AARST
RADON PROFESSIONALS SAVING LIVES

March 2020

THE RADON REPORTER™

Practical Information for Your Success

Strength in Unity

plus

BATTLING TAKES TEAMWORK | THE COST OF NOT TESTING
MONTE CARLO | LICENSURE IN MINNESOTA

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Please submit content, comments, or questions to editor@aarst.org

AARST™, the American Association of Radon Scientists and Technologists, is a nonprofit, professional organization dedicated to the highest standard of excellence and ethical performance of radon measurement, mitigation, and transfer of information for the benefit of members, consumers, and the public at large. AARST's leadership is democratically elected by the members.

AARST represents your voice as we meet the wide range of challenges facing radon professionals and the community. Your membership and participation provide you a voice in the changes to come, and allows you to gain updated information, discover new techniques, learn about new problems before they occur, and hone your professional skills.

Letter from the President

David Daniels, AARST President

Public awareness is rising, and thanks to persistent AARST efforts, HUD, Freddie Mac, and the Department of Defense are looking at radon issues with fresh eyes. 2020 will be a year that will see our industry flourish. Several state radon programs are reviewing and updating their rules, and Kentucky is finally implementing licensure via certification. Many of the changes will result in more business for radon professionals and more importantly, a significant reduction in radon risk.

> **“Being in business for yourself takes an exceptional kind of person.”**

Most of us experience a lull in business every once and a while. Think of ways to use your time wisely.

- Pick up the phone and send emails out to your local news, TV, and radio stations. Request that they do a story and offer to be interviewed as the local expert. Use your downtime to help raise public awareness and get some free publicity. I have done many call-in radio programs that had a significant and beneficial effect. Appearances during rush hour, seem to get great responses.
- Work on CE for yourself and your employees, especially if the workday is finished early.
- Contact your local paper to do a radon story. Don’t be afraid to do this because no matter who you reach out to, it will help. You will get a “NO” if you don’t ask, so give it your best shot.
- Find out if local home inspectors have a checklist for radon mitigation systems. If they don’t, ask if you can provide a checklist for them to use when inspecting homes. If they see a radon system and it does not meet standards, they can inform their client. Their cooperation will help in a couple of ways- it will protect the homeowner from any issues the system may have, and the home inspector can refer you to his clients so you can look at and potentially repair the system. Put a company sticker on the vent pipe, so your contact information is easy to find.

No matter how big or small your company is, make sure you are planning for your future. Our BOD meets twice a year to plan for AARST. As a company, you need to plan for the short term, the next 12 months, and the next 3-5 years. Planning goals and implementation are crucial to your business health. After being in the radon business for three years, I made plans for an office and shop/warehouse. Two years later, we were building it.

Being in business for yourself takes an exceptional kind of person. Most weeks, you work hard and put in long hours. Be sure to pat yourself on the back and keep up the good work. By planning and working with intention, you are bound to be successful.

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National AARST BOD Commits to Local Chapter Growth with New Startup Format

Dallas Jones, AARST Executive Director

In late 2019, the AARST Board of Directors approved a new Chapter Affiliate Agreement that will make starting a new AARST Chapter less complicated and more manageable for the founding volunteers. In the past, chapter initiations required members proceeding with minimal guidance from AARST National. We now have the pieces in place to assist a startup group with systems for dues, membership and websites, clear expectations, and a legal entity.

The first step in chapter formation is to submit a petition with the names of 15 founding members to the AARST Executive Director. Those 15 individuals must be AARST National members. The next step is for the AARST Board to approve the petition. Then AARST National will sign and file the legal startup documents (Chapter Incorporation Certificate, Bylaws and Affiliate Agreement).

The new Chapter Affiliate Agreement eliminates the need for individuals to pay national and local dues separately. In states covered by new Chapters, payment of national dues will automatically make the AARST National member a local Chapter member. For example, let's suppose Jan Fisher and 14 others start a New Jersey Chapter of AARST. Once the Chapter is formed, every AARST National member who resides in New Jersey will be notified that they have automatically become a local Chapter member and invited to participate. To fund the Chapter, a portion of the national dues for each NJ AARST member will be allocated to a Chapter account maintained by AARST National.

The founding members must propose, and AARST National must approve, an initial slate of Chapter Officers. After the initial officers' first term of service, the Chapter will hold regular elections. AARST will assist with the implementation of a Chapter website, handle the lion's share of the bookkeeping, and help organize an annual meeting and educational event.

The intent is for AARST National to manage many of the "drudgery tasks" that volunteers typically have little time for, so Chapter leaders can focus their efforts on getting to know their state legislators, convincing the state government to implement awareness laws and licensure via certification (where none exists), and managing an open dialogue on behalf of the members with state radon program managers regarding licensure requirements.

AARST National will provide training for Chapters on how to effectively advocate for state policies that support radon professionals, grow their businesses, and protect citizens from radon exposure.

Several existing AARST Chapters have indicated an interest in changing to this format. The goal of the AARST BOD is to achieve a strong, effective local chapter presence in locations across the country, and reduce the logistical burdens on local leaders.

To find out more about how you can start a local AARST Chapter, contact me at director@aarst.org.

Successful NW Radon Coalition Forums

Steve Tucker, Northwest Radon Coalition

The Northwest Radon Coalition hosted its 8th Annual NW Radon Forums in January. Held in Lake Oswego, Oregon, and in Vancouver, Washington, both events had strong representation from local and state agencies, as well as local schools and the EPA.

Emcee, Professor Scott Burns from Portland State University's Geology Department, discussed the basics of radon illustrated by an informative PowerPoint, cloud chamber video, and a new video by the EPA about Rn in the Pacific NW. The Q&A panel of experts included the Northwest Pediatric Environmental Health Specialty Unit, EPA Region 10, Public Schools, Real Estate (RMLS), and testing and mitigation professionals.

Resource tables featured AARST, Washington State Health Dept., Planet Clark (Clark County of WA), American Lung Association, and radon testers and mitigators.

Tiffany Belser, of the American Lung Association, was honored for her years of leadership of the coalition and forums, hard work, and dedication to spreading radon awareness.

The NW Rn Coalition thanks everyone for their help and interest, and are looking forward to next year's event.

Welcome to AARST!

