIATION PROTECTION
NOTE: A dotted line ---------- represents a major matrix liaison relationship
NRC
Radiation Protection Advisory Committee
Low-Level Waste Advisory Committee
Bureau Director
Regional Director / RP Program Liaison
Southeast Regional Office
South Central Regional Office
Southwest Regional Office
Regional RP Program Staff and Regional Counsel
Clerical Support
Support Services Section
Administrative Officer
Administrative Support
Clerical and Administrative Assistant
Director's Office
Program Analyst and IT
Bureau of Regulatory Counsel
Office of Policy & Communication
Appalachian States LLRW Compact Commission
Radon Division
Radon Division
Radiation Control Division
Decommissioning & Surveillance Division
Nuclear Safety Division
Radon Certification Section
Radon Monitoring Section
Accelerator and X-ray Section
Radioactive Materials Section
Decommissioning Section
Environmental Surveillance Section
Nuclear Safety Section
Emergency Response & Radioactive Waste Section
Regional RP Program Managers, Staff, and Legal Counsel; EPA (for Radon and D&D); FDA (for X ray); NRC (for RAM and D&D)
Bureau of Labs
TMI, LGS, PBAS, SSES, and BV Nuclear Plants
DEP Emergency Response, Regional RP Program Staff, PEMA, nuclear utilities, and other local, state, and federal agencies

Legislative Authority

- **Radiation Protection Act (Act 1984-147)**
- **Solid Waste Management Act (Act 1980-97)**
- **Appalachian States LLRW Compact Act (Act 1985-120)**
- **LLRW Disposal Act (Act 1988-12)**
- **LLRW Disposal Regional Facility Act (Act 1990-107)**
- **Radon Certification Act (Act 1987-43)**

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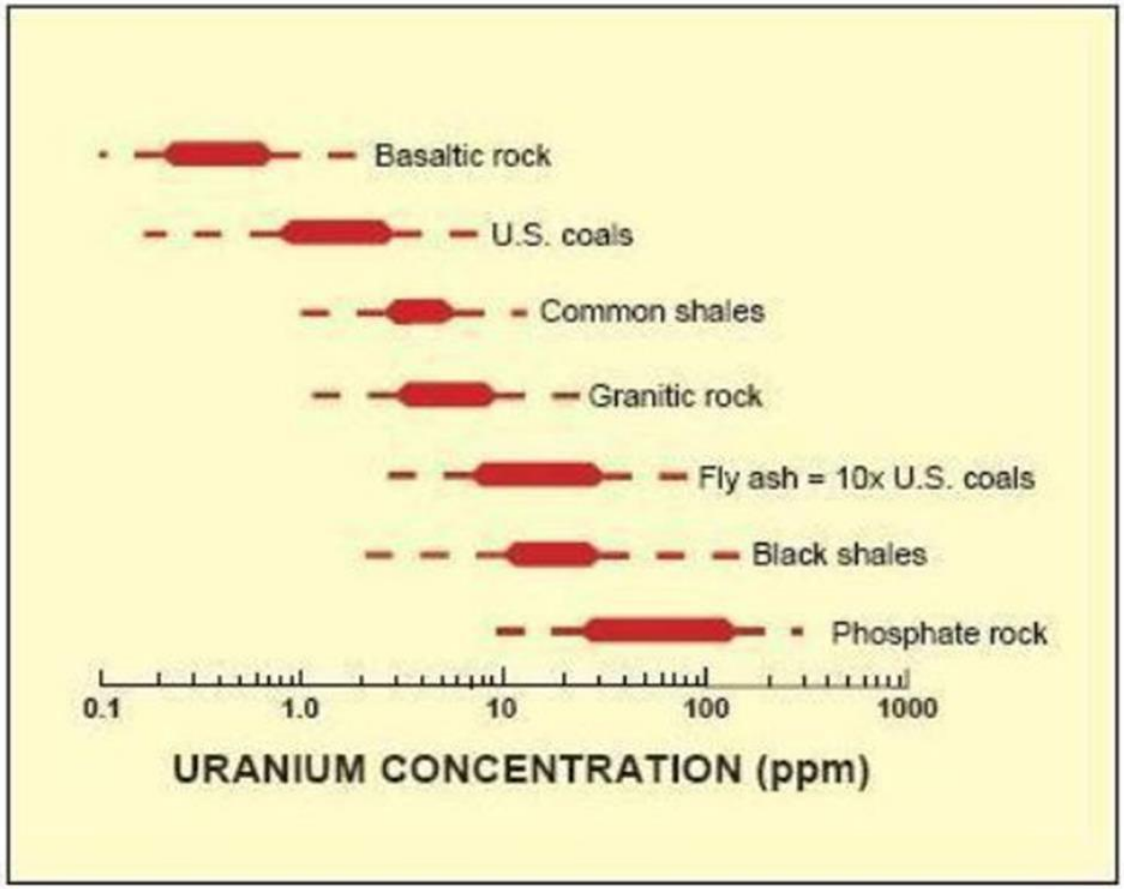
Uranium Concentrations



Typical range of uranium concentration in coal, fly ash, and a variety of common rocks.

c1978 C. PA Radon Study by PP&L.

BRP was preparing to do follow-up work, then we got busy…

Figure 1. Graph from Radioactive Elements in Coal and Fly Ash: Abundance, Forms, and Environmental Significance. U.S. Geological Survey Fact Sheet FS-163-97. October, 1997

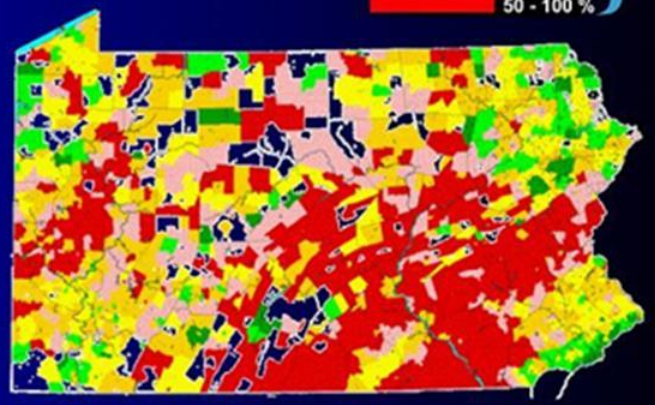
Dec. 1984 - the "Index House"

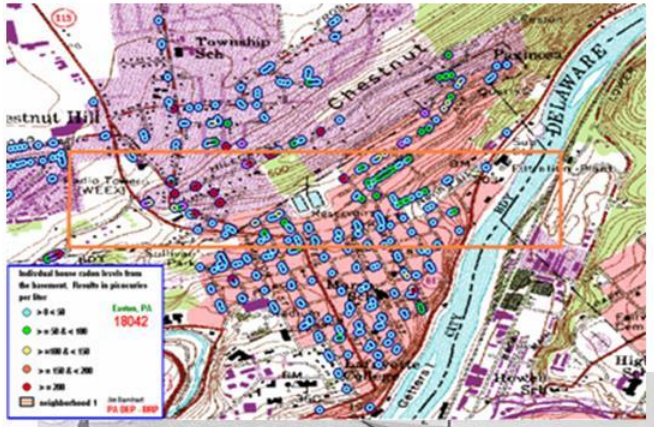
LGS employee's house in Boyertown, PA caused radiation alarms at this NPP.

Rn Radon
Atomic Number: 86
Atomic Mass: (222)

Zip Code map of Pennsylvania

This map of Pennsylvania shows the % of known test results that exceed EPA's action guideline of 4.0 picocuries per liter. It is estimated that over 40% of the homes in Pennsylvania exceed the EPA's action guideline.

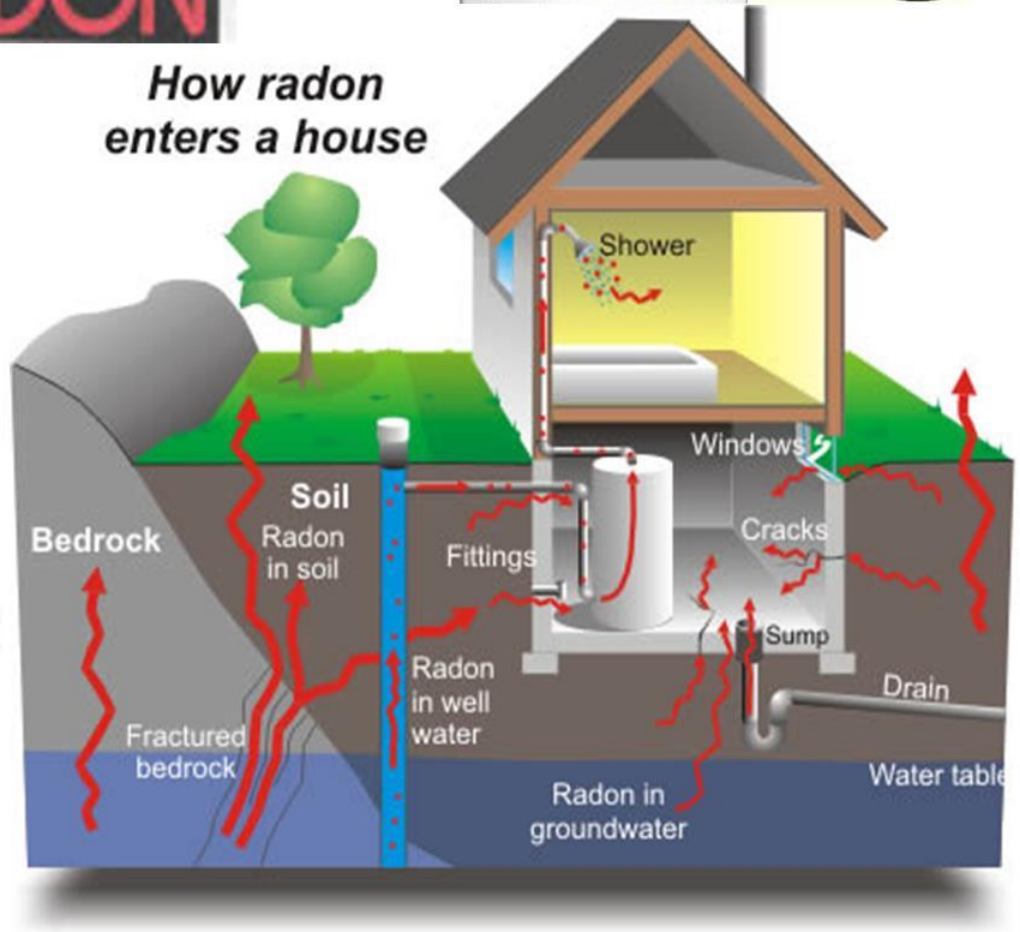




Radon-222

- **EPA's c1988 indoor radon 'action level' set at 4 picocuries per liter (4 pCi/L)**

- **Versus the 1984 "Index House" with 2,600 pCi/L!!**



The 'Index House' in 1984

The Pennsylvania Radon Story

by Thomas M. Gerusky

http://www.dep.state.pa.us/brp/Radon_Division/PA_Radon_Story1.htm
accessed 12-8-2009

ABSTRACT

In December 1984, the Pennsylvania Bureau of Radiation Protection found itself confronted with the discovery of a home in eastern Pennsylvania having the highest level of radon daughters ever reported. The Bureau responded with a massive radon monitoring, educational, and remediation effort. As of November 1986, over 18,000 homes had been screened for radon daughters; of which, approximately 59% were found to have levels in excess of the 0.020 Working Level guideline. Pennsylvania's response to the indoor radon problem is detailed in this article.

PENNSYLVANIA DER

The 'Index House' in 1984

THE PENNSYLVANIA EXPERIENCE WITH INDOOR RADON

by

MARGARET A. REILLY, CHIEF
Commonwealth of Pennsylvania

Presented at:

ATOMIC INDUSTRIAL FORUM
CONFERENCE ON NUCLEAR INDUSTRY RADIATION ISSUES:
1986 AND BEYOND

1. Indoor radon/radon progeny concentration dependencies:
2. False beliefs held by radon novices:
3. If you think you don't have a radon problem, you haven't looked hard enough.
4. Nowhere is it written that radon/radon progeny data have to make sense.
5. When radon/radon progeny data begins to make sense, you have probably settled on a false conclusion.

