



Radon Gas: Separating Fact from Fiction

By: Greg R. Wayman, ASHI Certified Inspector

What is radon gas?

Radon gas can't be detected by the human senses. Radon gas comes from uranium in the soil. Uranium is found in all 50 states. It's radioactive and when it breaks down it forms radon gas. Radon gas takes the path of least resistance and if that path is where your home is located, your home will have high radon levels. The only way to know if your home has high radon is to test for it. In Nebraska, the eastern half of the state has such high clay content that the radon gas is trapped. When we excavate down for basements, we disturb that soil making the house the path of least resistance for the gas to travel. In the Sand Hills on the western part of the state or in states like Florida or Texas, it's not as likely to find high levels of radon gas because the sandy soil lets the radon gas slip out into the atmosphere, however, high radon levels have still been found in these areas. Like Uranium, radon gas is radioactive. It breaks down into radon decay products. The radon decay products act like dust particles in your air. They too are radioactive, but have an extremely short half-life. When you breathe them in, they release destructive alpha particles. If the radon-decay products are in your lungs when they release the alpha particles, then they can cause your lung tissue to mutate leading to the cancerous growths.

Does radon gas lead to lung cancer?

Yes. Unlike the mold scare that is hyped up by the media, radon exposure can lead to lung cancer and is backed by scientific research. Did you know that radon gas has surpassed cigarette smoking and is now the #1 cause of lung cancer? Did you also know that a home with a radon level of 4.0 pCi/l (which is the action level set by the EPA) is the equivalent of subjecting your body to 200 x-rays a year? The University of Iowa conducted The Iowa Radon Lung Cancer Study from 1993 to 1997 on 413 female patients diagnosed with lung cancer who had lived in their homes 20+ years. Of the 413 patients, 60% had high radon levels in their homes. If you would like to read this study or other scientific research on the effects of radon gas, please go to The American Association of Radon Scientists and Technologists (AARST) website at www.aarst.org.

What types of homes have high radon?

High levels of radon gas have been found in all types of homes, new and existing. The only way to know if your home has unsafe radon levels is to test it. One rumor that I hear too frequently on real estate transactions is if you have a walk-out basement, you don't need to test for radon. That is flat out incorrect. The fact that a house has a walk-out basement has nothing to do with whether it has radon gas. Radon gas will enter a home through visible or non-visible cracks in the concrete floor or foundation walls, around any unsealed penetrations like plumbing piping, around inner drain tile systems, and probably in heaviest concentrations through the sump pit.

Radon Gas and Real Estate

The most accurate radon test is a long-term (90+ days) test. Unfortunately, real estate transactions don't have that kind of time, so the short-term test is accepted. A short-term test can be anywhere from a minimum of 48 hours up to 7 days. Per the EPA protocol, the closed house conditions need to be maintained during the entire test and 12 hours prior to placement of the test kit or machine. If I arrive at the house to find the doors or windows wide open, I can close them and still conduct the test. It takes 12 hours for a house to reach equilibrium. Per the EPA protocol, if this happens, I now have to test for a minimum of 72 hours for a legit test.

Most real estate agents in the Omaha Metro properly advise their clients to have the home tested for radon. They have attended classes on radon, made themselves aware of the dangers of radon exposure, and pass that information onto their clients so they can make an educated choice for testing. Unfortunately, there are some unprofessional agents out there that downplay radon in hopes that radon won't be an additional hurdle to cross before they can cash their commission check. If you've stumbled onto such an agent, fire them, and move onto somebody who will protect your best interest. Chances are if they are unethical about the subject of radon exposure, they may not be too honest during the rest of the transaction either.

Radon Resistant New Construction

Notice that the name doesn't state "Radon Proof New Construction". The numbers of new construction homes in the Omaha Metro that are being built with radon resistant techniques are growing. To build a radon resistant home, the Builder will typically make sure there is a minimum 2" layer of course stone covered over with an impermeable layer of plastic underneath the poured concrete basement floor. Prior to pouring the concrete, extra piping will be installed that runs from beneath the basement floor directly to the exterior. Once the concrete floor is poured, all of the penetrations are sealed around. The sump pit will be sealed. If the Builder does not install the radon mitigation fan, then this is called a "Passive" system. Most Builders only install the passive system. If the Builder does install the fan, then it's called an "Active" system and I would commend that Builder for doing it right! A passive system only works via gravity. If you have borderline radon levels in the basement, this passive system may bring the radon level down just below 4.0 pCi/l. It may not. If the radon levels are roughly 4.5 pCi/l or higher, a passive system normally doesn't reduce the radon levels enough. Most Builders promote their radon resistant new construction, but very few Buyers realize that these systems don't work until they pay for the fan to be installed. Every radon resistant new construction home should be tested for radon. This is the only way to know if the passive system is working or if a fan needs to be installed. Please be cautious if the Builder performs the radon test themselves.