New Members Since November 2019

Alan Hendershot (NJ)
Carmela Pocchia (NJ)
Christopher Scott (NJ)
Kathleen Shipley (OH)
Dave Rux (CO)
Tyler Dewhurst (OH)
Dusty Barwald (MN)
Dino Sfreddo (VA)
Jason W Elliott (NJ)
Edgard Chow (TX)
William G Day (VA)
Joanne Fisher (FL)
William P Kujak (MN)
Marek Minta (FL)
Wilson Sebastian (KY)
Thomas Peters (OH)
Amy Pierce (OH)
Timothy OConnor (NY)
Rushan Abayagunawardena (MD)

Battling an Unyielding Foe Takes Teamwork

Phil Rivas, AARST Membership Committee Chair

Our scene opens, camera low on a set of train tracks near a commuter station. The crowd bustles and flows with the haste of another busy day atop their minds. A family wanders onto the tracks as you hear the train approaching. Something is wrong, the crowd seems unfazed, unaware and indifferent to the danger of a family in harm's way. Did they not read the signs? Can they really be this uninformed about the dangers of the tracks?

Another average commuter breaks their routine to politely warn and escort the family back to safety with the train safely in the distance. Is this person a hero or are they simply a good steward of their fellow humans facing a threat?

Since the family wasn't in immediate threat, the day goes on with just mild interruption. But since many more people continue to ignore the situation, the threat grows. In a world that is fraught with danger, warnings, and fear... how does the radon industry expect to rise above the din to command a larger audience, highlight the threat of radon, and shout "Look out!" to the public at large?

AARST is so tiny in the face of so much that needs to be done, like securing ISO accreditation, maintaining and expanding standards, prompting federal agency action, enacting notifications/awareness policies, right-sized certification laws and RRNC. What stops mitigators and testers around the country from supporting the institution dedicated to serving the industry that they've chosen to join? Our recent surveys to the membership [present and past] yielded illuminating, though some unsurprising, results.

One common feeling from past members who were only renewing locally to get CEs was that they didn't understand what AARST leadership was doing for them directly. Yet benefits have been expanded and there have been frequent communications to report important accomplishments, all of which benefit members. Another perception was that AARST had become too biased towards certain members and companies. There was also a sentiment that tensions within the organization and extended family stifle progress, consume finite benevolent energies, and deter working together as an industry.

To answer the questions of "WHAT stops us from growing?" it's smart to ask the bigger question of "WHY are we here in the first place?"

Scarcity Mindset vs. Abundance Thinking:

Scarcity Thinking: "There will never be enough"
Produces these symptoms and behaviors:

Unhealthy Competition	Hoard knowledge & resources	Suspicion
Think small & avoid risks	Believe times are tough	Believe the pie is shrinking
Fear of change	Fear of progress	Fear of being "replaced"

Abundance Thinking: "There will always be more"
produces the following thoughts and behaviors:

Welcome Competition	Knowledge-sharing	Trust
Think Big and embrace risk	Believe the best is still ahead	Believe the pie is growing
Welcome change	Embrace Progress	Generosity

Why do many leaders of our industry operate with such a scarcity mindset? Can you imagine another life-saving effort operating in such a manner? Fire-fighters slinging mud at the other firehouse about where they buy their hoses or what route they take to get to the fire. No, firefighters know that when the call comes, someone needs them.

We all know the estimates on unmitigated homes around the country. We all hear the figures on "dead fans" where a family has a system and is unaware it's inoperable and the family is in danger. Now, add in the new construction by builders who are largely apathetic to planning for this threat. Still feel like radon system installs are a niche market with only so much to go around?

Accepting that the radon threat is larger than any single industry body, company, or individual to overcome is a good place to start. We are tasked with being the torchbearers of truth to light the way so that family members can avoid the unnecessary pain of a loved one succumbing to radon-induced lung cancer.

AARST is an organization of people with one clear goal: Saving lives through the effective mitigation of radon where we live, work, and play. Each bit of energy we waste on industry in-fighting is wasted effort by a selfish few. The very real result is that families across the country will be delayed in receiving the lifesaving information, and it will cost them dearly. *Embrace the abundance and we will continue to save lives exponentially faster.*

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A Year One Review of Radon Measurement Licensure in Minnesota

The Minnesota Department of Health

Radon licensure requirements for measurement started in 2019. Because this was the first year of a new regulation, MDH minimized enforcement actions and instead focused on compliance assistance. The MDH radon program has licensed approximately 400 individuals. The Minnesota Radon Licensing Act has helped improve the quality of testing in Minnesota, which provides residents reliable information to make decisions regarding their health, safety, and financial interests.

Unfortunately, incorrect information was recently distributed by an outside source, stating that some home inspectors have seen fines in excess of $25,000, despite their best efforts to comply with the new law. The truth is fines have only been issued for testing without a license and using unapproved test devices. They ranged from $500 - $1,500, and in all cases, the individuals came into compliance and the fines were waived.

MDH conducted educational and individual consultations to help professionals comply with licensure. Outreach was completed to approximately 200 unlicensed people that may be testing (such as home inspectors and previously certified individuals) to inform them about licensure.

MDH also provided a wide range of radon education to licensees, real estate professionals, schools, and the public. There were 21 unique hours of free CE offered to licensees throughout the state, in-person, and by webinar. These helped licensees meet their CE requirements while delivering valuable information on requirements and why proper testing is important.

MDH staff audited 312 licensees with a focus on compliance assistance. These were one-on-one education sessions to go through an individual's processes, testing equipment, and compliance obligations. Since they were tailored education sessions, one hour of CE was granted for the audit, and a summary with instructions for corrective actions was provided. Enforcement action was only needed in two audits, when information revealed that unlicensed individuals in that company were conducting testing.

The most common violations were not giving proper notice before and during the test, not documenting test conditions and not providing required standard language in test reports, not following their QA Plan, and not performing QC measurements such as duplicates. A significant, but less common violation was testing with equipment that was past its calibration due date.

On average, we found ten unique violations at each audit, with up to 22 violations. Interestingly, more violations were observed for licensees who were privately certified within the last two years than for uncertified individuals. Our findings confirm that regulation of the radon measurement industry is warranted, and that voluntary certification alone does not ensure adequate compliance with standards and public health protection.

MDH staff investigated 30 complaints this year. While we used education and enforcement actions to help bring the individuals into compliance, penalties were waived after compliance was determined.

By investigating one complaint, MDH staff identified and helped individuals who were using unapproved testing devices. MDH staff worked with the National Radon Proficiency Program (NRPP), the device manufacturer, and the licensees to identify and quit using unapproved devices.

Another accomplishment that has led to more accurate testing is having licensees perform routine device QC checks that were not previously performed or not with the same frequency. As a result, some licensees found problems with their monitors and got them fixed and recalibrated. Some were even brand new or recently calibrated. Without QC checks, they could have been providing customers inaccurate data for making financial and health safety decisions.

