Radon Testing in Pennsylvania Schools

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What is radon?

- Radioactive, inert, odorless, colorless, tasteless gas
  - Naturally occurring in soil and ground water
  - Formed mainly from the decay of uranium
  - In homes/ buildings, especially lower levels
- EPA recommends mitigation at 4 pCi/L
  - 4 pCi/L*= 200 chest x rays per year or 8 cigarettes/day
- Class A Carcinogen
  - #1 cause of lung cancer among non-smokers
  - Leading environmental cause of cancer in the U.S

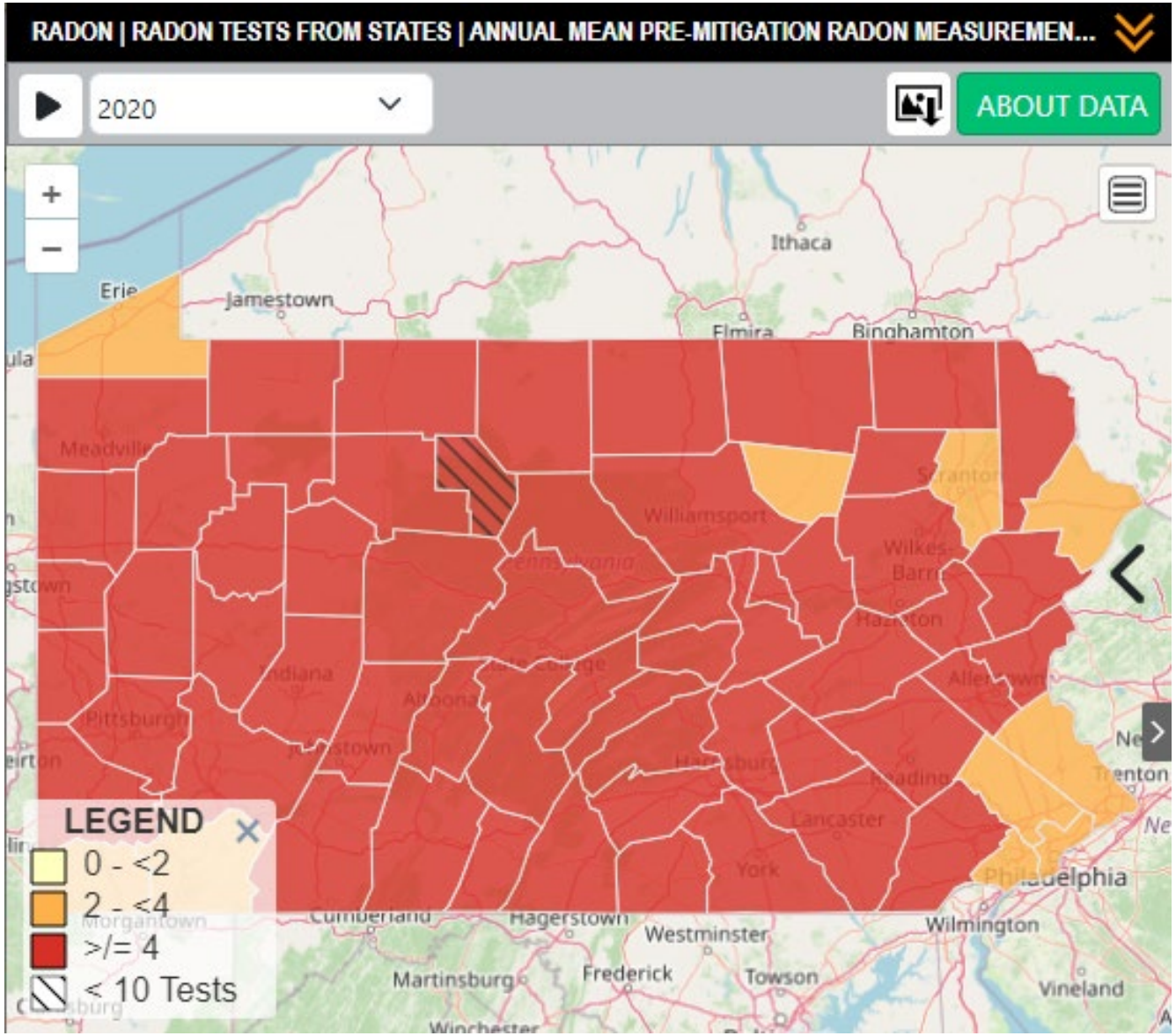
Pennsylvania

3rd highest average radon levels in US

Fourteen US states currently require testing in schools: Colorado, Connecticut, Florida, Illinois, Iowa, Maryland, Minnesota, New Jersey, New York, Ohio, Rhode Island, Tennessee, Virginia, and West Virginia

Pennsylvania currently does not require radon testing of schools or daycares

The majority of Pennsylvania counties report radon averages above 4pCi/L



https://ephtracking.cdc.gov/DataExplorer/?c=31&i=141&m=-1 Accessed September 7, 2024

How many School Children are potentially affected?

