Moderator: Hello and welcome to Public Health Live, the third Thursday breakfast broadcast. I’m Rachel Breidster and I’ll be your moderator today. Before we get started, I would like to ask that you please fill out your online evaluations at the close of today’s broadcast. Continuing education credits are available after you complete our short posttest and your feedback is helpful in the development of future programs. We encourage you to let us know what topics are of interest to you and how we can best meet your needs. As for today’s program, we will taking your questions throughout the hour by phone. Call us at any time at 1-800-452-0662 or send us e-mails throughout the hour at phlive.ny@gmail.com. Today’s program is: Prescription for Radon. Our guests are Dr. Paul Locke, an associate professor in the Department of Environmental Health Sciences and the Director of the DrPH Program in Environmental Health Sciences at John’s Hopkins Bloomberg School of Public Health, and Gloria Linnertz, a radon activist and advocate. Thank you both very much for being here.

Gloria Linnertz: Thank you.

Dr. Paul Locke: Thank you for having us, Rachel.

Moderator: Sure. We're excited to have this conversation. Paul, we're going to start with you today. We’re going to start just by having you talk about radiation risks and benefits and how we bring radon into the picture. So can you start us off with that?

Dr. Paul Locke: Sure, great. What I'd like to do is go through some data, some information that's been compiled by national and international, scientific organizations and as you said, we're going to focus on radiation risks and benefits.

Moderator: And what are some of the objectives that you hope to accomplish today? I know that we don't have a lot of time to cover two much material, but what do we want to do in the hour that we have?

Dr. Paul Locke: Well, I want to cover four items. First, I want to talk about typically how much radiation people are exposed to, that would be US residents. At what levels and what are the sources? And I want to talk about radon's health risks and then finally, how you can communicate radon risks in a medical or health setting. Now, I would like to make one clarification just to start out. We are going to talk about radiation today. And by radiation, I mean ionizing radiation. Non-ionizing radiation is not going to be covered. Ionizing radiation is defined as radiation that creates enough energy to remove electrons from atoms, thereby creating ions. So when I say radiation, please be aware I’m talking about ionizing radiation.

Moderator: Thank you for that clarification, I think it’s important for folks to know that. Now one of your objectives was to talk about the exposure sources we have in the United States. So why don’t we start with where do we get radiation from? Where are we exposed to radiation?

Dr. Paul Locke: Sure. I have some data on that. The first piece of data is a pie chart. This pie chart was put together by the NCRP, which is the National Council on Radiation Protection and Measurements. That's a congressionally chartered, not for profit organization that's been studying radiation issues for quite a while, really, since the 1920s. And what the NCRP did is they looked at radiation exposure from the 1980s and then again in about 2006. Now, the biggest changes you can see that there has been an increase in radiation exposure over that time. And this increase is due entirely to the increasing use of radiation in medicine, especially the use of CTs. So if you compare the two pie charts, you’ll note that this is really popping up as an obvious fact. Now, that being said, beyond the medical radiation, the largest source of radiation is background radiation, which is mostly radon. So we’re going to revisit those points later, but I just wanted to introduce them because they are important for our risk communication discussion.
**Moderator:** Sure, and now you have another chart that illustrates some of the different components of where the radon or radiation exposure comes from, as well.

**Dr. Paul Locke:** Yes, another set of pie charts. This is put together by the UNSCEAR, which is the United Nations Scientific Committee on the Effects of Atomic Radiation. I only wanted to present this to show other organizations are in basically the same place as the chart I showed you previously.

**Moderator:** Oh, ok, now what can you tell us about the different human-made radiation sources?

**Dr. Paul Locke:** Let's get back to the issue of human made exposure. Now, this pie chart shows what most people don't understand and that's that the largest part of human-made exposure comes from medical procedures as I mentioned. And this breaks down the different human-made sources. So CT is the largest source of this exposure, but it's important to note that very, very little, almost no radiation comes from nuclear power plants, consumer uses or occupational exposure.

**Moderator:** So you mentioned CT exposure being one of the largest sources. How has that number been changing over the years?

**Dr. Paul Locke:** That's very interesting. There's been an explosion in CT use since the 1980s. If you look at this next slide, you can see CT procedures by years. In the early 1990s, we were probably using about 18 million CTs, but that number has jumped to 62 million by 2006. That's a really significant increase. Now, I do need to be very clear here. I want to make sure that I'm not sending the impression in any way that this -- that CT scans are being overused or improperly used. That's not what I'm trying to say. These are important techniques in diagnostic radiation and, obviously, this is a way that our medical community learns more about what's happening in our bodies. So it's important to know that the increase is from CTs, but I don't want to indict CTs in any way.