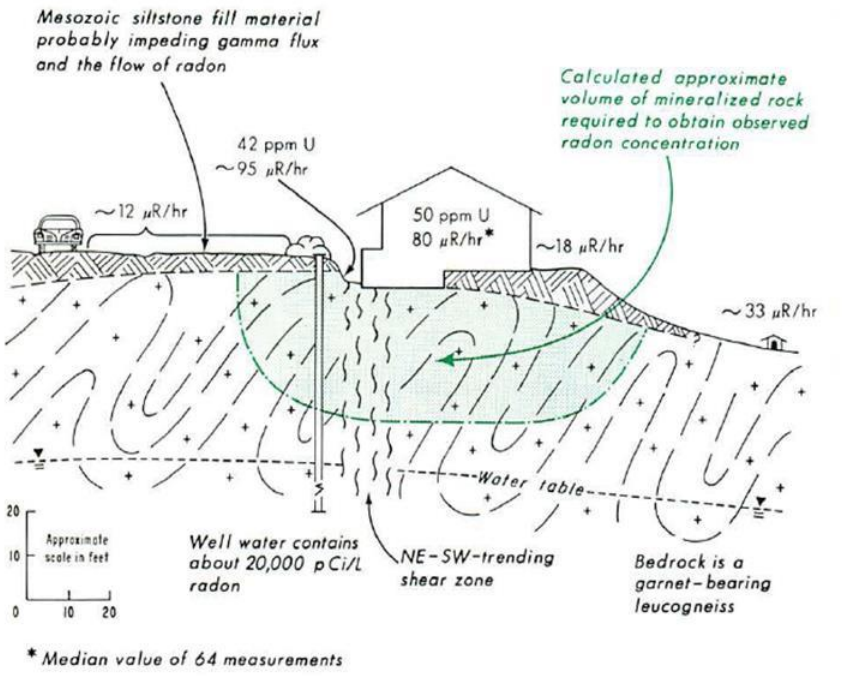
PENNSYLVANIA
DER

The 1984 'Index House'

PENNSYLVANIA GEOLOGY

PENNSYLVANIA GEOLOGY is published bimonthly by the Bureau of Topographic and Geologic Survey, Pennsylvania Department of Environmental Resources, Harrisburg, Pennsylvania 17120.
Editor, Donald M. Hoskins
Associate Editor, Christine M. Dodge
Articles may be reprinted from this magazine if credit is given to the Topographic and Geologic Survey.

VOL. 18, NO. 2 APRIL 1987



* Median value of 64 measurements

Figure 1. Generalized cross section of the "Index House" site as

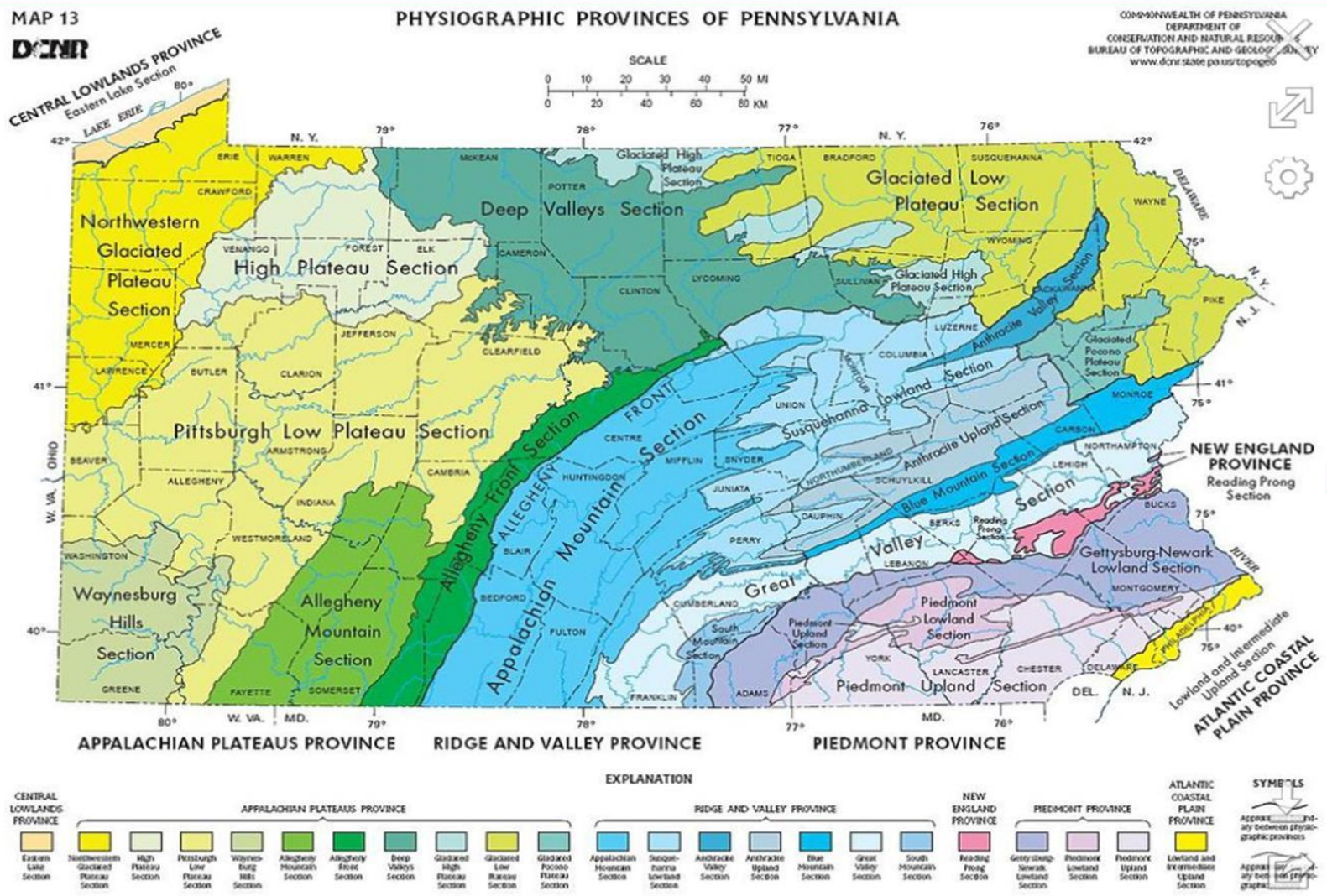
Radon: A Profound Case

by R. C. Smith, II, Pennsylvania Geological Survey
M. A. Reilly, Pennsylvania Bureau of Radiation Protection
A. W. Rose, The Pennsylvania State University
J. H. Barnes, Pennsylvania Geological Survey
S. W. Berkheiser, Jr., Pennsylvania Geological Survey

In late December 1984, the world's most severe indoor radon problem to date was discovered in a house in Colebrookdale Township, Berks County, in the Reading Prong physiographic province of Pennsylvania. Radon is a naturally occurring, colorless, odorless, inert, but radioactive gas, with a half-life of 3.8 days. It is a decay product of the most abundant naturally occurring isotope of uranium, U^{238}, and has radium as its immediate radioactive parent. Uranium and radon are found nearly everywhere in very small concentrations. Radon and its daughter products decay by the emission of alpha particles, essentially helium nuclei (two protons and two neutrons) carrying a charge of +2. Because of their large mass and charge, alpha particles travel only a short distance through body tissue, and have the capability of causing extensive damage when they encounter living tissue. The risk of lung cancer is understood to be proportional to the amount of exposure to radon decay products in air.

Radon is measured in radioactivity units called picocuries (pCi). One picocurie of radon is approximately the quantity that would yield the disintegration of two atoms per minute. The U. S. Environmental Protection Agency has suggested that the concentration of radon in the air of residential buildings should not exceed 4 picocuries of radon per liter (quart) of air. The house in Colebrookdale Township, the "Index House," was found to contain 2,500 pCi Rn/L (picocuries of radon per liter) for sustained periods.

High Radon in Reading Prong



The location of the Reading Prong is shown in dark pink.

Reading Prong (PA Geology – Spring 2014)

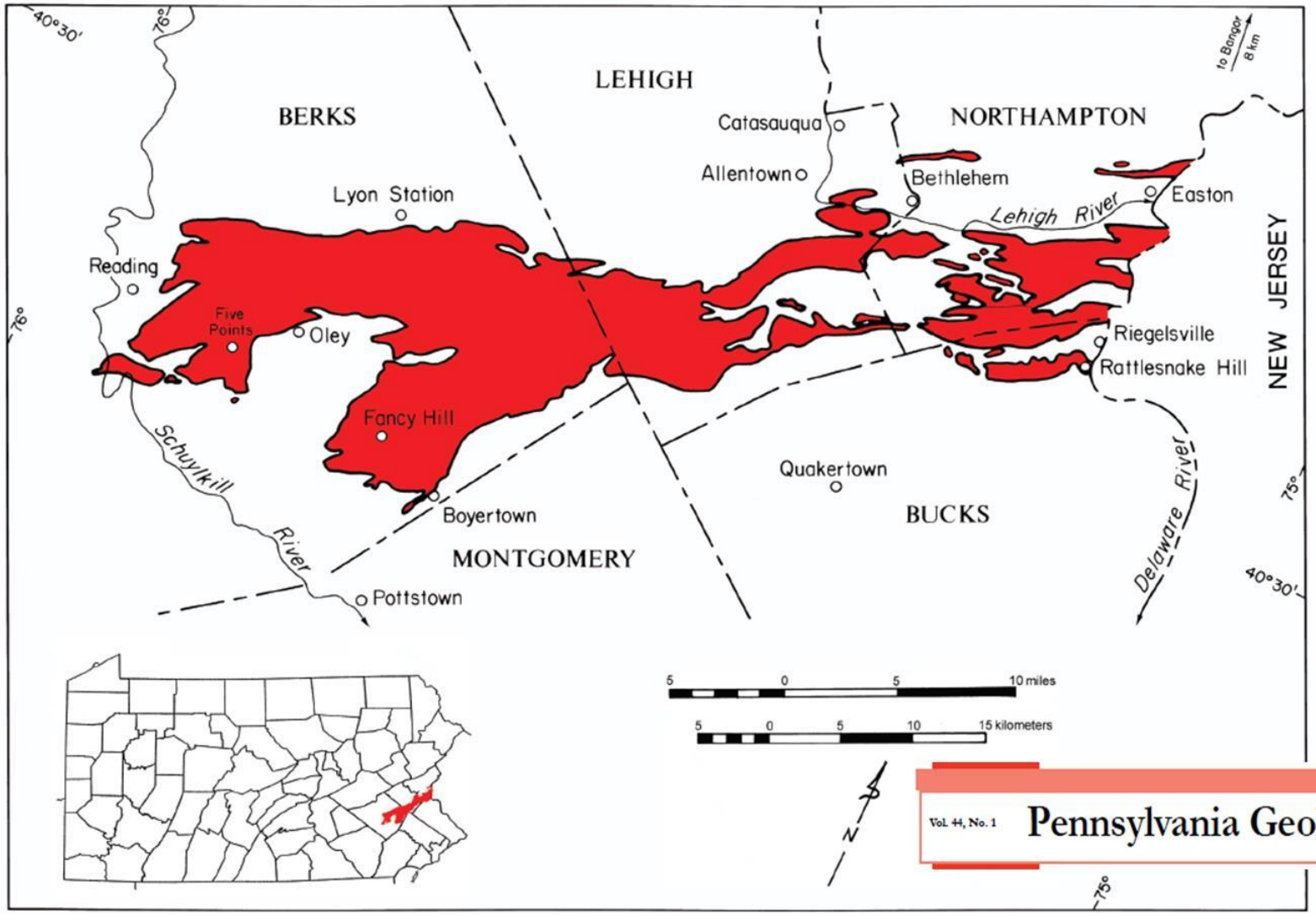
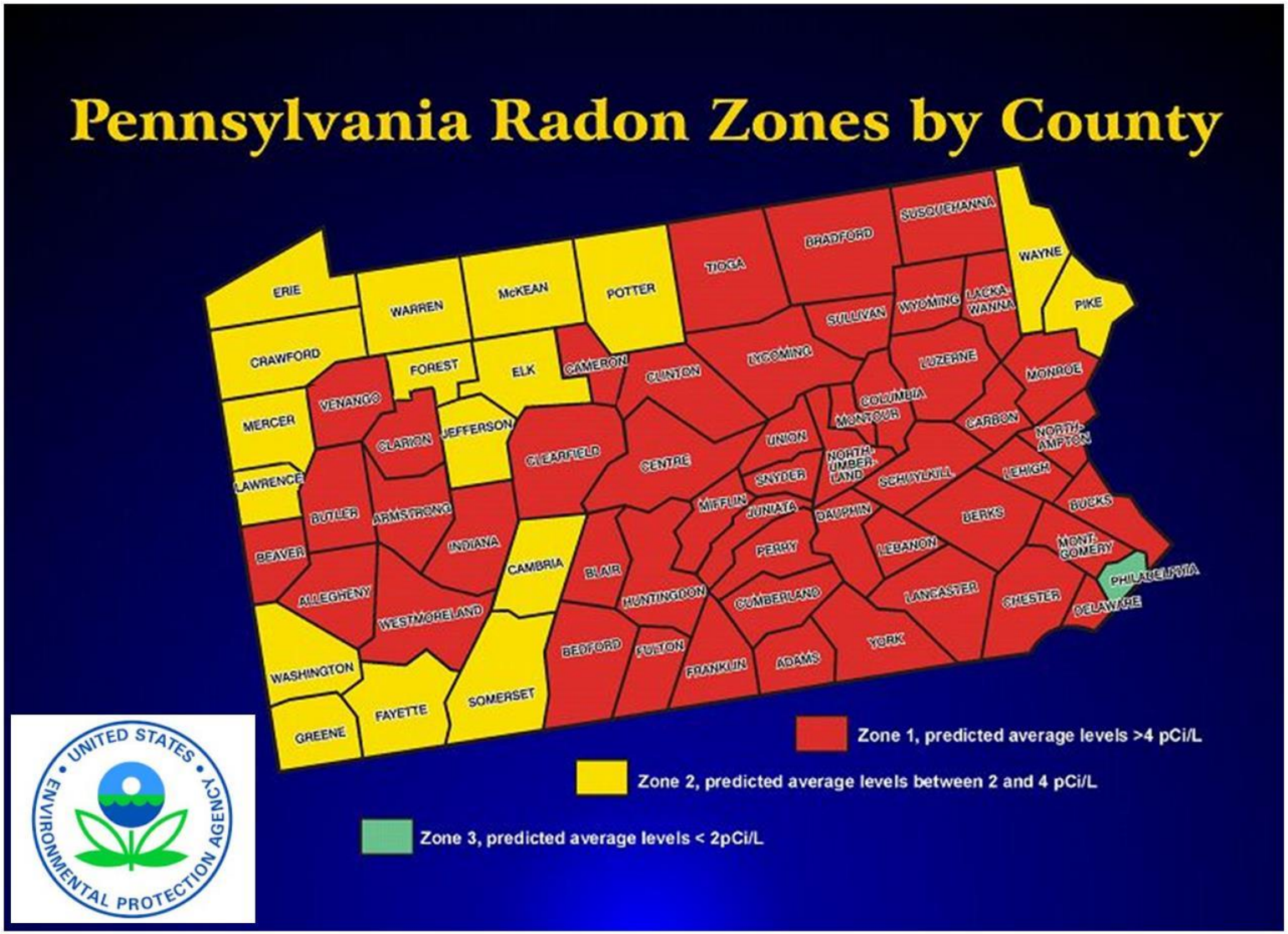
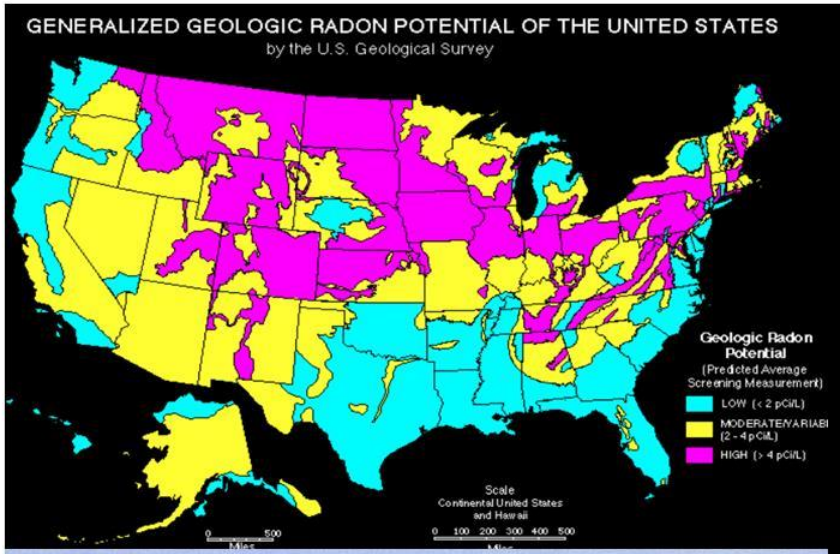