MDH adopted the ANSI/AARST standards with only one modification--requiring tests of each unzqique foundation type. Anyone who is NRPP certified agrees to follow these same standards. Nearly 50% of the licensees audited are NRPP certified or certified within the last two years.

To make it easier for licensees to meet the standards, MDH has created templates for every single-family testing requirement, including the QA plan, test report, test notification forms, test placement and retrieval checklist, and a spreadsheet for tracking QC measurements. Numerous factsheets, handouts, and guides have also been created to assist in the licensing process.

One process professionals are adapting to is how results are reported to customers. Since radon levels in a building can fluctuate based on numerous factors, it is important to know some basic facts about the person performing the test, the device used, and the conditions present during the test. Since all these can directly influence the test results, the information is necessary to determine the accuracy of the test and if it truly reflects the radon risk.

Unfortunately, none of the current device manufacturers report templates contain the required information and instead rely on testing professionals to create reports that meet the standard. This has been a big change for licensees in Minnesota who are used to giving the minimal report from the test device. MDH has been working with manufacturers to make them aware of the deficiencies and either modify their reports to come into compliance or, make the reports modifiable so that end users can bring them into compliance. As an alternative option, MDH has created a fillable PDF report template that licensees can use.

Despite the learning curve, some companies have increased their business, as demonstrated by adding monitors or licensed individuals while complying with the licensing requirements.

MDH is committed to protecting the health of all Minnesotans. Our efforts in the radon licensing program have been aimed at preventing radon-induced lung cancer by allowing Minnesotans to make decisions based on accurate radon test results. Working together with our radon professionals in Minnesota, we recognize that we share a very important common goal, "saving lives by preventing lung cancer."

Getting Radon Testing Right

Bruce Snead, Radon Programs Administrator and Director, Engineering Extension at Kansas State University

In the past ten years as a provider of national public radon technical assistance for the United States Environmental Protection Agency (EPA), the National Radon Program at Kansas State University has processed more than 100,000 calls and inquiries about radon. The range of questions is interesting to say the least.

We often find ourselves providing information during real estate conversations among citizens, home inspectors, and real estate agents; citizens, mitigators, and real estate agents; or buyers, sellers, and their real estate agents. Our goal is to provide an unbiased and practical source of information for everyone on all sides of the conversation, share EPA and state guidance, provide access to certified measurement and mitigation professionals, and assist callers in understanding and reducing their risk of radon exposure.

While some home inspectors and real estate agents think that radon testing is required (which is not a bad thing), it is only required in Montgomery County, Maryland, in rental housing in Maine, and in some multi-family projects financed by HUD. In many locations, especially those states and areas with higher radon potential, radon testing is standard procedure, even though it is not required. Unfortunately, in many other locations, agents may say, "Radon is not a problem in our area," which is, of course, not true, and leads to a reduction in testing and a lack of recognition of the risk posed by long-term exposure to elevated radon levels. The Surgeon General has repeatedly recommended that all homes be tested for radon, and the EPA is leading efforts for local education on radon testing to physicians and schools across the country.

Regardless of the views of the participants involved in real estate transactions, it is critical that appropriate and accurate radon measurements be conducted so that clients have a sound basis for the mitigation decision and negotiation. That means designing and following a Quality Assurance Plan (QAP), including following device operation and placement instructions, ensuring annual CRM calibrations, and conducting duplicates and cross-checks fundamental to assuring quality measurements. This assures all clients that results are valid and representative of the potential for elevated radon in the home. Radon professionals understand there is uncertainty in every measurement, and the standards outline what we do to minimize that for every measurement. Also, taking steps to minimize violations of closed-house conditions during short-term measurements is fundamental.

Test results under real estate testing options (especially when the result is at or exceeds 4.0 picoCuries per liter of air (pCi/L)) often are challenged as non-representative for any number of reasons. It is crucial that the testing professional evaluate the results, and assuming he or she determines the results to be valid and substantiated, then stand behind the results without casting doubt on the measurement. Conducting a second measurement simply because a participant in the transaction takes some issue with the result should be avoided as much as possible if there is no reason to doubt the initial measurement.

What happens to the house during the test has far more influence on the results than the specific device used to conduct the test. This is the reason why short-term tests must last for a minimum of 48 hours, provided closed house conditions were maintained for 12 hours prior. If the closed house conditions had not been maintained for 12 hours prior, the only option is to conduct the test for at least four days. Radon professionals do all they can to provide reliable results but are also aware that the natural variability of radon may lead to a result of 3.9 pCi/L at the time of this sale, and a result of 4.1 pCi/L when the same house is sold in another year.

When testing results lead to mitigation, properly installed systems have proven capable of reducing any level of radon to below 4 pCi/L and, in most cases, below 2 pCi/L and even 1 pCi/L.

A review of states with regulations will reveal numerous mitigation system inspection checklists, and it is important to access the state checklist as a reference when working in that jurisdiction. AARST and NRPP members have access to an excellent checklist in the MAH 2019 Companion Guidance, which can be found here: https://standards.aarst.org/MAH-2019/34/index.html on pages 34-36.

As radon professionals encounter field testing and mitigation challenges, representatives at the National Radon Program Services at Kansas State University are available to respond to you and your clients to help resolve situations based on practical knowledge and experience with these issues.

Contact Bruce at Engineering Extension at Kansas State University, 2323 Anderson Ave. Suite 300, Manhattan, KS 66502, bsnead@ksu.edu or www.sosradon.org, 1-800-557-2366.

Congress Opens New Market for Radon Services

Since the mid-1990s, the US Defense Department has privatized much housing for members of the military and their families, to the extent that 99% of all US military families and many individual service members reside in privately managed housing. As a result of reported health hazards and other problems in these properties, Congress initiated extensive changes in how such housing is maintained and monitored as one element of the Defense Authorization Act signed into law on December 20, 2019. The housing-related changes include the development of a uniform code of basic housing standards, plans for hazard assessments and inspections, CO detector, and radon testing/mitigation. Yes, you read that correctly! AARST's comments, advanced by our lobbyist Randy Pence, yielded new radon requirements in privatized military housing:

1) Regular testing of dwellings by persons who possess certification

2) Testing procedures consistent with current national consensus standards and in compliance with Federal, State and local radon regulations

3) Submission of mitigation plans for building with high radon levels

Progress to bring radon protections to federally supported housing continues, year after year!

Policy Updates: RRNC

Results Are In: ICC Members Supported Protecting Occupants from Radon

Collaboration among the Conference of Radiation Program Directors (CRCPD), the American Association of Radon Scientists and Technologists (AARST), and the Environmental Protection Agency (EPA) advanced consumer protection in 2019. Code officials participating in the International Code Council's code development process agreed during an October hearing in Las Vegas and again in online electronic voting in November- December to require testing of radon control systems installed in new homes per Appendix F of the International Residential Code. They also rejected adding an option for sidewall venting of radon systems. Appendix F is an optional part of the International Residential Code which can be adopted by local jurisdictions.