**Moderator:** Sure.

**Dr. Paul Locke:** And we'll talk more about this point again when we discuss risk communication.

**Moderator:** Absolutely. So our largest exposure, you know, as you showed on those charts is through medical procedures that's been growing quite a bit. But we're here today to talk more about radon and how that fits into the picture. So why don't you start talking to us a little bit about radiation exposure and those risks.

**Dr. Paul Locke:** Absolutely and radon is radiation. To be more specific, radon is an element. It's a radio nuclei that gives off several types of radiation. For our purposes today, the most important type we're going to talk about alpha radiation. It's a particle made up of two protons and two neutrons, just like a helium nucleus. I'm sure most people remember that from their high school or college chemistry. As radiation goes, it's a heavyweight. That is alpha radiation packs quite a punch, especially when you compare it with beta radiation or gamma radiation.

**Moderator:** So has -- over time, as our exposure to radiation through CTs, for example, has increased, has our exposure to radiation through radon changed over time?

**Dr. Paul Locke:** Well, not much. And that's really what the data I have will show here. This is really just a chart that I made from the pie charts that you saw earlier.

**Moderator:** Okay.

**Dr. Paul Locke:** And if you revisit this information, I wanted to just point out that over the past 30 years, the amount of radiation that we're receiving from background radiation, again, mostly radon, hasn't changed much.
It's still a very significant source of exposure. So I think maybe what we can do now is move on to radiation risk and talk a little bit about radiation risk, if that's okay with you.

**Moderator:** Sure. So one of the main objectives for today's program is to have that discussion and talk about what are the risks. So for those of us who are not from such a scientific or medical background, talk to us about what really is radon and how is this affecting us?

**Dr. Paul Locke:** Sure. If it's okay with you, before we do that, I'd like to tell the radon story.

**Moderator:** Sure, please do.

**Dr. Paul Locke:** So what is the history of radon? Not many people are aware that this story starts in the 16th century in something called the Erz Mountains in Europe. I frankly don't know where they are and I don't have a map of those. I'm sure we could find out if we went to a web browser. In this area, it was clear miners who were working in these mountains were dying of severe lung disease. Now, it took several centuries, about 250 years, to understand that these miners were exposed to high levels of radon in their work for long periods of time and were probably dying of lung cancer. In the 20th and 21st centuries, we've conducted thousands of studies on miners and we also have studies on home dwellers to learn more about radon's risks. In the early 1980s, we learned that high radon levels could be a problem in some homes. Early in this century, in the 21st century, scientists completed studies that showed that people that lived in high radon homes for long periods of time are at risk for lung cancer. So, let's start out with that background.

**Moderator:** Sure, that's a very interesting history because I think a lot of people, as we'll talk about later, are unaware of radon. And how do we first become aware of it? I think it's good to have that background. So, now let's talk about properties of radon. What is radon?

**Dr. Paul Locke:** Okay, so radon is a noble radioactive gas and the word noble there doesn't refer to any sort of regal title. It means that radon is chemically nonreactive. Radon is ubiquitous. It's everywhere. It comes from uranium bearing rock and soil that's around us and it can't be seen, smelled or tasted, so the only way you know if you have radon in your home or in any building is to test for it. That's a really important point. Now, radon is produced by the uranium decay chain. And we'll discuss that in a minute. But before I go on, I just want to remind everyone that radon and some of its background products emit alpha radiation, which I introduced earlier. Also, I want to state that radon has a half-life of about four days. Now, in the radiation world, the term half-life is defined as the amount of time it takes for half of the atoms to undergo decay. So for radon, that means in four days you have only one half of the original amount left. So if we could now, let's go to the uranium decay chain.

**Moderator:** Yes, please do. I think that would be helpful in showing what exactly is the uranium decay chain? What does this mean in layman's terms?

**Dr. Paul Locke:** Sure. And as I tell my students when I introduce this, this is not on going to be on the final. But what you see here is a very truncated version of the uranium decay change. It all starts with uranium 238. Uranium 238 has an extremely long half-life of about 4.5 billion years.

**Moderator:** Okay.

**Dr. Paul Locke:** Now, as uranium 238 breaks down to other radio nuclei, that's the decay happening, you would get radium and radium has a half-life of about 1600 years, and then, of course, radon, and I've circled radon in the uranium decay chain here. Radon itself breaks down into a series of radioactive compounds and eventually to a
stable compound, lead 206 which you see all the way to the left. Now, there are three things I want to emphasize about this decay chain that are important for radon. The first is that radon is the only gas among these radio nuclides. The rest are solids. That means radon in the air can be breathed into the lungs, obviously extremely important for understanding the fact that radon causes lung cancer. Second, even though the half-life of radon is relatively short, only four days, radon is constantly produced because the half-lives of both radium and uranium are so long. The uranium decay chain is the gift that keeps on giving and the gift it gives us is radon.