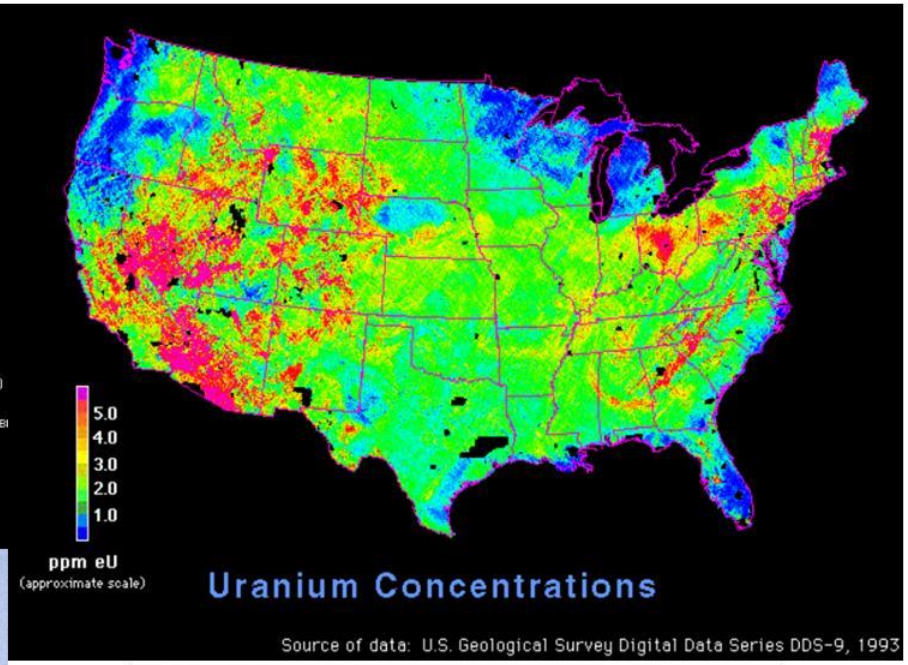
Figure 1. Map showing the extent and location of the Reading Prong in eastern Pennsylvania.

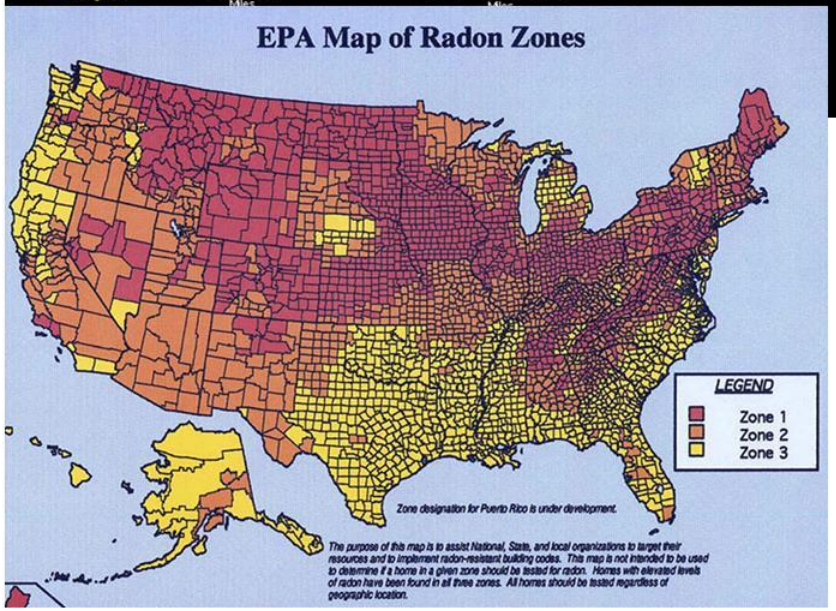
EPA - Radon Zones in PA

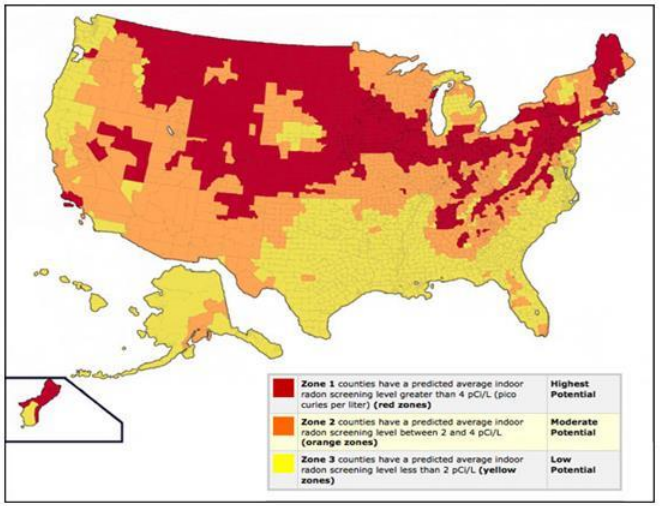


EPA & USGS Maps - note PA









PA Radon Program

- **Radon Certification Act required development of regulations**
- **Regs in PA Title 25, Article V, Chapter 240**
- **PA certifies all radon testers, mitigators and laboratories**
- **Thru an EPA 'SIRG' grant Radon Division does education and outreach to promote testing and 'radon resistant new construction'**

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PA Radon Program (cont.)

Radon education and outreach includes:

- Awareness thru TV & Radio PSAs and print ads
- Maintaining an 800 telephone number
- Trained staff to provide Rn test and mitigation assistance
- Frees test kits thru 'Newborn' program
- Training for educators, builders and real estate agents
- Work with PA Departments of Health and Education

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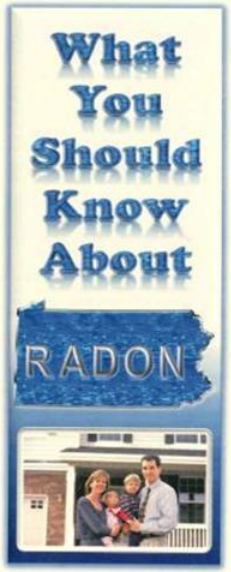
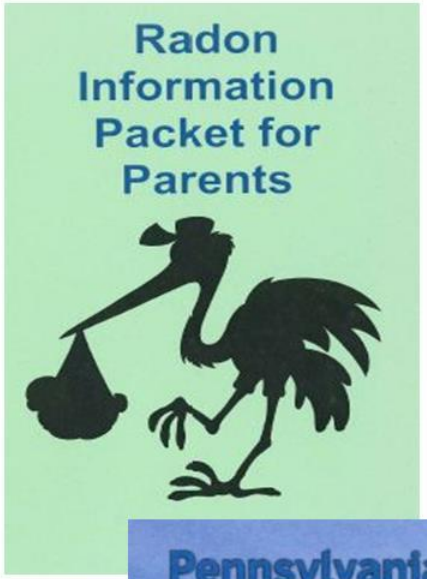
PA Radon Program (cont.)