Ready for Prime Time: AARST Standards for New Construction of Homes

Some six years after the publication of ANSI-AARST CCAH-2013, also known as RRNC 2.0, the AARST Consortium has completed the hard work of revising/updating CCAH and publishing a second standard ANSI-AARST RRNC-2019, also for new construction. Both standards involve the same rough-in of the core components of a radon system but only CCAH requires activation.

All in the extended radon family are encouraged to present RRNC and CCAH to state legislatures and code/housing agencies to (1) promote their adoption into laws/regulations/ordinances and (2) prepare for acceptance of these standards in the 2022 International Code Council's code development process. Remember that the ANSI-AARST standards are available for free online viewing – all you need to do is include the link in your email to the legislator or code official of your choice!


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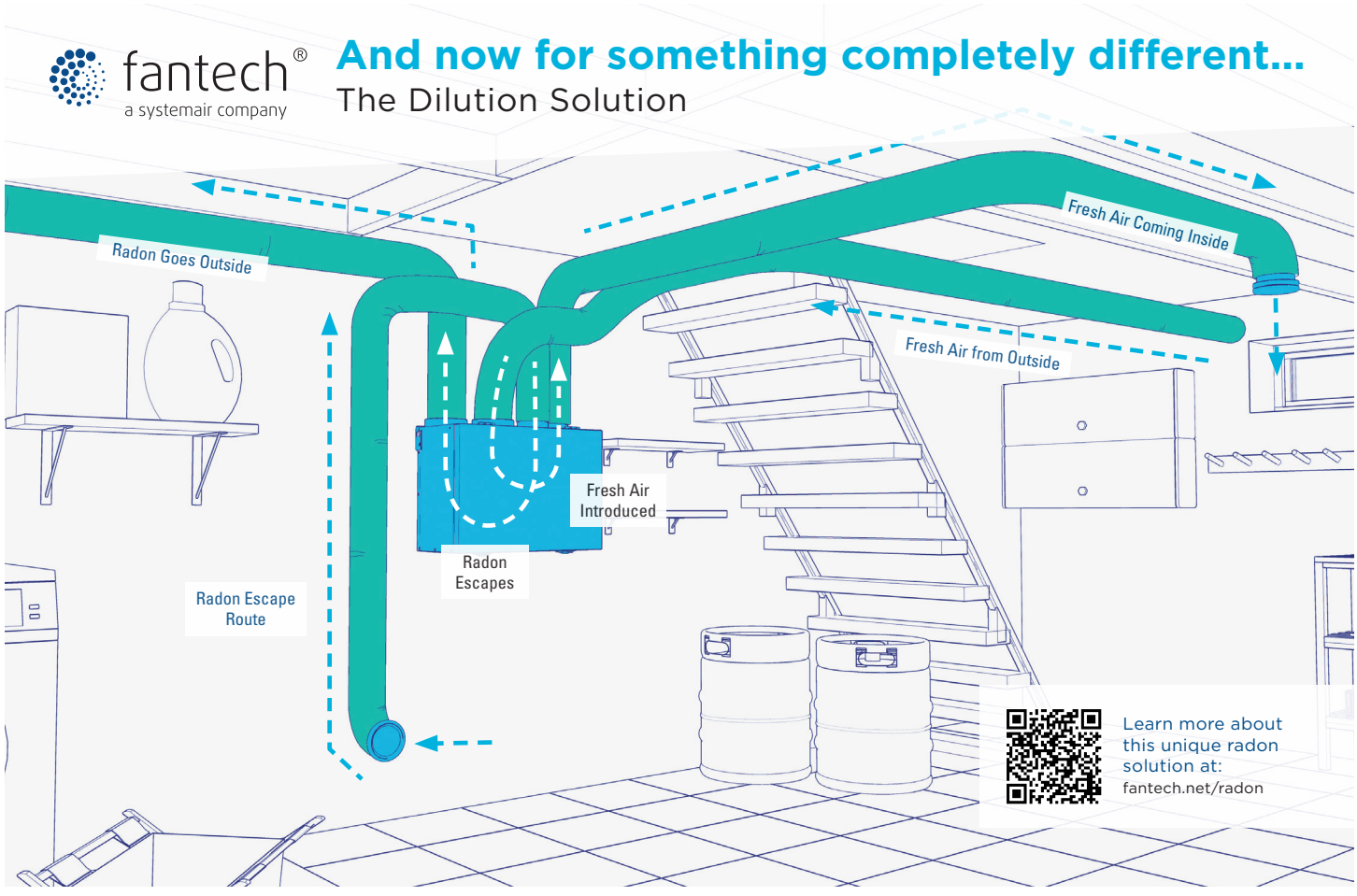
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The Cost of NOT Testing

Amy Morris, AARST Membership Coordinator, Media Manager

THE NUMBERS

After learning that the U.S. Environmental Protection Agency recommends every home be tested for radon, one of the first questions a homeowner will have is, "How much does it cost to test?" What if we reverse that mode of thinking and ask, "How much does it cost if I DON'T test?"

The price to test and even mitigate is minuscule compared to the expense of treating lung cancer. Quantifying the cost of not testing is a challenge, but we can be certain it will far exceed the cost of testing if unknown radon levels cause illness.

A recent National Cancer Institute article, *"Financial Toxicity Associated With Cancer Care,"* states "Cancer is one of the most costly medical conditions to treat in the United States. Prices higher than $10,000 a month for individual drugs and biologic agents are common."

Cancer costs do not stop with the astronomical price of medications. More recently compiled data reveal a financial loss profile that is staggering - lost wages, expenses for travel, childcare, long-term care, etc.

AARST Government Affairs Committee Chair, Kyle Hoylman, suggests the current EPA risk estimates are outdated and understate the number of lives impacted, as well as the financial burden caused by radioactive radon gas. "The current risk estimates are based on the EPA's 2003 document, Assessment of Risks from Radon in Homes," says Hoylman. "Our country has experienced tremendous growth over the past 17 years, and none of this data is reflected in the current risk estimates."

Using updated data available to the public through organizations such as the Centers for Disease Control and Prevention, the National Institutes of Health, and the U.S. Census Bureau, Hoylman estimates the number of annual radon-induced lung cancer incidents exceeds 30,000, with direct and indirect medical costs topping $7.2 billion.