**Moderator:** That’s a really helpful breakdown of where this really comes from. For a lot of us, we may be somewhat familiar with the idea of radon or we may have never heard of it but how does it occur? I think that's helpful information to have. So we know how it occurs now. The problem or the issue that we want to talk about is that it causes lung cancer. So can we start talking a little bit about the relationship between exposure to radon and breathing it in and lung cancer?

**Dr. Paul Locke:** Yes. And I think building on what we just discussed about the decay chain and alpha particles and the radon itself and what it breaks down to, we can theorize why. And I want to briefly discuss what's known about that. Scientists describe the way that radon and alpha radiation cause lung cancer in what's known as a biophysical model.

**Moderator:** Okay.

**Dr. Paul Locke:** Now, that's very complicated and researchers have been looking at it for many years. I’m just going to introduce it today in a very simplified fashion.

**Moderator:** Okay.

**Dr. Paul Locke:** And this is what describes how the alpha particles and the radiation that they give off causes lung cancer. So here is what happens: you take a nice deep breath, you get some radon in your lungs. Some of it gets exhaled, but some of it stays close to the nice, sterile lung tissue that you have. When it does, the radon gives off alpha particles or the radon breaks down to solid particles which of course now get right next to your tissues. Some of that alpha radiation is going to hit cells and it's going to hit their DNA. Now, when cells' DNA is damaged, basically three things can happen. The first thing is that the cell can die; the damage can be so severe that the cell just dies. And that's good because it gets a damaged cell out of your body. The next thing that could happen is the cell could repair itself properly and go on and live the normal life of a cell. But the third thing is where the trouble starts. And that is if the DNA is misrepaired. What happens then is that you get the abnormal cell. If the abnormal cell invades the body’s immune system, then that will clone and grow and that is a lung tumor.

**Moderator:** Have there been consensus reports, studies, research done that demonstrates things that you're talking about?

**Dr. Paul Locke:** Absolutely and let's turn to those now. There have been many consensus reports written. There’s one that was just released in 2010. But I am going to focus on two earlier ones that were done by the US national academy of sciences. And that is what I introduce now. These are two studies that came out of something called the biological effects of ionizing radiation reports. And since scientists like acronyms, they call this the BEIR series of reports. And that's easy to remember. What these studies do is compile and analyze the data from the thousands of studies that be done on radon’s health hazards. An expert panel meets and creates risk models. These risk models are used by agencies such as EPA to set radon action levels and New York State adopts those as well. We’re not going to go through all the studies and the work. But I do want to point out two of these BEIR reports. The first one is BEIR IV, and you can see a picture of it. The nice thing about BEIR IV in addition to it being
an excellent scientific report is that you can get it for free. You can download it from the National Academy of Science’s website if you want it. Now, the BEIR IV report analyzed four groups or cohorts of miners. As I mentioned earlier, miners are particularly important because that’s where we first discovered that radon caused lung cancer. So we know a lot about miners. We know what levels of radon they were exposed to. We know about their smoking history to some extent. We know about other things, their age, and doing all that, putting all that together, we could compile this information and develop risk formulas. So that was done in BEIR IV and I have some data from BEIR IV that I’ll share with you; this is a compilation of data. What you see is a couple of things. This shows clearly that as the radon dose goes up, the risk goes up. And in public health, you’re always looking for that. It’s called a dose response effect. And if you have a dose response effect, that’s one of the things that provides evidence that something is causally linked to a disease. The other thing you see here is that as the dose goes up, the risk accelerates. That’s another important thing. That was a great study, the 1988 BEIR IV study, but that was followed up by a study just 11 years later. The BEIR VI study which you can also download from the National Academy website analyses data for more minor studies and it created two risk models: an age exposure concentration model and an age duration model. These models give pretty much the same results. And if you want to know more about them, you can look at the report. I’m not going to go through them here. At this point, I want to just spend a little time looking at some of the data.

**Moderator:** Sure.

**Dr. Paul Locke:** I know this is a lifetime relative risk table and it’s quite busy. And I’m not going to go through it in great detail.

**Moderator:** But then I’ll remind the audience that all of the slides that you’re seeing on your screens are available on our website. So if you want to print them out after the show, our audience has access to printing them out and printing them out in a larger format as they’re following along.