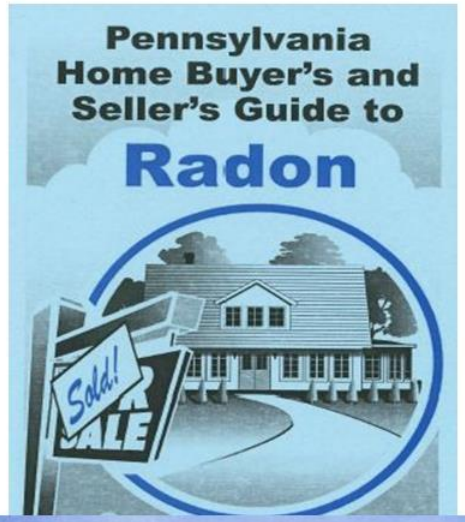
Radon education and outreach includes:

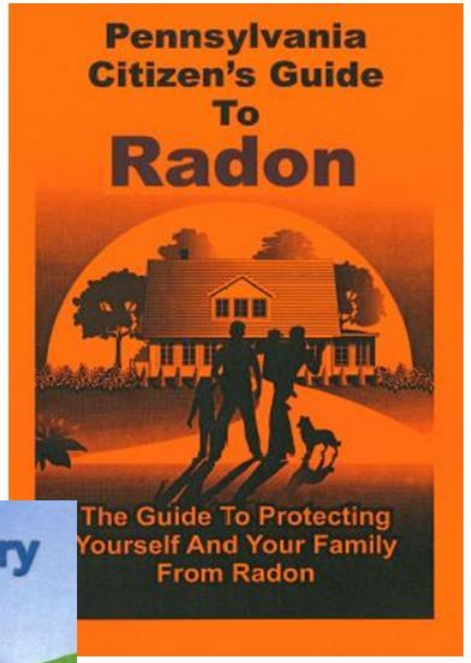
- Regular calls and meetings with EPA and other states
- Special studies (e.g., data trends, 'hot spot' surveys, blind testing, moisture mitigation, etc.)
- Assistance for hard to mitigate home
- Frees test kits thru American Lung Association
- School science project support and Radon Calendar contest
- Develop radon educational materials

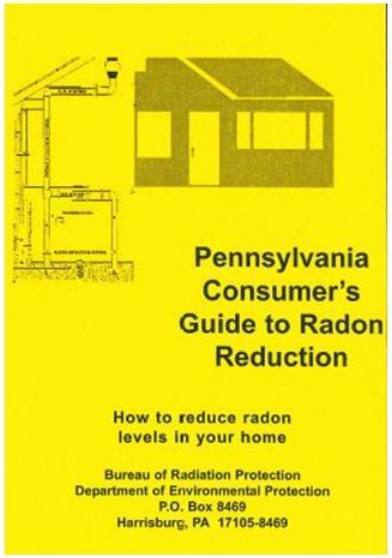
PA Radon Educational Materials

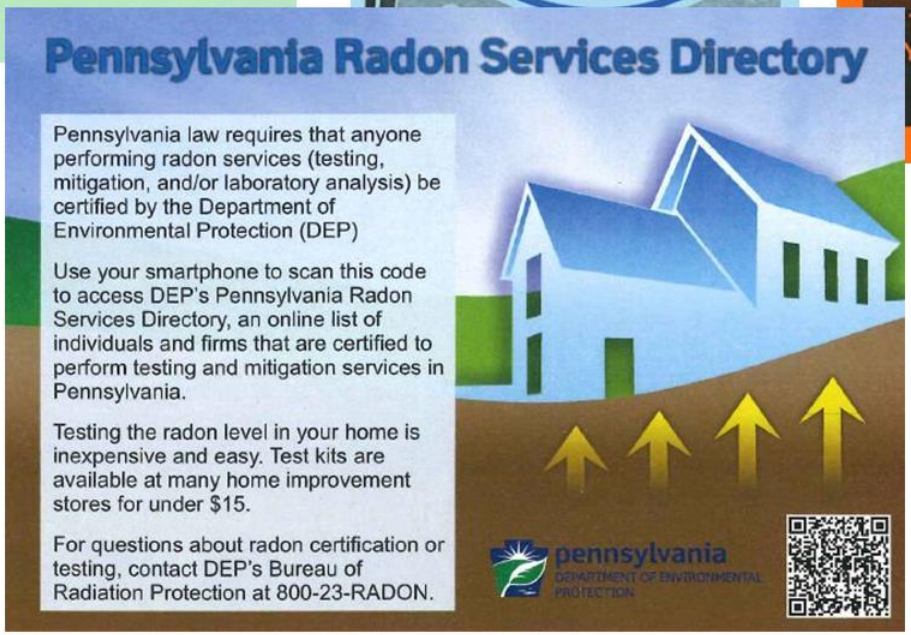


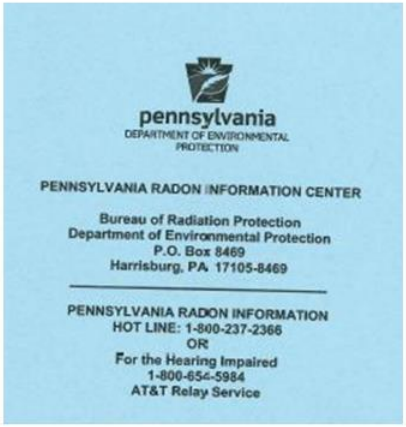




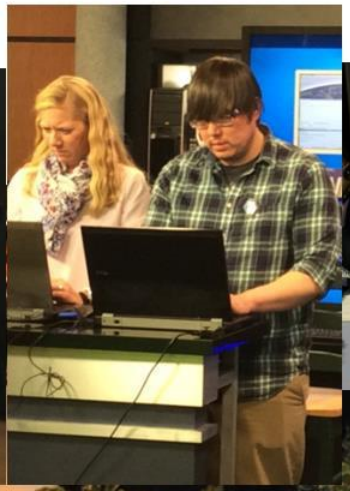








TV Radon Phone-a-thons



Radon Test Devices

Pylon CRM

E-PERMs

Charcoal Detectors

Short-term, or

Long-term

Radtrak ATD

Occupational Exposure

Review Paper

By Robert K. Lewis

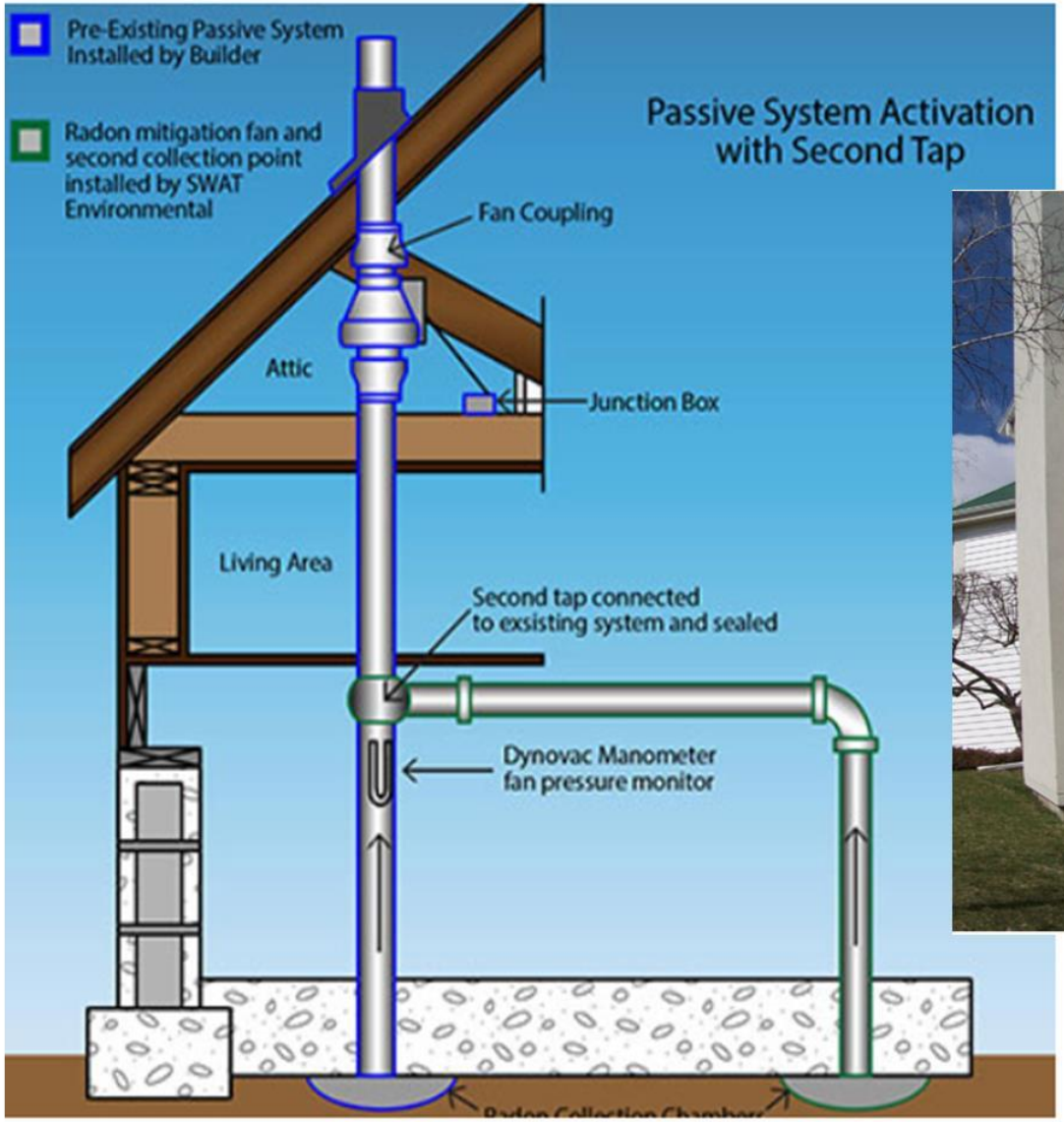
Health Physics October 2016, Volume 111, Number 4

RADON IN THE WORKPLACE: THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) IONIZING RADIATION STANDARD

Abstract—On 29 December 1970, the Occupational Safety and Health Act of 1970 established the Occupational Safety and Health Administration (OSHA). This article on OSHA, Title 29, Part 1910.1096 Ionizing Radiation standard was written to increase awareness of the employer, the workforce, state and federal governments, and those in the radon industry who perform radon testing and radon mitigation of the existence of these regulations, particularly the radon relevant aspect of the regulations. This review paper was also written to try to explain what can sometimes be complicated regulations. As the author works within the Radon Division of the Pennsylvania Department of Environmental Protection, Bureau of Radiation Protection, the exclusive focus of the article is on radon. The 1910.1096 standard obviously covers many other aspects of radiation and radiation safety in the work place. Health Phys. 111(4):374–380; 2016

Key words: ^{222}Rn; occupational safety; radon; safety standards

Radon Mitigation



Re-entrainment Study

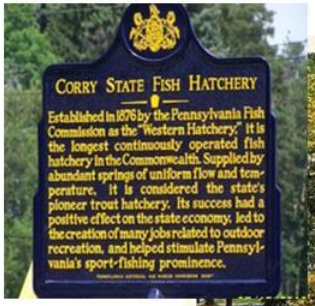
Sub-slab Depressurization

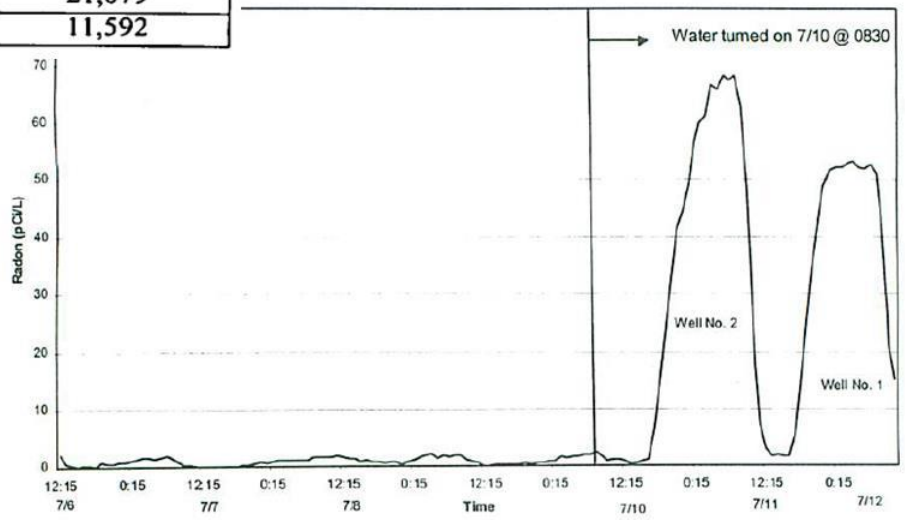
Fish Hatchery Study

Hatchery	Measured Air Conc. (pCi/L)	Calc. Air Conc. (pCi/L)	Source H2O Conc. (pCi/L)	Rn Liberated to Air (pCi/min)
Benner Spring	17.2	5.9	392	52,450
Bellefonte	27.7	5	384	132,575
Big Spring	7.7	6.6	132	149,393
Corry	20	4.1	758	58,409
Corry	40	18.9	758	267,708
Huntsdale	3.2	2	109	33,750
Huntsdale	7.3	0.8	133	28,935
Linesville	1.3	0.04	148	3500
Oswayo	5.6	3.5	633	35,909
Pleasant Gap	7.3	2.1	Unknown	35,984
Pleasant Mt	8.2	3.5	1683	35,208
Pleasant Mt	7.8	4.5	Unknown	66,666
Reynoldsdale	13.2	1.1	716	51,431
Tionesta	4.2	0.8	480	21,079
Tylersville	5.6	0.5	139	11,592

An Investigation of Radon Occurrence in Pennsylvania Fish and Boat Commission Fish Culture Stations

Robert K. Lewis
Pennsylvania Department Environmental Protection
Bureau of Radiation Protection/Radon Division