Some homeowners may choose not to test despite the scientific facts and financial data. Others are completely blindsided, only to learn about radon after they become ill. Had they known from some source - a real estate agent, a homebuilder, a doctor, or an awareness law, perhaps they would have tested.

Industry professionals must actively and without hesitation be the ones to provide the knowledge of radon risks - health and financial - to as many people as possible so they may make an informed decision about testing.

PART TWO: THE INTERVIEW - see page 26

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Using the Monte Carlo Method

to Evaluate the Reliability of Screening Multifamily Housing for Radon

David Wilson, Research Staff, Oak Ridge National Laboratory

When screening for radon in a multifamily housing complex using a fixed sample density (e.g., testing 1 in 10 (10%) or 1 in 4 units (25%)), the statistical confidence is dependent upon the assumed elevated radon frequency. For example, testing 25% of units in a complex estimated to have eight units with elevated radon levels will provide 90% confidence. However, if it is assumed that, in the same complex, there are only three units with elevated radon levels, the confidence drops to around 58% for the same sample density. Furthermore, in the previous example, if elevated radon levels are not found during the screening, all that can be stated is that the screening provides 90% confidence that there are no more than seven units in the complex with elevated radon levels.

To more fully illustrate this uncertainty, ten separate multifamily housing radon data sets with 1 to 10 units with radon levels ≥4 pCi/L (Table 1) were selected for analysis using the Monte Carlo statistical method. Unlike other mathematically based statistical approaches, the Monte Carlo statistical method relies on repeated analysis of randomly selected data from a 100% sampled complex at various sample densities. Success for each simulation is defined as finding at least one unit with elevated radon levels. In this statistical method, confidence in the overarching conclusion can be greatly enhanced by repeating the simulated screening hundreds or even thousands of times.

Table 1. Radon data summary by complex

Number of units	Building type	EPA radon zone	Units ≥ 4 pCi/L	Average radon level (pCi/L)	Standard deviation	Highest result (pCi/L)
104	4-plex	3	1	0.6	0.8	4.5
108	6-plex	3	2	0.9	1.1	5.3
144	6-plex	2	3	1.4	0.8	5.3
156	6-plex	2	4	1.4	1.0	7.1
112	8-plex	2	5	1.3	0.9	4.9
112	8-plex	3	6	1.5	1.3	6.2
112	4-plex	2	7	1.5	1.1	6.1
108	4-plex	2	8	1.6	1.2	5.8
120	8-plex	3	9	1.7	1.9	7.8
100	4-plex	1	10	1.4	1.5	7.5

For this study, each of the ten data sets was simulated 1,000 times. For each simulation, the data set was randomized three times before the fixed percentage of data was selected. In cases where the result was a fraction, the number of samples was rounded up to the next whole number. After each individual simulation, the selected data were checked to see if at least one unit had elevated radon levels. If that was the case, the simulation was counted as a success. The simulated process was then repeated ten additional times. The average of all ten times—1,000 simulations—was then calculated and plotted (Table 1). These simulations approximate the findings resulting from screening each complex 1,000 times using randomly selected radon data at a fixed sample density with known units with elevated radon levels.

As can be seen in Table 2, 90% confidence can be achieved in multifamily housing neighborhoods at sample densities of ≥25% provided that there are at least eight units in the neighborhood that have radon levels ≥4 pCi/L. However, as the table shows, the confidence decreases as the number of units in the complex with elevated radon levels decreases. For complexes with seven or fewer units with elevated radon levels, correspondingly higher sample densities are required to achieve a similar confidence interval. For example, if only one unit was ≥4 pCi/L, 90% of the units would need to be sampled to achieve the same level of confidence.

In summary, the Monte Carlo simulation data shown in Table 2 provide a realistic estimate of the confidence level at various sample densities vs. the actual number of units within the complex known to have elevated radon levels. In a real-world situation in which the actual number of units with elevated radon levels is unknown, achieving minimal 90% confidence in every case would require a minimum 90% sample density to ensure that there is no more than one unit in the complex with elevated radon levels. Even at this high a sample density, 1 in 10 surveys would still reach the wrong conclusion.

Table 2. Number of successful simulations as a function of sample size.

Units > 4 pCi/L	1	2	3	4	5	6	7	8	9	10
10% sampled	10%	19%	27%	35%	41%	47%	53%	58%	62%	66%
25% sampled	25%	44%	58%	69%	76%	82%	87%	90%	93%	95%
33.3% sampled	34%	56%	71%	81%	87%	92%	94%	96%	98%	99%
50% sampled	50%	75%	88%	94%	96%	99%	99%	100%	100%	100%
66.6% sampled	67%	89%	96%	99%	100%	100%	100%	100%	100%	100%
75% sampled	75%	93%	99%	100%	100%	100%	100%	100%	100%	100%
80% sampled	80%	96%	99%	100%	100%	100%	100%	100%	100%	100%
90% sampled	90%	99%	100%	100%	100%	100%	100%	100%	100%	100%
95% sampled	95%	100%	100%	100%	100%	100%	100%	100%	100%	100%

• *The ANSI-AARST MAMF Standard requires testing 100% of ground floor units.*

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Transforming Public Health Systems to Integrate Radon and Tobacco Control

Ellen J. Hahn, Nicholas B. Conley, William C. Haneberg, Elizabeth Anderson-Hoagland, and Clay Hardwick

What if every health-care professional advised their patients who smoke to test their homes for radon? What if every radon professional urged homeowners with high radon to adopt a smoke-free home? The purpose of this paper is to describe a novel pilot project to increase capacity for coordinated lung cancer prevention by integrating public health systems for radon and tobacco risk reduction.

The purpose of the pilot project is to brainstorm ways to build capacity, promote collaboration, and break down traditional silos. The goals are to: (1) create a novel partnership within and between programs at the state health department and the university; and (2) actively engage radon professionals and tobacco control specialists in a conversation to develop novel ways of combining the radon and tobacco smoke risk reduction message. The project team is comprised of experts in the fields of radon, tobacco control, and geology from the Kentucky Department for Public Health's radon and tobacco control programs, faculty and staff from the Kentucky Geological Survey, and faculty and staff from the University of Kentucky's College of Nursing BREATHE team.

The team submitted abstracts to present at two state conferences (i.e., Kentucky Rural Health Association Conference; Kentucky Environmental Health Association). We shared an interactive, hour-long 'road show' presentation with public health professionals to provide basic radon and tobacco smoke education, and summarized existing programs, projects, and activities led by each organization. We highlighted one example of a successful collaboration between BREATHE's Radon Policy Division and the Kentucky Geological Survey to create new geologic county-level maps to emphasize synergistic risk, personalize radon risk potential, and prompt radon testing (see https://www.uky.edu/breathe/radon/radon-data-county).