**Dr. Paul Locke:** Great, yes and we encourage them to do that. What I want to point out in this slide are just a couple of important things. The first thing that if you study the slide a little bit, you can see radon and smoking together greatly increase your lung cancer risk. So scientists refer to this as a sub-multiplicative effect. In other words, if a person who smokes is at x risk from the smoking and then are exposed to high levels of radon and they are at y risk, then their total risk is almost equal to x times y. So that’s quite striking. Second, you can see both of these models give basically the same results. But the important thing, really, is what do these models means in terms of the number of lung cancer deaths? And that’s what we have in a table that is the next table. This table five, which actually came from an EPA report but originated in the National Academy of Sciences study shows a couple of interesting things. First, this is based on 1995 data. You can see in this time period there were a total of 157,400 lung cancer deaths. And of those, somewhere around 22,000, the number here which is circled is 21,800, are attributable to radon. You’re going to see this number again because Gloria is going to talk about it and how important it is. Now, we want to note that this number is estimated by the data. It’s a very good estimate and about 19,000 of these deaths have occurred in what this study refers to as ever smokers, people who are current smokers as well as people who may have smoked in the past. That’s not surprising because lung cancer is caused by cigarette smoking. Let’s get this right out: everyone knows cigarette smoking is the leading cause of lung cancer. Radon is the second leading cause of lung cancer. But the combination of radon and smoking is particularly pernicious. You can see that the attributable deaths to radon in nonsmokers is around 3,000, a very high number.

**Moderator:** Sure.
**Dr. Paul Locke:** So to sum up, this very extensive database which we’ve just cracked and its analysis show that radon is the second leading cause of lung cancer and it creates risks in both smokers and nonsmokers. This has been confirmed by many studies, including studies in homes.

**Moderator:** Well, thank you for sharing that with us and for pointing out that those studies can be downloaded for free. I think that’s a great resource for people to be aware of. Now here in New York State, we have viewers all across the country, but we are here out of New York State, today. Are there certain areas of New York State where exposure levels could be higher? Does it vary by region?

**Dr. Paul Locke:** Yes. But let me state right up front -- and Gloria knows this extremely well. The only way to really know whether radon is a problem in a home is to test that home or in a building is to test that building. This map does show that certain counties in New York have higher potentials for radon levels. And that is true and this is a useful map for allocating resources. But just because you live in a -- what looks to be a low radon county doesn’t mean that your home is going to have a low level. But if this map is viewed by people out there, they should understand that if they live in one of the high potential counties, they should certainly test their home if they haven’t.

**Moderator:** So this information, is this useful for if I’m living in one of those lighter color counties, should people still be talking to me about radon? I mean should we be eliminating certain people from the conversation or really should be we communicating about this to everyone?

**Dr. Paul Locke:** We want to communicate to everyone for a couple of reasons. The first reason is that, historically, we found some of the highest levels of radon in homes are in homes with low potentials. Second, people move. People move on the average every three to five years. So you may move from a low county to a high county or vice versa, but you still want to test your home for radon.

**Moderator:** And what are we doing in terms of a lot of our target audience are people who work in the health care field. So how should doctors or physicians be talking about this to patients? Or are they talking about this risk to patients?

**Dr. Paul Locke:** Well, they should be. And this applies, of course, to physicians, physician’s assistants, nurse practitioners, anyone that has contact with a patient and is talking to them about medical conditions and medical advice. It’s important that patients know about radon. First, they have to know what it is. Second, they have to know how to fix it. It is the second leading cause of lung cancer as we pointed out. It claims more than 160,000 lives per year, lung cancer does. So patients need to know about radon and they need to know about lung cancer’s risks from radon. Lung cancer is a tough disease to diagnose very often. Sometimes by the time you find out that you have it, it’s unfortunately too late to take preventive action. So you want to try to prevent any source that you can that might cause lung cancer.

**Moderator:** So, really, taking a preventive approach to it is what we’re advocating for?

**Dr. Paul Locke:** Absolutely, yes.

**Moderator:** Now, if physicians are going to be bringing up radon exposure to their patients, does that raise an issue of -- we talked earlier about the largest exposure to radiation is through CT scans. So how does a physician navigate through that, you know, we’re going to talk to you about the dangers of radiation, but we advocate for certain types of radiation.
**Dr. Paul Locke:** Right. That is a tricky question. Before I get to that, let me emphasize one other thing. And that is the reason why physicians are so important in the radon communication chain is that physicians are a trusted source of information. So physicians and pas and nurse practitioners talk to patients about radon, it's much more likely that they're going to take action. So that's why it's really, really valuable.

**Moderator:** Sure.

**Dr. Paul Locke:** That and, of course, the need to prevent negative health conditions. So now, let's talk about the whole issue of communication. Now, you are going to have some particularly well informed patients. Patients are much more like consumers than they used to be. And they're going to ask physicians about this issue that you just pointed out. Well, you're giving me radiation from a CT scan or some other diagnostic procedure. And now you want me to eliminate radiation. What's the deal here? Physicians and health professionals need to be able to answer that question. I have a slide here that contains a quote from the ICRP report, the International Commission on Radiation Protection. And, really, the key to a conversation about this begins by examining risks and benefits. And the risks and benefits of radiation in medicine in particular. For diagnostic radiation procedures, the doses are low and the risks are low as long as the cumulative dose is managed. For therapeutic radiation, risks and doses are much higher. But what you really want to do is you really want to think about optimization. And optimization is minimizing the putative risk without sacrificing or unduly limiting the benefits. Now, it's very useful to explain to patients that in medicine, radiation has some risks, but it also has tremendous benefits.