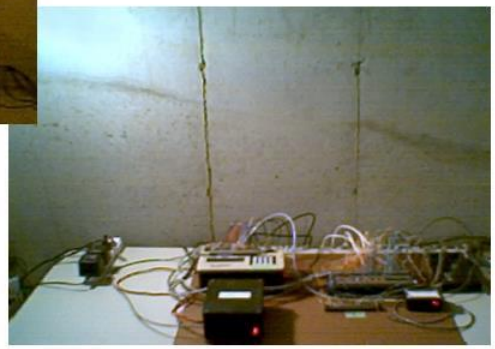
PA Moisture Study

Movement and Sources of Basement Ventilation Air and Moisture During ASD Radon Control
Additional Analysis

May 20, 2009

Table 6. Summary of Moisture, Radon, and Interzonal Flows under Different Seasons

House #	Season	ASD Config	Average AH (g/m^3) Bsmt Air	Upstairs Air	Outdoor Air	Soil Gas	Radon Concentrations (pCi/L) Outdoor Air (est)	Upstairs Air	Bsmt Air	Soil Gas	Upstairs (cfm)
PA01	Winter	Off	5.3	5.0	3.3	12	0.3	39	60	230	11
		On full	5.8	5.3	4.9	12	0.3	0.4	0.4	240	32
	Spring	Off	7.3	6.9	7.4	12	0.3	11	50	380	6.8
		On full	7.0	7.2	9.1	13	0.3	0.4	1.3	320	2.8
	Summer	Off	9.7	9.3	17	15	0.3	21	26	930	18
		On full	9.6	9.1	16	16	0.3	1.0	0.8	360	33
	Fall	Off	9.7	9.3	9.1	15	0.3	17	55	910	2.4
		On mod	10	11	13	15	0.3	0.5	0.7	470	4.4



PA Radon Database

Residential Data, Basement , Grouped by Season		
Season	**Sample Size**	Average (pCi/L)
Jan, Feb, Mar	172,600	7.56
Apr, May, Jun	187,051	5.95
Jul, Aug, Sep	161,189	5.45
Oct, Nov, Dec	162,965	7.72

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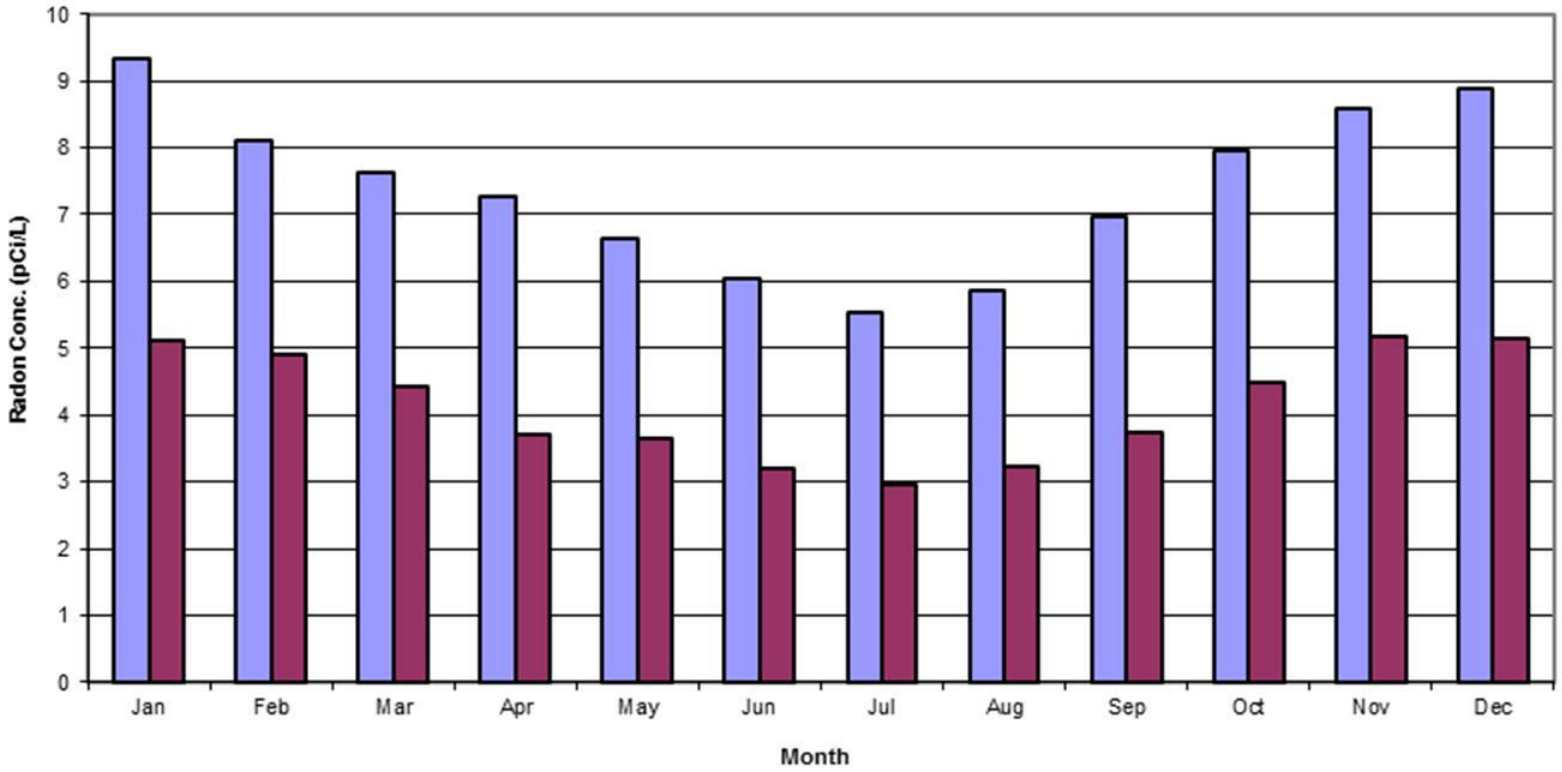
PA Radon Database



< 1st Floor; ave. ~3.5 pCi/L

< Basement; ave. ~7 pCi/L

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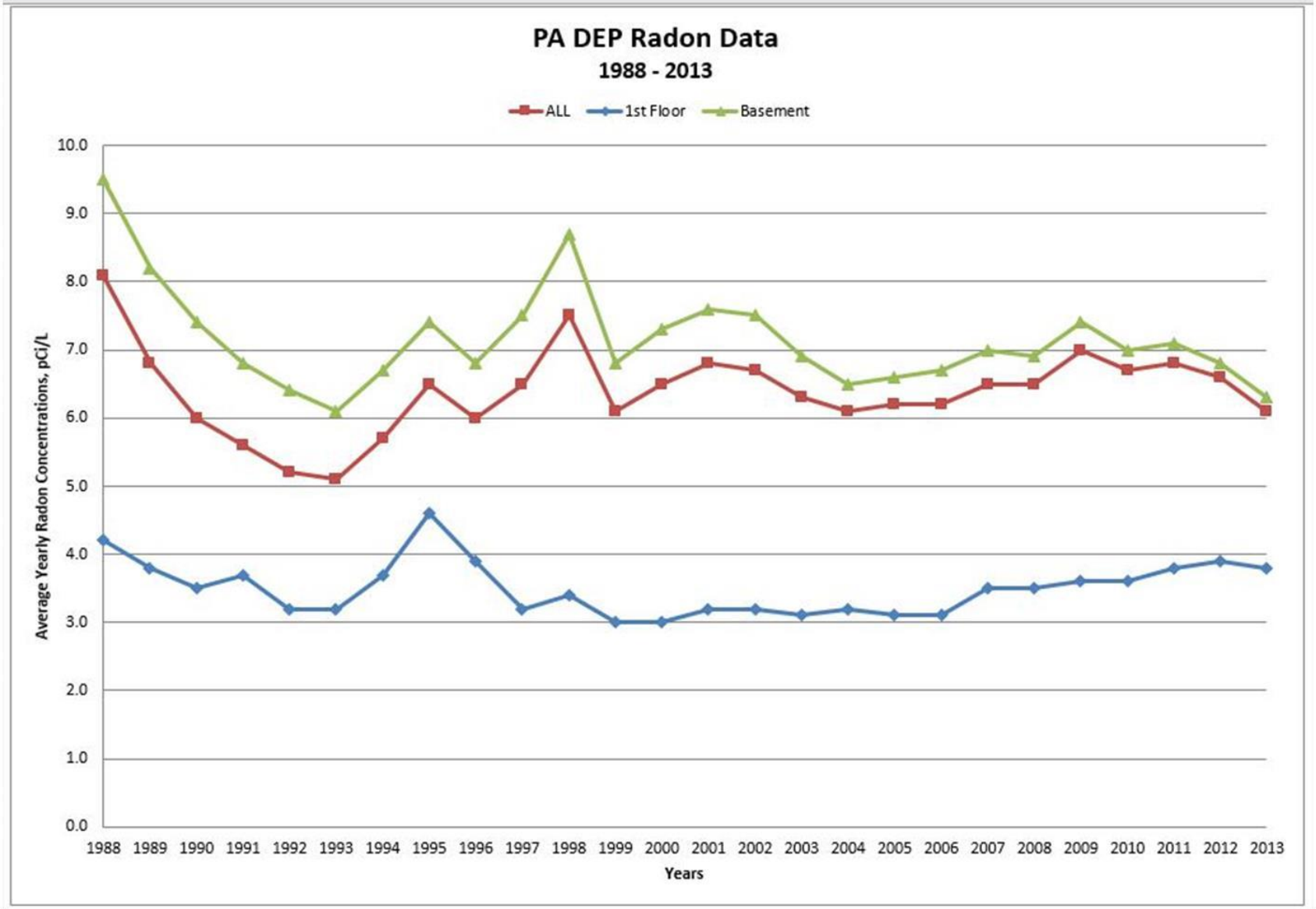
PA DEP Radon Database

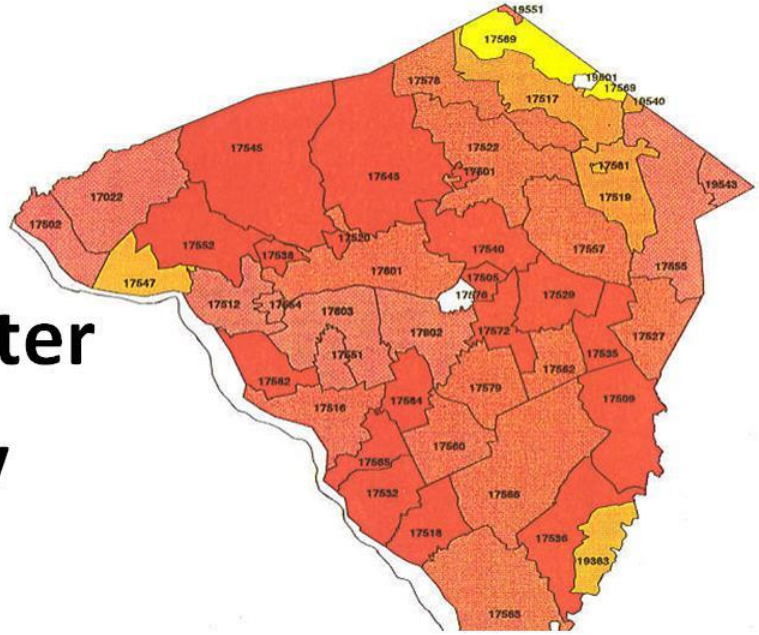


Radon Testing

New App -

Rn by Zip Code

Lancaster County



Percentage of homes above 4.0 pCi/L

	No data
	10% 20%
	20% 30%
	30% 40%
	40% 50%
	50% 60%
	60% 70%
	70% 80%
	80% 90%

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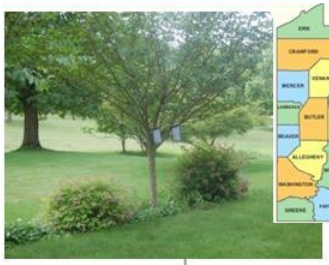
Radon Test Data by Zip Code

Zip Code	Location	Num of Tests	Max Result pCi/L	Avg Result pCi/L
17022	BASEMENT	3573	347.8	8.2
17022	FIRST FLOOR	331	70.0	5.0

http://www.depreportingservices.state.pa.us/ReportServer/Pages/ReportViewer.aspx?/Radon/RadonZip accessed 11-19-2017