The 'road show' concluded with an audience conversation to generate ideas for combining the message. First, they recommended launching an ad campaign on the combined risk of radon and tobacco smoke exposure. One low-cost strategy could be to include the free tobacco quit line (800-QUIT-NOW) on National Radon Action Month advertisements and social media posts. Second, audience members suggested collaborating with schools to reach parents and youth. They proposed that radon and tobacco smoke exposure be added to the school health screening questions. The recommendation to partner with schools is supported by the BREATHE team's research revealing that the presence of children in the home did not prompt action to prevent lung cancer.[1] Lastly, audience members advised us to actively and deliberately connect existing health and wellness coalitions with radon and tobacco resources for radon testing and remediation (e.g., mitigation and adoption of smoke-free homes).

The pilot project has yielded several preliminary outcomes. First, the state tobacco control program invited the state radon coordinator to present at a monthly Tobacco Control Webinar, attended by 65 tobacco control specialists. Second, the BREATHE Radon Policy Program manager was invited to present information about the combined risk of radon and tobacco smoke at a statewide radon mitigation training. Lastly, the state tobacco prevention and cessation manager has agreed to join the BREATHE Radon Bi-weekly meetings to promote coordination.

In conclusion, public health systems need to promote collaboration and integration between radon and tobacco control programs. We recommend that radon measurement and mitigation professionals provide quit materials during radon testing and mitigation and that all tobacco cessation programs provide free radon test kits. All radon measurement and mitigation training needs to include information about tobacco cessation and smoke-free homes resources. All tobacco control conferences need to include radon prevention strategies. If we work together, or at least share radon resources with the tobacco control community, this will start the conversation about combined lung cancer risk. Finding novel ways to integrate radon and tobacco exposure messages will improve radon testing and mitigation rates.

For more information, go to www.breathe.uky.edu. Follow BREATHE on twitter @UkyRadon

Reference
1. Huntington-Moskos L, Rayens MK, Wiggins A, Hahn EJ. Radon, Secondhand Smoke, and Children in the Home: Creating a Teachable Moment for Lung Cancer Prevention. Public health nursing (Boston, Mass). 2016;33(6):529-538.

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Thinking Outside the Pit

Douglas L. Kladder, Director, Center for Environmental Research and Technology (CERTI)

Active Soil Depressurization (ASD) is a very reliable means by which radon laden soil gas can be reduced from indoor environments. In its simplicity, one can even say it is elegant. Core a hole, dig out a pit, connect a fan and pipe, and voila, problem solved. However, there are situations where we may want to think "outside the pit" when dealing with larger buildings, such as schools and offices where heating ventilation and air conditioning (HVAC) systems play a significant role.

It is rare that all rooms within a school or building are elevated. Plotting radon readings on a floor plan helps identify areas of concern. When one is asked to explain why one portion of a building has elevated levels and others do not, the answer is typically, "because there must be a high radium content in the sub-grade under those rooms." NOT! The likelihood of substantial differences in subgrade make-up beneath the footprint of a building is low.

What is more likely when seeing localized areas of high radon is the effect that an imbalanced, or even disabled, HVAC system can have. Imbalanced HVAC systems can create tremendous negative pressures in localized areas, causing radon to preferentially enter those rooms, even to the point where an ASD system cannot overcome them. Hence, less than effective results.

The problem is either solved, or the ASD system can function as desired. Here are a few tips:

Most buildings constructed in the last 50 plus years have had provisions within their HVAC systems for the introduction of outdoor air when the building is occupied. This involves ductwork to the air handler, typically with an energy management system that controls a motor that closes the damper during off-hours to reduce energy costs. This outdoor air may be provided to large central air handlers or unit ventilators serving individual rooms.

First, verify that outdoor air provisions exist. Then verify that they are working and actually allowing in fresh air. I have seen where the damper motor is operating, and the energy management system is telling the damper to open, but the linkage to the damper is either broken or disconnected.

There are often protective devices that will close an outdoor damper if the outdoor air gets so cold that a coil may freeze (called Freeze Stats). These are set up such that if the sensor or control fails, the damper will return to a closed position, i.e., "fail-safe." Failure of a damper control in one room's unit ventilator but not in another room can easily account for significantly different radon measurements in these rooms.

There are also filters on the fresh air make-up and sometimes dehumidification coils. These filters need to be changed regularly and the coils cleaned or a reduction in the required airflow will result. If you are told they are working perfectly, take your smoke bottle and verify. Many times the HVAC systems serving the elevated rooms are not allowing in air. In one case, I asked the maintenance person when was the last time the filters were changed. The answer was never because the access to the filter (from the outside) had been compromised when they had repointed the exterior brick 20 years ago. After a little hammer and chisel work, the situation was fixed and new filters installed with two results: the radon went down, and the occupants noticed a significant improvement in air quality — all without a pit.

Second, when determining a strategy, in addition to looking down and searching for footings, also look up at the ceiling vents. Are there both a supply and a return? Sometimes a partition wall has been added, turning one room into two rooms, and the HVAC ductwork is not modified resulting in one room having the supply air and the other having the return air. The one with just a return is under negative pressure and is the high radon room. Adding the ductwork to both sides so there is balance can be an easy task for the school or building maintenance staff.

Third, radon levels within a building equipped with an energy management system, as is typical in buildings that are not occupied 24-7, will vary more with HVAC operation than diurnal variations that we see in residences. It is likely the testing methodology that identified the problem was a short-term integrating device. As a follow-up, utilize a continuous monitor to differentiate levels between occupied and unoccupied periods. In other words, the building's HVAC system may already be reducing radon exposures while people are within it. I have seen levels above 20 pCi/L at night but less than one during the day. That is the power of a properly operating HVAC system.

New Endeavors Spark Change

Gloria Linnertz, Founder and Director, Citizens for Radioactive Radon Reduction

CR3 is cultivating our message in new ways and to new audiences. Our crusaders are growing in number and determination, with approximately 50 members in 20 states. Radioactive radon exposure doesn't stop stealing the lives of our loved ones, friends, and co-workers, so Radon Action Month is every month for us!

New endeavors include Teachers for Radon Reduction campaign, which encourages school administrators and legislators to protect our younger generations from radon exposure. Partnering with us are Women for a Healthy Environment, Environmental Health Project, Pennsylvania Comprehensive Cancer Coalition, and the Pennsylvania Chapter of AARST. Our PA pilot project will be a model for the country. As an integral part of this mission, we will spark awareness of radon with our ambassadorship in "The Bark Side of Radon" with the distribution of flyers to schools and animal hospitals. We will seek sponsorship for schools from nonprofits, federal agencies, and independent corporations for test kits and training of school personnel.