**Moderator:** Sure.

**Dr. Paul Locke:** And this dates back to an earlier conversation we were having about, gee, you know, do we want to indict CT's? We don't because medical professionals use radiation to help figure out what's going wrong in your body or to treat a condition you have. So the radiation use has benefits. Now, compare that to radon. Being exposed to radon is being exposed to excess radiation that has no benefits. And this is, I think, an important point that physicians and PA's and nurse practitioners can make. It's a corollary to this optimization philosophy. And that really underlies how you would talk about radiation in medicine and radon.

**Moderator:** Now, as far as you know, are there physicians right now who are currently trying to talk to their patients about radon? Is this something that is common practice?

**Dr. Paul Locke:** My understanding, based on my conversations with the New York State radon program, is that they have an active physician’s campaign. They're distributing materials to about 35 physicians now. They have a lot of pamphlets that they give out and they're increasing outreach. Let me point out that as a physician or a medical professional, the best thing you can do is talk directly to your patients about radon. But sometimes that's not possible. So the next best thing you can do is you can offer your patients information about radon in terms of pamphlets and directions; get them in touch with the New York State radon program so that the patients can be activated to do something.

**Moderator:** Sure. And I know you're not from the department of health, but we do have contact information that's available for folks if they want to reach out and get more information from our radon program. And are you willing to -- you know, we do accept questions during the broadcast, but if people have questions after the broadcast and want to reach out and have questions for you, are you available for folks to contact?

**Dr. Paul Locke:** Yes. I've provided my direct number. People should feel free to call me. I answer the phone; there's no one between me and the phone lines so if somebody picks up the phone, it's me. I've also listed my e-mail address. Let me just point out that the New York state Department of Health website is a great resource. It's
a great place to start your investigations. And they have some direct information there about what physicians and health care practitioners can do about radon.

**Moderator:** Excellent. Thank you so much for all of the information you shared. I think you've given us a tremendous foundation for the rest of the conversation and really some great background information on what exactly it is we're talking about. So thank you.

**Dr. Paul Locke:** My pleasure.

**Moderator:** So now, Gloria, Paul talked to us a lot about exposures to different types of radiation and where radon comes from. You are an activist and advocate for radon so let’s hear from your perspective. What are some of the things you typically communicate to people about radon risks?

**Gloria Linnertz:** Thank you, Rachel and thank you, Paul, for a great conversation. Most people are not aware of radon. Most people are not aware that lung cancer is the leading cancer killer. They are not aware that radon is the leading environmental cause of cancer mortality or that, as Paul mentioned, radon causes the -- up to 18% to 20% of the lung cancer deaths. Of course, some of those people have been smokers, also. I think to be considered a smoker, you have maybe smoked 100 cigarettes in your lifetime. So as he said, that multiplies the effect, smoking and radon.

**Moderator:** Sure.

**Gloria Linnertz:** But radon is the leading cause of cancer in nonsmokers. So I tell people that and they have no idea about it.

**Moderator:** As I shared with you before we were on the set today, I was pretty unaware of radon before we started having this conversation. So it doesn't surprise me to know that people are largely unaware. Does the CDC have data available on the rates of death for lung cancer?

**Gloria Linnertz:** Yes, they do. Most people are not aware that lung cancer takes the lives of twice as many women -- I'm sorry, affects twice as many women as breast cancer does and three times as many lives as prostate cancer in men. That's out of 100,000. So the statistics are there from the Center for Disease Control.

**Moderator:** So the statistics are there. As Paul talked to us, there's science, there's data, and there have been studies. But you found that a lot of people are really unaware of radon and risks. Is that correct?

**Gloria Linnertz:** Right. There was a recent study that showed 88% of the people surveyed have no idea what radon is, that it causes lung cancer. They don't know that it is a radioactive gas. They may know the word, but they really don't understand what radon is. They don't know that it is the leading cause of lung cancer in nonsmokers. Actually, they don't know that it's found in every home and the only difference is the level that it is present in the home. People are very much unaware of radon, what it is and what it can do, and yet they're very confident in their ignorance, as I was I have to say. Not knowing, but thinking that it can't be in my home.

**Moderator:** So that brings an interesting point. Now, you are a radon activist, you're an advocate, you have all of this data and information to share, but you weren't always. Can you tell us a bit about your story and how you came to be in the position where you are now?