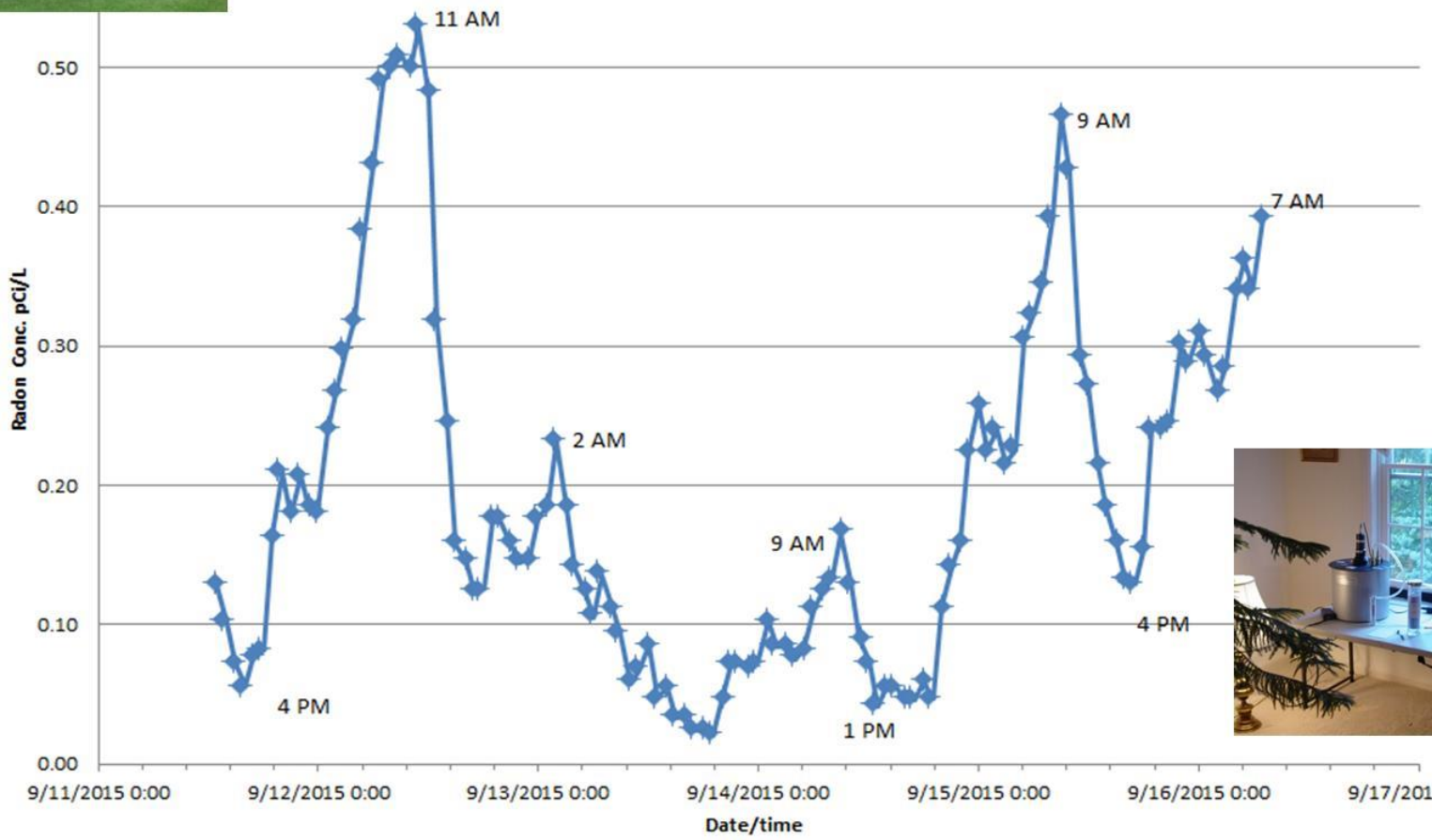
The PA DEP, Radon Division recommends that all homeowners test for radon, regardless of your local zip code result. When a local zip code result shows a low average, there can still be many homes in that zip code with elevated radon results. Do not depend on other results; test your own home for radon.

Current Ambient Radon Studies



Ambient Radon
Elizabethtown, PA

Avg. +/- 1sd = 0.19 +/- 0.13 pCi/L



PA Radon Database Use

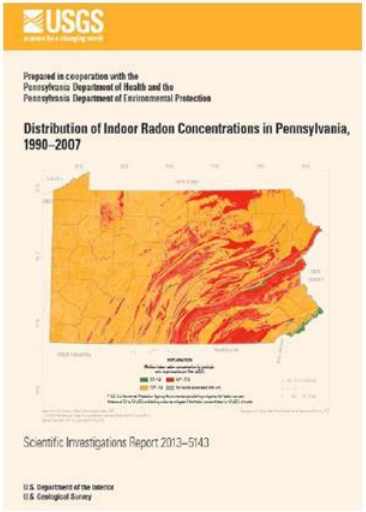
USGS Analysis

USGS science for a changing world

USGS Home
Contact USGS
Search USGS

Scientific Investigations Report 2013–5143

Distribution of Indoor Radon Concentrations in Pennsylvania, 1990–2007



Prepared in cooperation with the Pennsylvania Department of Health and the Pennsylvania Department of Environmental Protection

By Eliza L. Gross

Abstract

Results from 548,507 indoor radon tests from a database compiled by the Pennsylvania Department of Environmental Protection, Bureau of Radiation Protection, Radon Division, are evaluated in this report in an effort to determine areas where concentrations of radon are highest. Indoor radon concentrations were aggregated according to geologic unit and hydrogeologic setting for spatial analysis. Indoor radon concentrations greater than or equal to the U.S. Environmental Protection Agency (USEPA) action level of 4 picocuries per liter (pCi/L) were observed for 39 percent of the test results; the highest concentration was 1,866.4 pCi/L.

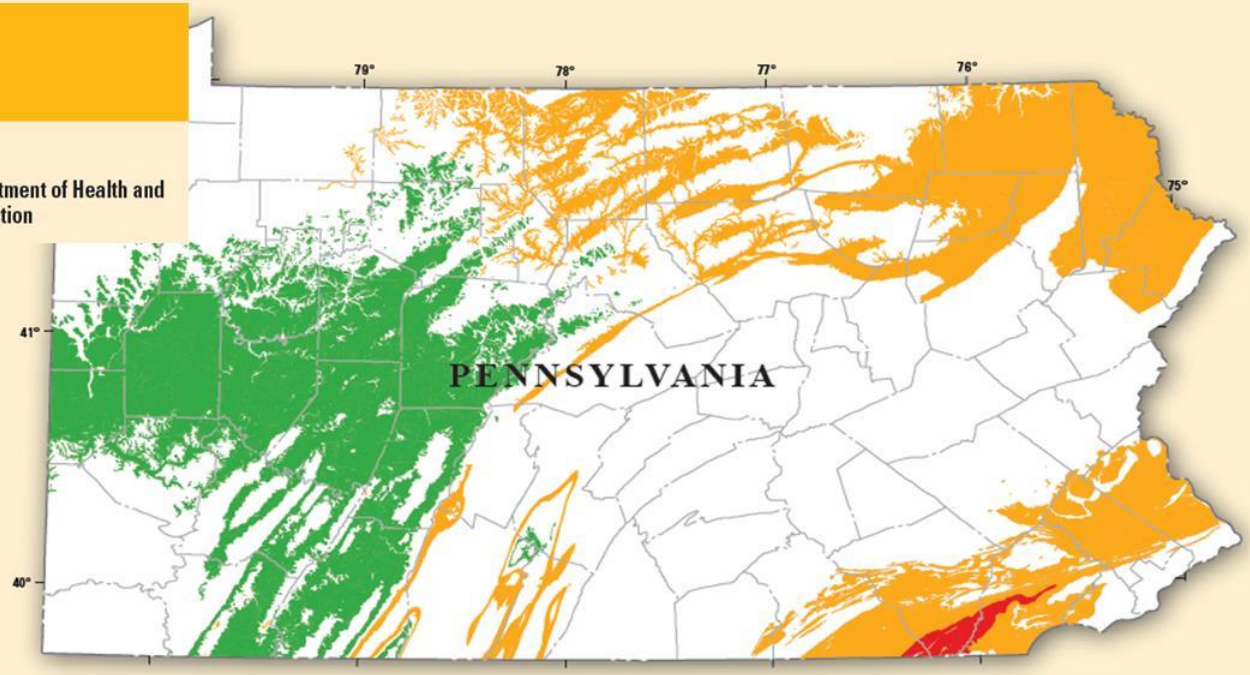
Radon in PA Groundwater

Evaluation of Radon Occurrence in Groundwater from 16 Geologic Units in Pennsylvania, 1986–2015, with Application to Potential Radon Exposure from Groundwater and Indoor Air

USGS
science for a changing world

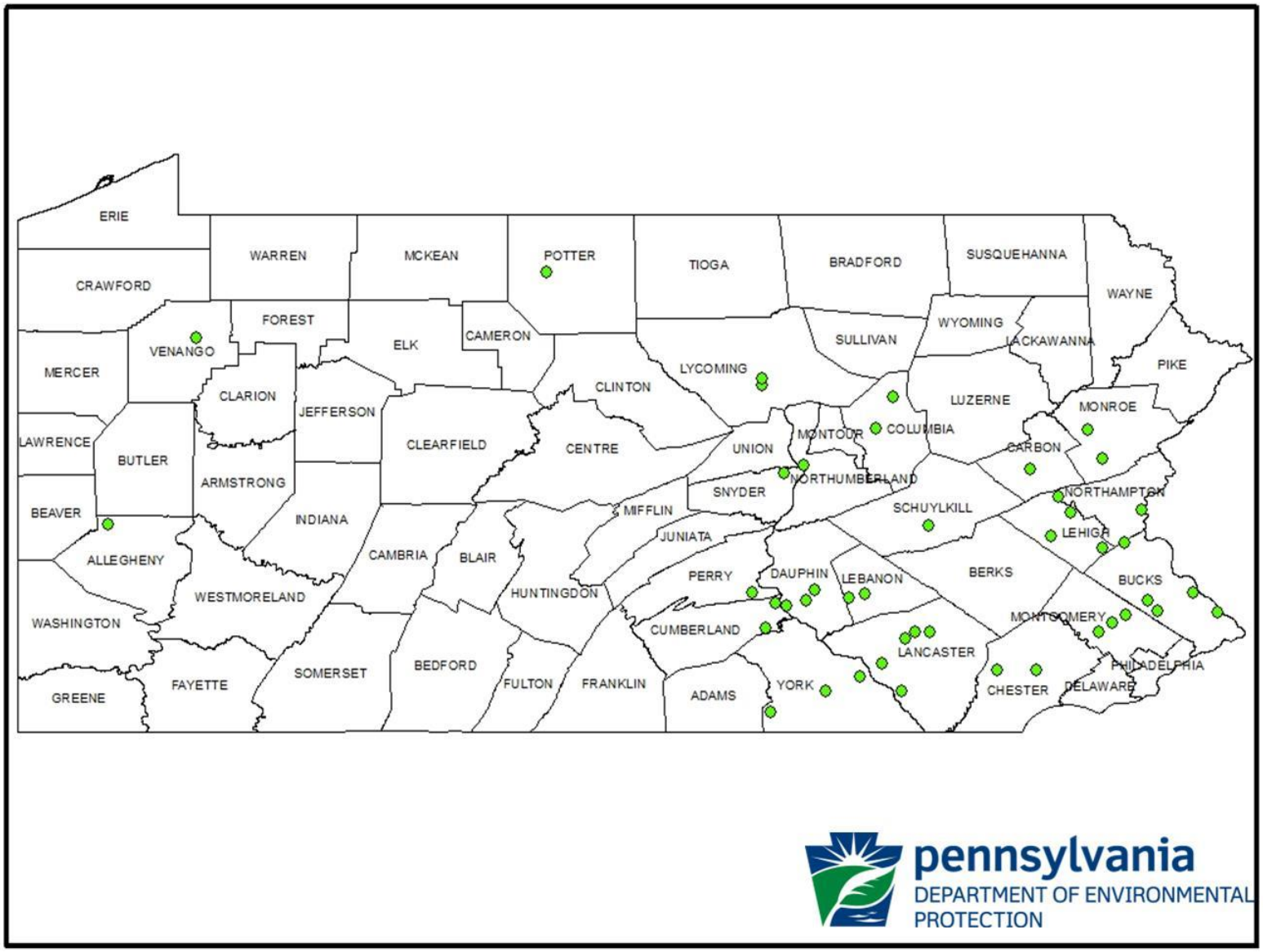
Prepared in cooperation with the Pennsylvania Department of Health and the Pennsylvania Department of Environmental Protection