One Builder in Omaha is utilizing a slightly positive pressure system on their homes to combat radon. From all of the tests I've done in 2009 on their new construction, their techniques appear to be working.

Short-Term Radon Tests

When I first started inspecting homes 8 years ago, I tested for radon via the charcoal test kits. I quickly switched over to using continuous radon monitors after I found out how inaccurate the charcoal test kits were. The Nebraska Radon Program, Douglas County, and most County Extension Offices give out free or low cost charcoal radon test kits. I think it's great that they are trying to educate the public on radon gas, but giving out such an inaccurate test kit drives me nuts! Charcoal test kits are heavily weighted towards the last 4 hours. If you have high wind (Hello, we're in Nebraska!) or a storm blows through, the charcoal test kit can be significantly off either reading extremely low or off the charts high. A homeowner might test their home, have the readings come back falsely low, and think they have safe radon levels, when in fact they are high. E-perms are another type of test kit that I wouldn't recommend to anybody. Like charcoal test kits, they have 1 average number returned from the lab that the person performing the test has to go off. They have no idea what the fluctuation levels of the radon were, no way to see if the EPA's closed house conditions were maintained, or if somebody was trying to fudge the test results.



Continuous radon monitors are, in my opinion, the most accurate way to test for radon. I utilize Sun Nuclear's 1027 & 1028 models. Both models record the radon level every hour throughout the test and calculate an overall average. With the 1028 model, I can provide the hourly readings and the corresponding chart to show my clients how the radon levels fluctuated during the test on their home. If the EPA's closed house conditions were not maintained, then I can see the dip in the radon levels on the reading. I can tell the client the exact hour the windows or doors were opened and show them how it falsely impacted the readings. You can't do that with the charcoal test kits or E-perms. If a storm blows through and the barometric pressure spikes, then I can see the impact on the hourly readings and advise my client if the test is accurate or if it needs to be re-tested. You can't do this either with the charcoal test kits or E-perms. I've encountered unethical people during my

radon tests trying to manipulate the tests. I won't go into details to give anybody ideas, however, the continuous monitors have tamper features that assist me in determining if the test is legit or not. Anybody using a charcoal test kit or E-perm would not be able to detect manipulation.

Radon mitigation systems

If your home tests high for radon, then it can easily be fixed so the radon levels are brought back down to safe levels. A radon mitigation system acts like a big vacuum cleaner on your home. Once it's installed, the continuously running fan will suck the air from under your basement floor or from under the plastic in the crawlspace and pump it to the outside. As long as the fan stays running, you should never have high radon levels in your home again.

To have a radon mitigation system installed, first you need to hire a state licensed radon mitigation company. Not all companies offer the same level of quality so do your research. I inspected a home this year that had a mitigation system. Once I found out whom the installer was, that he was not a state



licensed radon mitigation company, I recommended for my client to have a radon test. No surprise, the radon level was still high even though the mitigation system was sucking air and the manometer was reading off the bubble properly. This company never tested their own system to make sure it was drawing air properly from underneath the entire basement.



The manometer

The installation will take a few hours.

It consists of drilling a 5" hole in the basement floor at a select location where the system will get proper draw. This will usually be where there are known coarse stones under the floor near the sewer stacks or by the footer or both. They'll dig out about a 5 gallon bucket of dirt at this location, install the PVC piping with proper hangers, have a licensed Electrician install the fan, and turn it on. If you have a sump pit, they'll seal the pit with installing the 4" PVC into it for the suction point instead of boring a hole through the concrete floor. After the system has had a chance to run for 48 hours, then the home needs to be tested again for radon gas to make sure it's working properly. If it still tests high for radon,

then the mitigation company will have to return and install a second suction point with more piping. They usually tap into the same fan. Complicated houses sometimes require multiple radon mitigation systems, but these aren't typical. A typical radon mitigation system will cost you \$800-\$2,000 depending on how complicated a system is needed. If you have a crawlspace and some not-so-fun-to-reach places, then the price will be higher.

Nebraska state law does not require the radon mitigation company to re-test using a continuous monitor. As a result, most radon mitigation companies will hand the homeowner a charcoal test kit and ask them to perform the test, mail it in, and let them know the results. Because these are highly inaccurate, I would recommend asking the radon mitigation company to conduct the post-test with a continuous monitor or hire a NE Radon Measurement Specialist who utilizes a continuous monitor to perform the test. This way, you'll know if the system is working properly.



The suction port



View of system on exterior

Greg Wayman is a Certified Inspector of The American Society of Home Inspectors, Inc., has been inspecting full-time for over 8 years, and has personally inspected over 1,900 properties. Greg is Heat Exchanger Experts Certified and is a NE Radon Measurement Specialist. He is a member of the Go-ASHI Chapter in Omaha. He is the past Nebraska Chapter of NAHI President from '03-'07, past Board member of NAHI from '07-'08, and past national Secretary/Treasurer of NAHI '08.