1.7 million children* enrolled in Pennsylvania public schools 2019-20

777 public local schools

*Does not include private or parochial school attendees

Examination of potential radon exposure in PA schools

- Between 1990-2022, millions of indoor radon tests were performed in the state of PA by homeowners and the private radon industry.
- This data was collected and made available to the public on the PA state Department of Environmental Protection (DEP) website
- Bethlehem, Allentown, and Easton School Districts analyzed
- Student Demographic data was taken from National Center for Education Statistics
- Radon level for each zip code was matched to the zip code for each school in the NCES data

Allentown City School District

Zip Code	Students	Free Lunch %	POC %	Radon	Grade Range
18102	813	100	94	5.3	K-5
18102	439	97	93	5.3	9-12
18102	662	100	94	5.3	K-5
18104	909	100	96	6.9	6-8
18101	733	100	91	4.6	6-8
18103	636	100	94	7.1	K-5
18102	240	100	93	5.3	K
18103	524	100	92	7.1	K-5
18103	278	100	95	7.1	K-5
18109	1915	89	91	5.2	9-12

Allentown City School District

Zip Code	Students	Free Lunch %	POC %	Radon	Grade Range
18102	625	100	96	5.3	K-5
18109	482	100	93	5.2	K-5
18104	488	100	90	6.9	K-5
18109	409	100	87	5.2	K-5
18103	532	100	98	7.1	K-5
18102	560	100	93	5.3	1-5
18103	1007	100	93	7.1	6-8
18102	820	100	94	5.3	6-8
18104	658	100	94	6.9	K-5
18102	346	99	97	5.3	1-5
18104	2852	87	93	6.9	9-12

Bethlehem Area School District

Zip Code	Students	Free Lunch %	POC %	Radon	Grade Range
18017	226	15	28	6.7	K-5
18017	263	61	62	6.7	K-5
18018	2640	50	63	5.8	9-12
18017	319	77	76	6.7	K-5
18017	300	90	93	6.7	PK-5
18020	340	37	43	6.6	K-5
18018	781	49	50	5.8	6-8
18018	725	75	76	5.8	6-8
18017	508	46	46	6.7	K-5
18018	224	78	72	5.8	K-5
18018	239	72	69	5.8	K-5

Bethlehem Area School District

Zip Code	Students	Free Lunch %	POC %	Radon	Grade Range
18017	339	30	33	6.7	K-5
18015	500	88	87	7	6-8
18018	224	64	58	5.8	PK-5
18018	382	63	59	5.8	K-5
18015	449	90	93	7	PK-5
18017	1047	47	47	6.7	6-8
18045	361	32	40	6.5	K-5
18015	513	86	84	7	PK-5
18020	1753	38	55	6.6	9-12
18017	347	78	73	6.7	K-5
18017	459	57	53	6.7	K-5

Easton School District

Zip Code	Students	Free Lunch %	POC %	Radon	Grade Range
18042	538	100	81	8.5	K-5
18045	2844	92	57	6.5	9-12
18040	1874	100	60	7.1	6-8
18040	357	100	40	7.1	K-5
18042	268	100	51	8.5	K-5
18045	514	100	41	6.5	K-5
18042	579	100	81	8.5	K-5
18040	602	100	47	7.1	K-5
18040	414	100	53	7.1	K-5

Results

Sample public schools located in zip codes where the average radon measurements from 1990-2022 exceed EPA action level of 4.0 pCi/L

Bethlehem Area School District	• Average radon levels range: 5.8 to 7 pCi/L
Allentown City School District	• Average radon levels range: 4.6 to 7.1 pCi/L
Easton School District	• Average radon levels range: 6.5 to 8.5 pCi/L

Radon exposure likely poses additional health burdens on students

Bethlehem Area School District (12,973 students)	Allentown City School District (15,988 students)	Easton School District (7,990 students)
• Free lunch % varied from 15.5%- 90.3% • 50% of homes are renter-occupied	• Free lunch % varied from 87.0%- 100% • 58% of homes are renter-occupied	• Free lunch % varied from 91.5%- 100 • 54% of homes are renter-occupied

Pennsylvania children in rental apartments may face additional radon exposure

No state laws mandating radon testing in rental homes, apartments and public or commercial buildings

https://www.lehighvalleynews.com/environment-science/lehigh-valley-is-home-to-the-highest-radon-levels-recorded-in-pa-heres-why

Radon in Schools

- Lung cancer risk in children approx **3x higher** vs adults exposed to the same amount of radon due to:
  - shape differences between children's lungs vs adult lungs
  - higher respiration rates of children vs adults
- U.S. children spend approx. 6.64 hr/day, 180 days/year in school, not including after school activities
- 2nd largest contributor to radon exposure for kids is their school

Children are more sensitive to radon

Normal respiration rate for an adult at rest is 12-20 breaths/min

Normal respiration rate for a preschooler is 22-34 breaths/min and even faster when running, playing

Normal respiration rate for school age is 18-30 breaths/min

Children more susceptible to ionizing radiation damage vs adults

Radon associated with asthma exacerbation in school children

- 292 school-aged asthmatic children enrolled in the School Inner-City Asthma Study (SICAS-1)
- Students with high radon exposure had significantly more days with asthma symptoms compared to students with low radon exposure
- In asthmatic children, radon may be associated with increased asthma morbidity, suggesting radon may be a modifiable environmental risk factor for airway inflammation

Banzon TM, Greco KF, Li L, et al.. *Pediatr Pulmonol*. 2023;58(7):2042-2049.

Radon revealed to significantly increase the incidence of lung cancer & childhood leukemia

- Meta-analysis of 55 case–control studies
- Residential radon was revealed to significantly increase the incidence of lung cancer & childhood leukemia in homes with radon measurements ≥ 2.7 pCi/L

Ngoc LTN, Park D, Lee YC.. *Int J Environ Res Public Health*. 2022;20(1):97.

2009 World Health Organization's recommendation of a lower radon action level

- The most noteworthy recommendation of the 2009 WHO Handbook On Indoor Radon - A Public Health Perspective is that country reference levels for radon should be set at **2.7 pCi/L,** if possible, or as-low-as-reasonably-achievable, or ALARA, but should not exceed 8.1 pCi/L

Conclusion

Children are more sensitive to harmful effects of radon

Children may be exposed to radon in school and in their homes

Testing should be required in schools and daycares