Efforts continue to get the "Guide for Health Care Providers" in the hands of physicians, nurses, and public health departments. CR3 members are encouraged to join the Cancer Control Board or Consortium in their states and spread the message of including radon awareness, education, and action as part of the state cancer plan.

Participating in lung cancer walks and conferences are always part of our agenda, and we communicate with legislators about radon reduction and policy implementation when possible.

citizensforradioactiveradonreduction.org/e-mag
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Radon & Chemical Soil-Gas/ Vapor Intrusion:

Update On Testing (& Using) Associations

Henry Schuver, Chris Lutes, Chase Holton, Brian Schumacher, John Zimmerman, & Robert Truesdale*
**schuver.henry@epa.gov, Personal perspective & presentation – does not represent EPA policy*

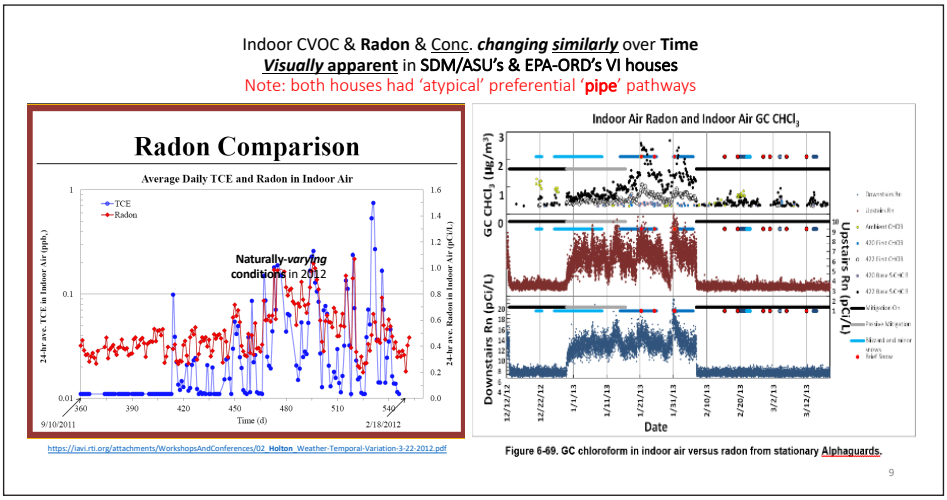
This paper reviews an ongoing analysis of the high-resolution indoor air radon and chlorinated volatile organic compound (CVOC) concentration data from vapor intrusion (VI) field studies, with emphasis on evidence from two data-rich studies: Sun Devil Manor (SDM), a single-family residence in Layton, UT studied by researchers at Arizona State University (Holton et al., 2013; Johnson et al., 2016), and the EPA's Office of Research and Development's (ORD's) "Indy" duplex research house in Indianapolis, IN (Schumacher and Zimmerman, 2015a,b; Schumacher et al., 2012). Note, both of these buildings were influenced by a significant amount of preferential- (e.g., pipe) pathway intrusion. This review includes a summary of these studies as well as the latest analyses, interpretations, and potential applications that can provide quantitative confidence in the percentiles of VI exposures represented by a few occasional, regularly-scheduled, indoor air CVOC samples.

While radon samples collected along with a few occasional CVOC samples are somewhat informative and helpful, they add little information on the range of variability of soil gas intrusion into the home between the occasional samples. Thus, it is the continuous measurement of indoor radon that can significantly add to our statistical understanding of meaning, representativeness, and confidence in an occasional indoor CVOC sample for assessing that building's potential VI exposure concentration levels.

The Evidence & Analysis

The evidence we have reviewed to date has shown general visually-apparent correlations between indoor concentration of radon and CVOCs from VI. The figure on the left side of presentation slide 9 is from the SDM VI study house in Layton, UT, under naturally-varying conditions and shows some visibly apparent correlations of the peaks of radon (in red) and TCE (in blue) whenever TCE is above the detection limit. Note when the TCE levels are not detected (i.e., no VI is occurring), the indoor radon levels likely reflect the outdoor radon levels and are readily measurable around 0.4 pCi/L. Also note in this slide that radon is plotted on a linear scale and TCE on a log scale (i.e., TCE is much more variable than radon). The figure on the right side of presentation slide 9 shows chloroform concentrations in the indoor air of the EPA's VI research duplex in Indianapolis, IN. The central part of the upper panel (without the black or grey horizontal bar) shows the chloroform concentration during naturally varying (i.e., mitigation system off) conditions and the lower two panels show the generally similarly-elevated radon concentrations in both the upstairs and downstairs areas of the Indy duplex.

SLIDE 9



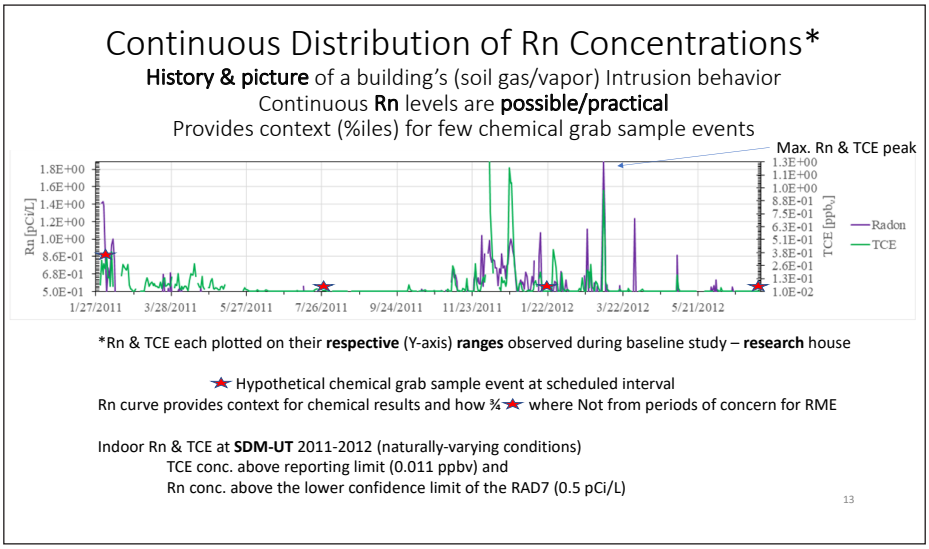
The statistical testing of the association of radon and the solvents TCE, PCE, and chloroform across time in each of the SDM and Indy VI study houses, using time series (linear) regression, showed two components of the association. The first component is how the concentrations of both radon and the chemicals change in direction of concentration together. When the concentration of radon is increasing or decreasing, so is the CVOC concentration, 99% of the time in the Indy duplex, and 99.9% of the time in SDM. However, only about one-half of the magnitude, or proportionality, of the change in numerical CVOC concentration was explained by the change in radon concentration (r2 value).