**Gloria Linnertz:** Yes, seven years ago, my husband was diagnosed with lung cancer. We asked the oncologist what caused it. And he said a known cause of lung cancer is radon. My husband lived six weeks after his diagnosis. And
he had no symptoms. He was -- his lung cancer was found completely by accident. His liver enzymes were elevated and we found that out by a normal blood test. Most people that are diagnosed with lung cancer are diagnosed in a late stage because people usually find out that they have lung cancer by accident because, again, there are no symptoms that specifically would direct you to say, oh, maybe I have lung cancer. There is a -- only a 15% five-year survival rate of lung cancer in a patient. However, if you're diagnosed in late stage, that number is only 2 to 4% five year survival rate. When the oncologist told us that radon was a known cause of lung cancer, we went home and checked our carbon monoxide detector. Even though I knew that it didn’t have anything to do with radon, you grasp at straws when you’re given that diagnosis. We let that is slip by, the radon issue. And after Joe’s death, I heard of radon and lung cancer on the news, the morning news. So I thought that's what the oncologist told us. So I went to the internet. I found I could get a test kit at the hardware store. I tested and the level was over four times EPA action level in our home and we had been living there for 18 years. So when we found that out, I, of course -- before Joe died, I prayed to god to give me a reason to live because I had no reason to live. I felt that finding out about radon was my reason to live and that I had to share that with other people. So I did nothing but solid research for three weeks, days and nights, to get all the information that I could. And I knew then that there had to be a law so people wouldn't buy homes with high levels of radon. So I knew that I had to make that law. I had to get that law made.

Moderator: So I would imagine that losing your husband, taking a test and finding out that your home has four times the levels of recommended radon, I mean, that must have been really overwhelming and startling to realize that you'd been living there for that amount of time. Where did you go? You said you did three weeks of research. Then what? What are your next steps once you’ve been confronted with that situation?

Gloria Linnertz: The first thing I did was, of course, have my house fixed. I called the state radon program director and he gave me a list of licensed radon mitigators and I contacted one of them, had the home fixed. It went down from 17.6 to 1.1. Then I took a -- I also contacted the American Association of Radon Scientists and Technologists and the State Home Inspectors Association. And so I took -- I gathered all of my data and I went to my state representative. And I told him, I said, there has to be a law so people don't buy homes with high levels of radon.

Moderator: And so as you began to gather this data and went to your representatives, who did you meet with? Who did you work with? What was some of the process?

Gloria Linnertz: Well, of course, I went to D.C. with AARST -- and I met with EPA representatives. But I also met with the acting Surgeon General at that time, Kenneth Moritsugu. And he told me, he said, people will listen to your story. So I did go from my home, called three TV news casters and one came that very day. And I relayed to them about radon. So I, along with so many other people, have been telling their stories.

Moderator: And now, you do most of your work in the state of Illinois. So what has been your experience in trying to bring this matter to the attention of representatives in Illinois? What's your experience been like?

Gloria Linnertz: Well, when I went to my state representative, Dan Reitz, he was very receptive. He gave me an entire hour. I poured my heart out to him and I told him that we have to have a law. I spent that entire summer e-mailing, calling, faxing, visiting, writing letters to all of the state legislators in Illinois and on my husband and my 31st anniversary, the governor signed that bill into law. It had passed the house and the senate unanimously that first year. So it's not something that happens overnight, but the legislators are just like everyone else. They're very unaware of what radon is and what it can do.

Moderator: Now, you also, in addition to the work that you do as an individual, you work with an organization called canSAR, correct?
Gloria Linnertz: Yes. Cancer Survivors Against Radon is an organization of people like me and my husband who had no ideas that they were living with high levels of radon until they were diagnosed with lung cancer. It is a 501(c)3 nonprofit organization and unfortunately, the members have grown tremendously because more and more people and so many of our members are very young, under 50, that are diagnosed with lung cancer and have been living with high levels of radon. Our president is Liz Hoffman. She's been president since the very initial establishment of the organization which was in 2004. She has been battling lung cancer for ten years and it has spread to her bones and her liver and her brain.

Moderator: And she's still president of the organization?

Gloria Linnertz: And she goes to -- when she's able, she goes to D.C. with us on the hill.

Moderator: And in addition to going to D.C., what sorts of activities does your organization do?

Gloria Linnertz: Well, we do everything that we can. We give presentations; we give TV/radio presentations any time. We do walks, runs; we participate in walks, runs, climbs. We have booths at home shows and various other health fairs. And, again, we do talk to the state and federal legislators.

Moderator: And do you partner with other organizations? Are there other agencies that combine their efforts with yours?

Gloria Linnertz: Yes, we do. Certainly the American Association of Radon Scientists and Technologists. We work with ALA, American Lung Association, and other lung associations which make up organizations called Lung Cancer Action Network. We work with university offices, education offices, EPA, and American Cancer Society in that Relay for Life.