By Eliza L. Gross



Scientific Investigations Report 2017–5018

Greater than 100 pCi/L Potential Hot Spot Survery Areas



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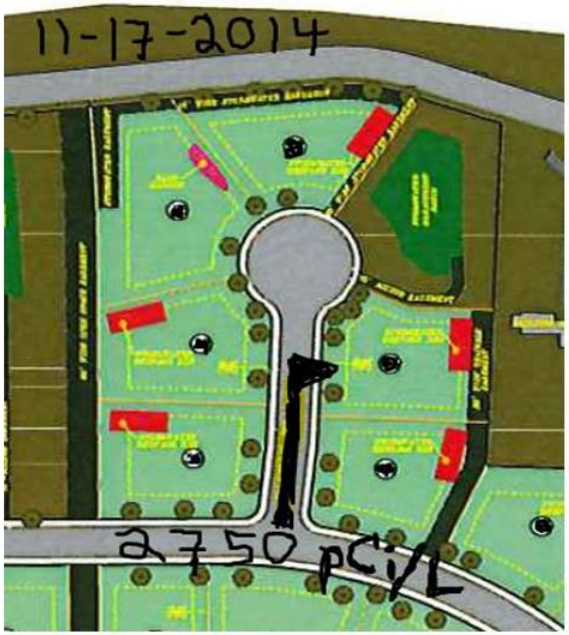
Discovery of a Very High Radon Area

- **Mitigator informs DEP of home > 1,000 pCi/L in early October 2014**
- **Radon Division does a targeted 'hot spot' survey mailing to over 500 homes**
- **Begin to see homes with 100s to 1,000s of pCi/L**
- **In 2014 one home over 2,700 pCi/L; another with over 3,700 pCi/L**
- **In 2016 one over 6,100 pCi/L!**



High Radon Area Tally

	Count	Percentage
0 - 4 pCi/L	0	0 %
4 - 20 pCi/L	0	0%
20 - 100 pCi/L	20	29 %
100 – 1,000 pCi/L	30	44 %
> 1,000 pCi/L	18	27 %

100% of these results are over 20 pCi/L.
Typically, only 40% of results in PA are over 4 pCi/L

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Radon Levels Over 1,000 pCi/L

- **Current state [world?] record >6,176 pCi/L !!!**

- **As of 11-3-2017, there are 18 homes >1,000 pCi/L**

- **Specific values >1,000 pCi/L are as follows:**

  1611, 2558, 1545, 2478, 1703, 1024, 1244, 1812, 1270, 6176, 1414, 3715, 1951, 1295, 1267, 2748, 5336, 2182 pCi/L

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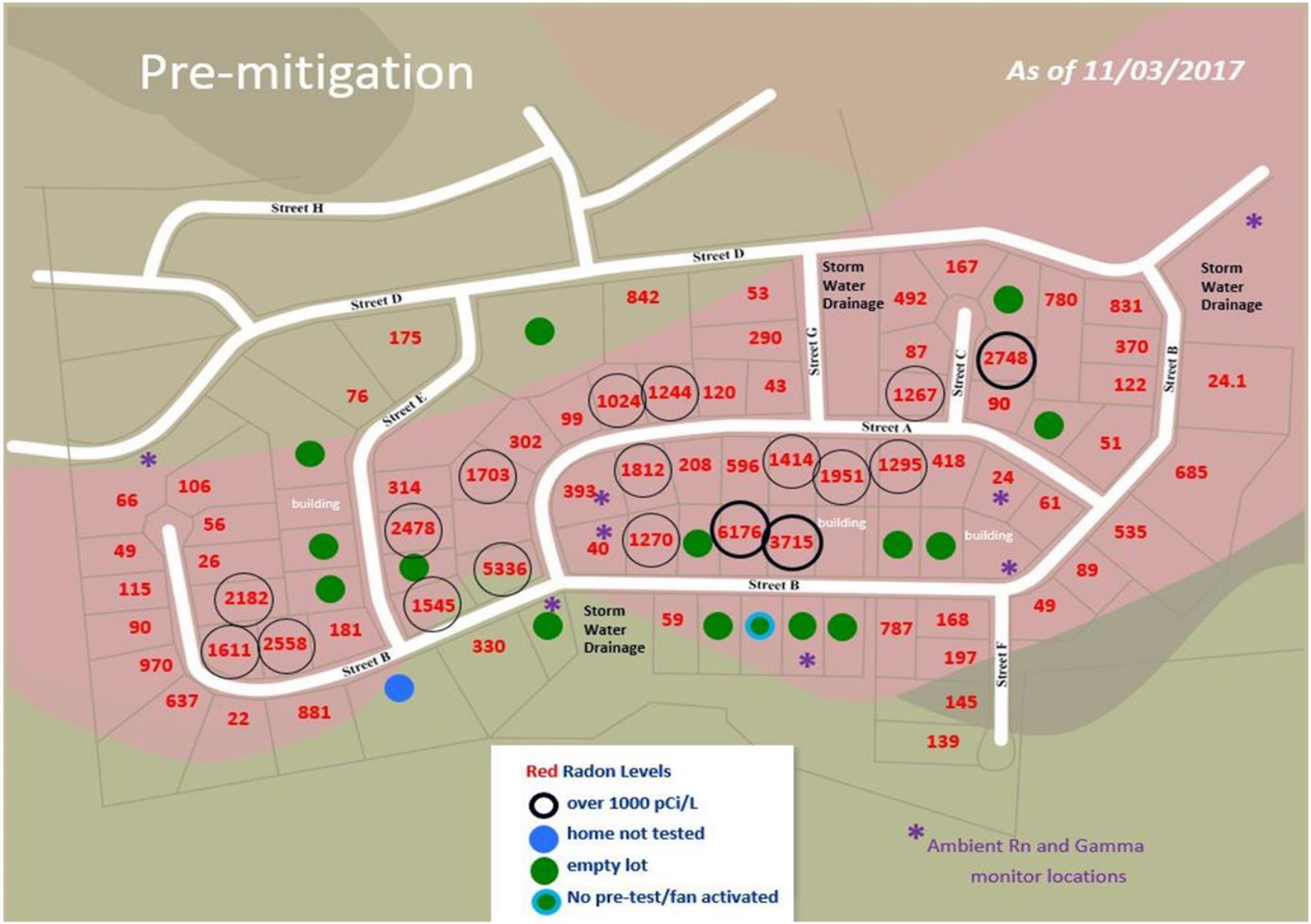
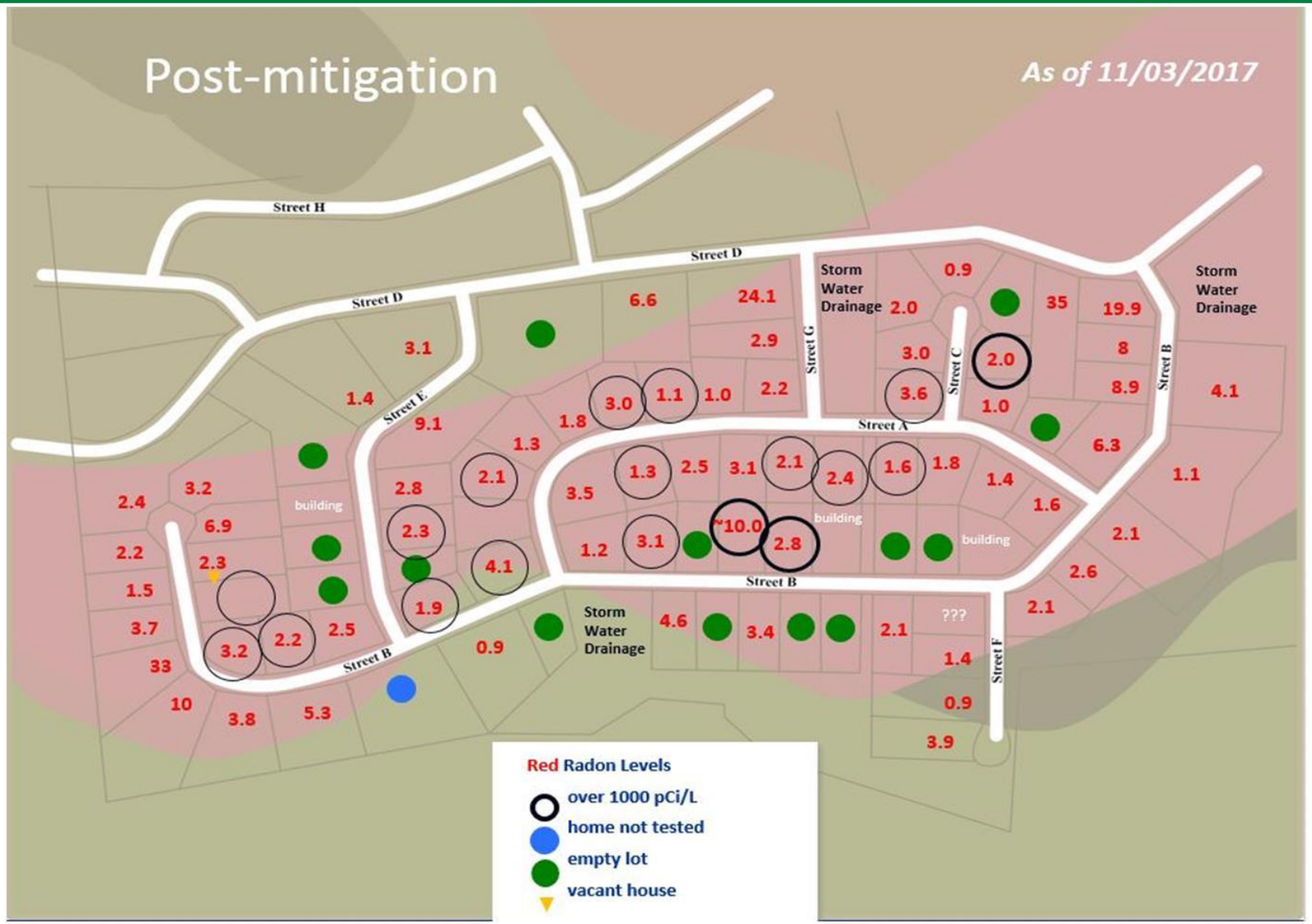
Discovery of a Very High Radon Area

Discovery of a Very High Radon Area

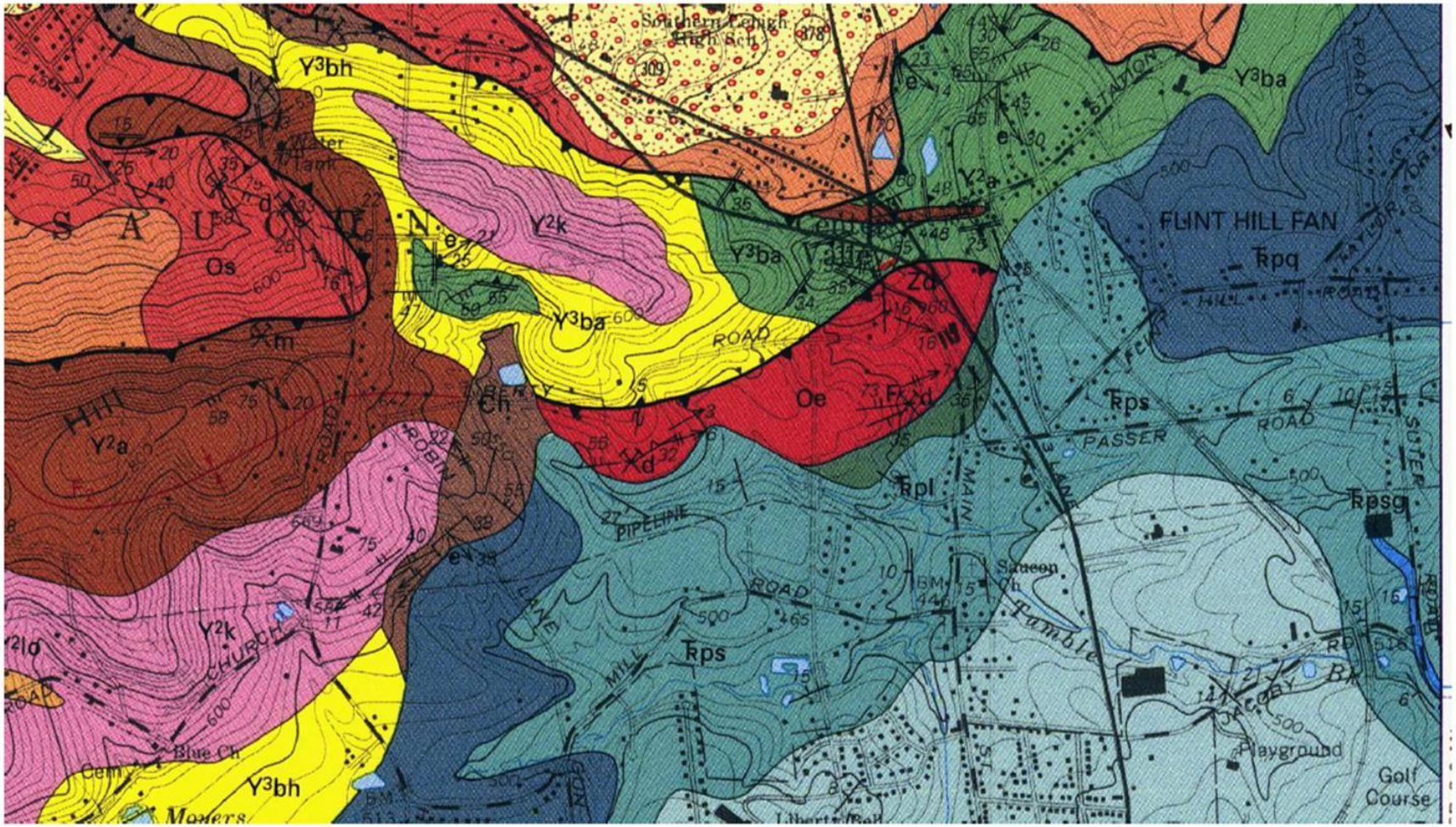


Discovery of a Very High Radon Area



Discovery of a Very High Radon Area

Geology of the Center Valley PA Area [from a map by Avery A. Drake]