To improve the practical applicability and predictive value of indoor radon levels, we looked more closely at high

frequency/continuous measurement of indoor radon and CVOC concentrations from VI for possibly more useful associations across time. Presentation Slide 13 shows a graph of nearly continuous measurements of indoor radon and TCE, which is plotted on the maximum range observed for both constituents in their respective units (as an approximation of the percentiles of the distribution). This graph shows a general temporal association for many of the peaks of radon and TCE. While some peak pairs are also nearly identical in height, there are also some notable differences in the height of other peak pairs (i.e., the magnitude of concentration).

It is important to note how the real-time, sequential data (even with just Rn alone) can provide an important qualitative context for understanding general level of soil-gas VI into a building over time, and an invaluable context for understanding how occasional 1-day grab CVOC samples do, or do not, represent the 'elevated' exposure conditions over time in the building. Presentation slide 13 uses red star patterns to show how hypothetical typical quarterly sampling events could result in approximately average/random concentrations (not 'elevated levels of concern) regardless of the seasons sampled, as specific daily events/conditions drive the day-long-average sample concentrations.

SLIDE 13



Editor's note – This paper was edited to fit the available space. We encourage readers to consult the entire paper at https://internationalradonsymposium.org/category/2019-symposium-abstracts/

NRPP Certification Council News

The National Radon Proficiency Program is pleased to announce that its Certification Council (formerly known as the Policy Advisory Board) has undergone an election for representatives to the Council representing various aspects of our industry, and announces with regret the recent resignation of Chair Doug Kladder.

Notices for filling the eight vacancies were posted and emailed. Seventeen applications were received and reviewed by staff against previously established minimum criteria and experience. Votes were cast by sitting members of the Certification Council as of December 1, 2019.

NRPP constituents are encouraged to communicate thoughts and concerns to the representatives who have stepped up to represent you as new policies and certification criteria are developed. Election results are as follows:

2020 NRPP Certification Council

To be determined, Chairman; David Metzger, Rn Measurement- Residential; Rick Welke, Rn Measurement- Large Buildings; Bill Brodhead, Rn Mitigation- Residential; Dawn Goard, Rn Mitigation- Large Buildings; Natalia Deardorf, Certified States; Justin Otto, Non-certified States; Angela Tin, Consumer Interests; Jonathan Russell, Home Inspectors; Owen Reese, Rn Laboratories; Dan West, Rn Educators; Mike Kitto, AARST Technical & Science Committee; Matt Hendrick, Rn Equipment Manufacturers; Bruce Snead, Rn Chambers.

https://nrpp.info/standards/nrpp-certification-council/

Special thanks to our departing Certification Council members for their hard work and commitment over the last several years: David Grammer, Dr. James Burkhart, Kevin Stewart, Shawn Price, Andrew Harris, Chrystine Kelley, Shannon Cory, Steve Albright, Troy Morris, and most especially to Chairman Doug Kladder.

The Cost of NOT Testing

Continued from page 15

FIND A WAY

To only look at the high financial cost of not testing is insufficient. Even more devastating than the financial struggle of treating cancer, is the human suffering.

The importance of radon-awareness cannot be overstated. Industry professionals must find a way to connect with more policymakers, homeowners, real estate agents, builders, medical professionals, and school boards to share the testimony of radon-induced cancer patients passionately fighting alongside us.

Had she known about radon, Rachael Malmberg would have tested her home. But the radon message came too late to protect her from Stage IV lung cancer. Now, she must live with the cost of cancer treatments and the emotional cost and pain of the battle.

Rachael has summoned relentless dedication to find ways to advocate for radon awareness. It's important to contrast being an advocate during a healthy time, with the extra fortitude required to sustain advocacy work while in the fight against cancer. Rachael graciously spent some time sharing her reality with AARST.

You are again courageously fighting radon-induced lung cancer and still maintaining an active advocacy schedule. How has your advocacy perspective shifted during the changing condition of your health?

"In the beginning, determination and raw emotion were driving the advocacy. I was living as if I didn't have tomorrow. Now that I am 2.5 years in, I have been able to take a step back and reflect on what is important and work more intentionally.

When things are good in the cancer journey, they are great, as if you are a normal person living without a terminal illness. You realize that you must enjoy them those times and be intentional because suddenly, you can be in a distressed situation again.

Advocating when [cancer] progression is found becomes more meaningful. The desire to make a change becomes the fire to continue and the need to positively impact others is stronger because the disease is right in your face.

What do you have to overcome physically/emotionally to continue advocacy?

The hardest part of advocating when I am struggling with pain, progression, fear, or even the emotional side is having to deal with it front and center. I like to try and live a normal life, and I do not want sympathy, or the pity people give when they know you are sick. I think there is a time and place in which you need support; however, for me, my biggest support comes from people who act and support the cause.

Daily I am living with severe pain and extreme fatigue caused by medications. Taking medication multiple times a day, and having to watch what I eat and drink is a constant reminder I am sick. I am coping with the constant fear of progression, not being here for my daughter, and not making a big enough impact while I am here. On top of all that, being a single mom and worrying about how long I will be able to work and ensure I can provide for my daughter has weighed heavily.

From your perspective as a patient, what would you want radon professionals to know about your story to inspire them to seek ways to pull together to create change?

They need to know that we, as patients, need change, which comes from numbers. The people in Washington, D.C., always say to me, "change comes in numbers and those that show up." We need to show up and be present.

We need people to acknowledge that radon causes major health issues. Until that is front and center, there will continue to be less funding and more deaths. Until radon testing and monitoring are like smoke detectors, we have not won this battle.

Does your daughter understand the work you are doing?

I have worked hard to remove her from the cancer world. In the beginning, it was all about time with her and her understanding that I am going through something hard but not going to give up. As a 6-year-old, she has dealt with more in her life than I have in 33 years. She has lived for two years in fear that mommy isn't coming home. She is not able to live a normal 6-year-old carefree life.

What significant change(s) would you like to see in 2020 from your efforts?

I would like to see radon testing in schools passed. There is a massive volume of children and educators that we can protect if we can get this done. Our children spend 8+ hours a day in the schools and 15+ years often within them. That's a major portion of their lives, especially during developmental years. If we reduce the risk and exposure during that time, we have an opportunity to make a difference.

> **"My biggest support comes from people who act and support the cause."**

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