Moderator: And what are some of the messages or what are some of the way you try to get the messages out? You're here today on this web cast, which is terrific and we're glad to have you with us, but are there other ways that you spread the message?

Gloria Linnertz: Yes, we do. We do what we can on TV, radio, newspaper articles. We also have a website, www.cansar.org. We have Facebook presence, brochures, webinars, we do blogs and twitters and press releases.

Moderator: So certainly your organization is taking a multi-faceted approach as trying to get the word out. But one of the things that we wanted to try to get more of is really having some physicians as well do this work to create awareness, right?

Gloria Linnertz: That's right. We urge the physicians to tell their patients about radon, how easy it is to fix, and we also ask the physicians, have you tested your home for radon? And if so, have you fixed it if the level was high? Gale Orcutt is one of our members. She has had as her mission to educate the physicians on radon and to urge them to put questions on their patient history forms such as have you tested your home for radon? If so, what's the level? Gayle has been active. Gayle is a teacher in the middle school. In fact, we've had four teachers in our group. Two of them have passed. And Gayle has been very active in getting radon tested in schools in Des Moines, Iowa, and also she had her congressman introduce a bill for radon testing in schools, a federal bill. So we never quit. We just keep working.

Moderator: That's great. Now, I would imagine that one kind of unique challenge with this is the lack of awareness, right? With other public health issues, people might know, smoking is a problem; I should try to do
something to cut back on my cigarette smoking because it's going to cause lung cancer. But with this, people don't even know that they're at risk. So that must create a special challenge in trying to create awareness.

_Gloria Linnertz:_ Oh, it is. People have no idea. And sometimes people don't want to accept the fact that they don't know. I guess when you're egotistical, there's very little I don't know, but there's a lot we don't know. They're unaware because it's invisible. It's odorless, tasteless, and here you see a picture of Debbie Greenman in -- who is also a teacher in Washington State and Debbie does a lot of outreach and not only in her school and educational opportunities that she has. She lets everyone know that it can be in any kind of house. Old, new, frame, brick, basement, no basement, crawl space, slab on grade. The only way is to test. That's the only way that you're going to find out. And Debbie does a great job. She is -- I told her the other day, she's on the radon war path.

_Moderator:_ So you have a number of different -- I mean, it seems like you have a diverse membership and you've got some teachers and survivors and so what do you think is kind of the mission or what would you say when you talk about the canSAR members, what is it that you're doing?

_Gloria Linnertz:_ Well, we do whatever we can. As I said before, we speak, we act and we do. We don't want others to find out about radon the way we did. We want them to take action before that happens.

_Moderator:_ Sure. And what are some of the specific things that your organization does to try to create change?

_Gloria Linnertz:_ Well, we've been involved in numerous medical forms throughout the nation. Again, trying to educate the physicians about radon and how they can educate their patients. We participate in other lung cancer organizations; their activities, events, and always supply information on radon. We form coalitions. And we create awareness through advocacy days, radon action month in January and we have the second -- third week of October is radon action week. So we try to do things at those times, too. Again, we have booths at fairs and home shows and health fairs. We do participate in walks, runs, climbs, and we give many presentations.

_Moderator:_ And so you've got all of these different ways that your organization is trying to get the word out. You also have a diverse membership. I think we spoke and you said that some of your -- you have young members in your organization, as well. Is that --

_Gloria Linnertz:_ Yes. Some of our greatest radon warriors are children. But extremely mature children. Two of them that have just bowled everyone over with their presentations are Christine and Eric bear from Golden, Colorado. We have representatives in Castle Rock, Colorado. And a very intelligent and passionate young man in Maryland.

_Moderator:_ and what kind of things do the youth do? What kinds of activities do they tend to be involved in?

_Gloria Linnertz:_ presentations, climbs in Colorado. Climbing is very popular. And raising money for canSAR so that we have the money to do the things that we do. And that came from my good friend in Maryland. And, actually, Eric and Christina there have been very active politically. And talked with their local government officials and state government officials in trying to get laws passed.

_Moderator:_ That's terrific. Now, I understand there's also a national radon action plan. Can you tell us a little bit about that and canSAR's role in that?

_Gloria Linnertz:_ Well, a couple of years ago, EPA and other federal agencies got together and thought, how can they do more for awareness and action and preventing radon induced lung cancer. And that -- actually, that
meeting is going to continue on October the 23rd. And canSAR will be there. And, again, it will be not only the federal agencies, but many nonprofit agencies along together with the federal agencies to make a difference.

**Moderator:** Great. Now, does canSAR work for increased funding, as well?

**Gloria Linnertz:** Yes. Unfortunately, EPA has for several years, because of budget conditions, thought that they would remove the state search grants, the state indoor radon grants for states to continue outreach and education of the public. So last year, you can see on that picture, four of us did go and we had another friend from another organization that went and testified how important this state program -- how important their work is.