Survey Area Geology: The 'Perfect Storm'

- **Epler Formation - Limestone, Dolomite**
- **Deposition of Reading Prong uranium bearing material**
- **Uranium mineralization at base of the Epler**
- **Most intense mineralization at brecciated thrust fault at base of Epler**
- **In carbonate soils, radium concentrates up to 15-20x the amount supported by U in bedrock**

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Discovery of a Very High Radon Area

Ongoing Soil and Rock Sampling and Rad Analysis

Soil Profile	Isotope	pCi/g
A Zone	Ra-226	82 pCi/g
	U-238	85 pCi/g
B Zone	Ra-226	170 pCi/g
	U-238	199 pCi/g
C Zone	Ra-226	24 pCi/g
	U-238	20 pCi/g
R Zone	Ra-226	79 pCi/g
	U-238	67 pCi/g

Above data from March 2015 samples.

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Discovery of a Very High Radon Area

Public Meeting

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News for Immediate Release

Dec. 3, 2014

DEP Finds Record-High Radon Level in Lehigh County Home
Area residents urged to attend information meeting on Dec. 4

Harrisburg – The Department of Environmental Protection (DEP) has identified a home in the Center Valley area of Lehigh County with the highest home radon level ever measured in Pennsylvania. DEP encourages all area residents to have their homes tested for radon. This is especially important now that homes are winterized, limiting the amount of fresh air that will be entering those structures.

The concentration measured was 3,715 picocuries per liter (pCi/L). Additionally, several other homes in the area have had measured concentrations over 1,000 pCi/L. The U.S. Environmental Protection Agency (EPA) recommends that that any dwelling or structure with a radon concentration of more than 4 pCi/L be remediated to lower the radon concentration. In this circumstance, DEP recommended the occupants vacate the home until the measured radon concentration is verified and remediated to a level less than 4 pCi/L.

Media Coverage

philly.com

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http://www.philly.com/philly/news/Record-breaking_radon_levels_found_inside_Pa_home.html accessed 8-18-2015

Record-breaking radon levels found inside Pa. home

Alex Wigglesworth, *Philly.com* Last updated: Thursday, December 4, 2014, 4:52 PM

A Lehigh County home has returned the highest concentration of radon ever measured inside a Pennsylvania dwelling, according to the state Department of Environmental Protection. The home, located in the Center Valley area, registered a measurement of 3,715 picocuries per liter of the cancer-causing radioactive gas, the DEP announced. The U.S. Environmental Protection Agency recommends any structure with a radon concentration of more than 4 picocuries per liter be remediated.

Discovery of a Very High Radon Area

Mitigation of the > 3,700 pCi/L home…

to < 3 pCi/L!!

1st FL > ~1,600 pCi/L

Basement > ~2,900 pCi/L

Interior ~100 uR/h ^

^ Ventilated basement to perform work.

< Standard sealing then used subslab depressurization. >

Discovery of a Very High Radon Area

Ongoing Efforts to Mitigate Homes

- Builders have used some RRNC methods
- Work with local mitigator to train builders on RRNC methods
- Builders are funding any needed mitigation
- BRP continues to track construction and testing
- Regular contacts with residents who have not tested or mitigated
- Studies of local rock and soils for U/Ra content
- This may be a 'perfect storm' for radon

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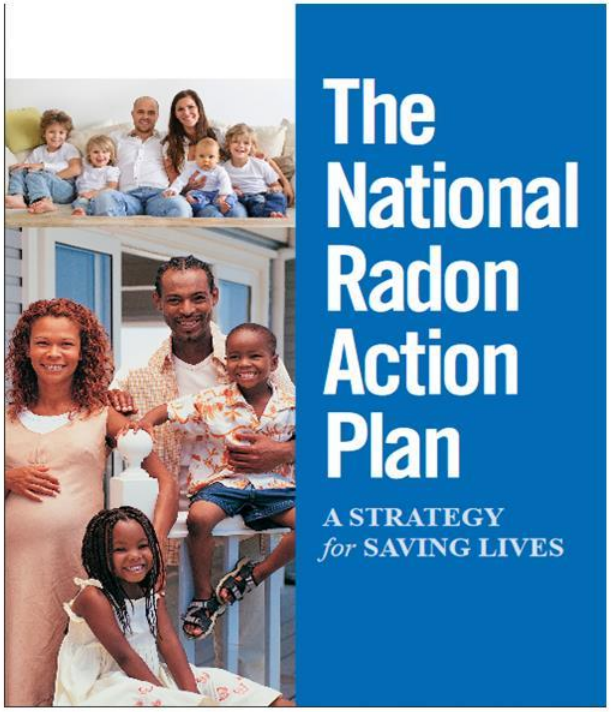
National Radon Action Plan

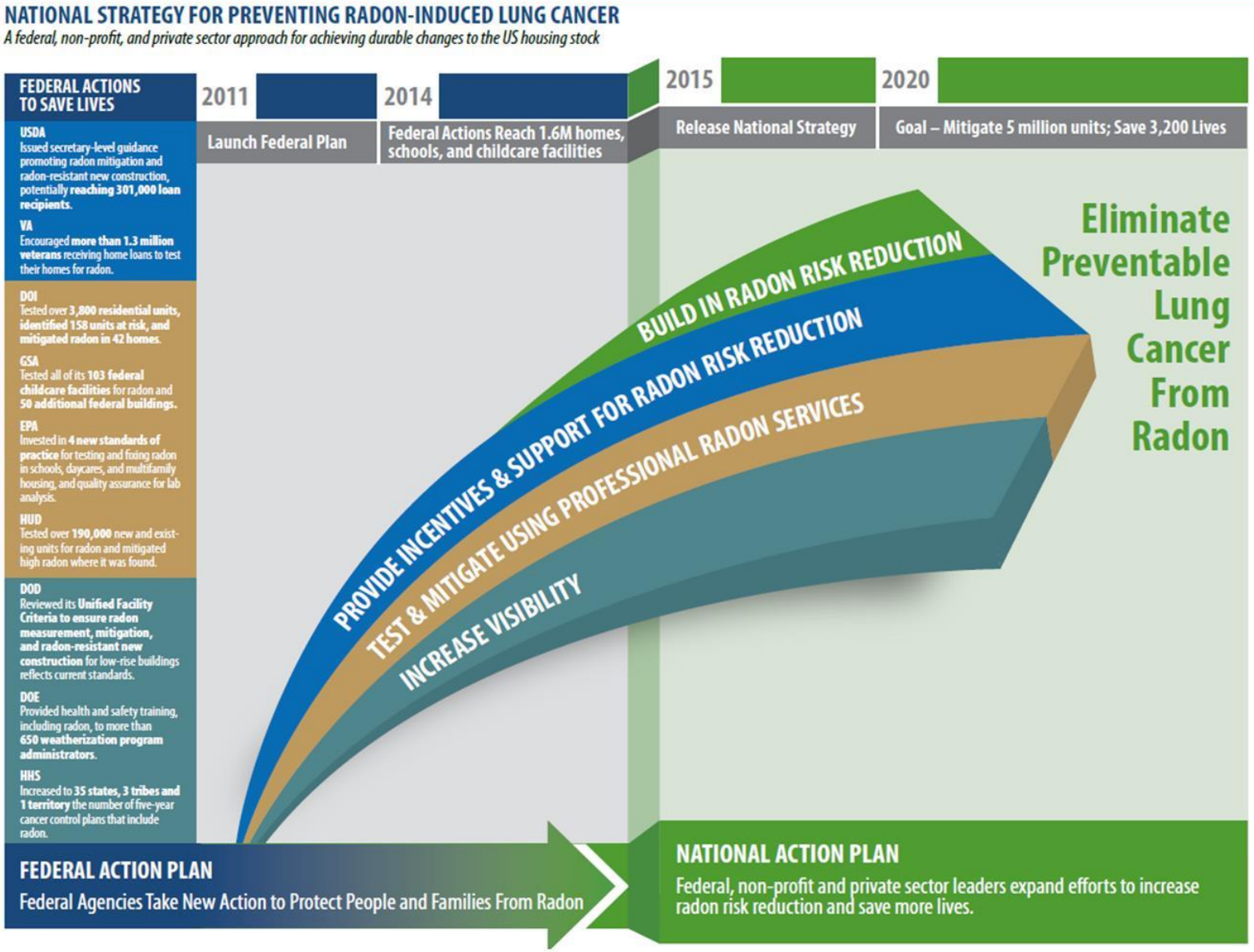
Reduce the Risk from Radon Exposure

Strategy =>

- **Building Standard Practices**
- **Test and Mitigate**
- **Increase Visibility of the Issue**
- **Provide Incentives and Support**
- **Use Professional Services**



National Radon Action Plan



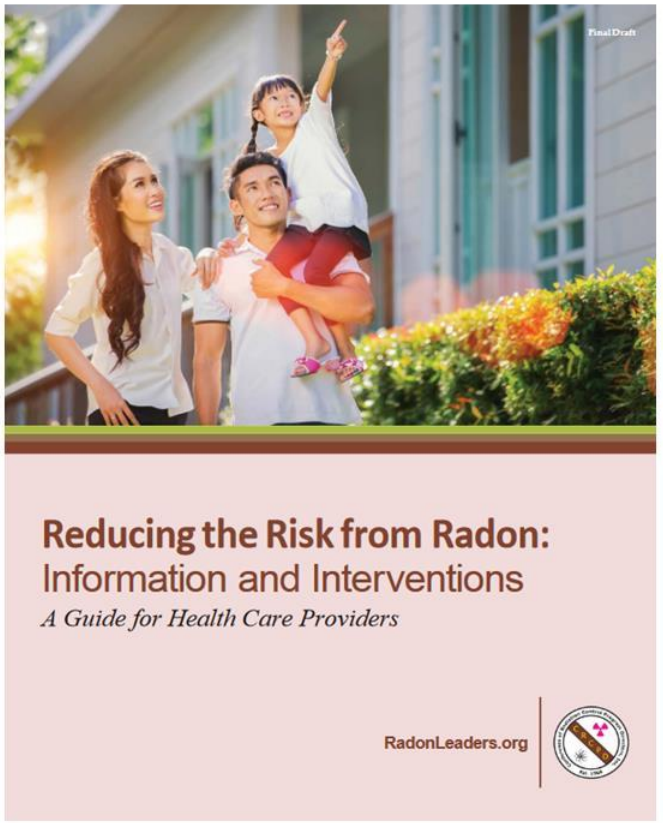
New Guide for Health Care

Radon Leaders
Saving Lives

RadonLeaders.org

This guide has the latest information on:

- Radon statistics and public health impact.
- The science behind the risk estimates.
- Radon testing and reduction.
- Sample guidance for use in health care settings.
- The role of health care providers in reducing the burden of radon-induced lung cancer.



Needed Initiatives

PA 'Wish List' =>

- Require radon testing for all property sales; with disclosure to the potential buyer
- Require all schools to be tested on a regular basis
- Amend the state building code to require 'radon resistant new construction' methods

EPA – continue states $ support thru SIRG!

Conclusion

PA is [perhaps] the most highly impacted state with respect to indoor radon, and has one of the best programs to mitigate and address the risk to the public and associated issues… but, there is still work to be done.

The PA 'Radon Monitoring Team'

Robert K. Lewis (rolewis@pa.gov)

Denise Bleiler (dbleiler@pa.gov)

L to R: Bob Smith*, Denise Bleiler and Bob Lewis

*Retired DER/DCNR Geologist

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Thank You

Questions?

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