**Moderator:** So canSAR is doing a lot of work to try and increase awareness but what can an individual do? What should I be doing?

**Gloria Linnertz:** Well the first thing is test your home. If the level is between 2 and 4, test again. If it continues to be high, certainly have a radon professional install a mitigation system into your home. After that, test and make sure that it is working properly. It is suggested that people test every two years because things change. We have earthquakes, we have construction going on in our neighborhoods and in our yards and in our homes.

**Moderator:** So for those of us watching the broadcast, we'll all know, go out and buy a test and get your home tested. For the folks that aren't watching the broadcast or aren't attending any of your events, how does the medical community effectively help to get this word out?

**Gloria Linnertz:** Well, they can do many things. At one of our medical forums that we had recently, one of the patient assistants said to us, well, in the hospitals, we have CE sessions that everyone attends. And I thought, well, you know, that would be a great space to educate the physicians medical personnel, not just the physicians; all of them, about radon. Once they understand about the importance of knowing about radon and taking action against it, share their information with others with their patients. And as I said, test their home first and fix it if it's high. I think, too, I think that if we could get some publications into the medical -- the famous medical journals or have presentations at the medical association meetings on radon, that would be wonderful.

**Moderator:** Now, are there videos available online where people can learn more information?

**Gloria Linnertz:** Actually, there's a great video developed by one of our world's leading epidemiologist on lung cancer and radon, Dr. Bill Field, but the video features physicians. It's called “Breathing Easy.” And there's two versions. There's a short version and a long version and the longer version has one of our members in it, Gayle Orcutt. It is very good. Extremely -- and you can get it from the website, Iowa cancer consortium.

**Moderator:** And so what would you say, we're coming to the close of our program here and is we've got some questions from the audience, but what would you say are the next steps in putting the pieces together?

**Gloria Linnertz:** Well, I think that we need the help with the medical field. All of the medical personnel. To bring radon awareness to increase preventive action, telling them how easy it is, telling the patients how easy it is. We need partnerships in some of the things that we do partnering with the medical community. Letting them accept us as presenters. And, of course, physician education.

**Moderator:** All right. So we have a few questions for you guys from the audience. So thank you so much for everything you've shared so far. The first question that came in said, you've mentioned that radon causes lung cancer, but are there other types of cancer that radon radiation can cause? Also, does radon radiation affect the possibility of developing asthma?
**Dr. Paul Locke:** Those are really good questions. As for the first question, does radon cause other types of cancer, right now, the strong, strong science links radon to lung cancer. There have been some other studies linking radon to other types of cancers, but I would describe them as not quite ready for prime time at this point. The way science generally works on this is one study doesn't lead you to assume that something is linked to a disease. You need a group of studies. So I would stay tuned on that. But when I talk to people, obviously, I focus on the lung cancer. In five years, we might know more about other cancers.

**Moderator:** Sure.

**Dr. Paul Locke:** I am not aware of any evidence that radon is implicated in asthma. I think asthma is a serious but different disease.

**Moderator:** Okay.

**Dr. Paul Locke:** So is it’s really an issue of lung cancer with radon.

**Moderator:** All right. The next question says Dr. Locke indicated that when radon decays, it gives off an alpha particle or leaves behind a solid particle in the lung. I’ve always thought that all radon decay did both and that lung cell damage occurs from the alpha radiation discharged during the initial decay and by the decay left behind progeny. When radon decays, does it give off alpha and leave behind progeny or does the decay process involve one or the other?

**Dr. Paul Locke:** That is a good question and it’s a very complicated process. Let me try to -- I think that the question actually gets it right. And I feel that I didn't do probably a good enough job explaining this. So let me go back at it again. Radon breaks down to what are known as progeny or other compounds, that’s the nature of radiation- radio nuclei, they decay. Radon itself gives off alpha radiation. However, several of the progeny also give off alpha radiation. So you get alpha radiation from more than one of the compounds in the decay chain. Now, when you inhale radon, if the radon decays into a solid particle, that particle will get next to your lung and eventually because of the decay chain you might get alpha radiation from it. So it is a process where the alpha radiation comes from radon to some extent and from the progeny to another extent.

**Moderator:** Thank you. All right. We have a question, is drinking water with radon contamination a risk? How does this compare to inhalation of radon gas?

**Gloria Linnertz:** Well, inhaling radon means that it gets into our lungs. I mean, the alpha particles attach, as Paul has so well described, attached to the outer lung -- outer cells in the lining of our lungs. So the inhaling is the main thing. Now, I think when you take showers, if it is in the water, then -- and you're in the shower, then you very well may inhale some of it in that condition. But do you want to add?

**Dr. Paul Locke:** Yeah. I think you’re absolutely right and you've sort of taken me down the road that I can just add a little bit. For radon and water, generally, what we assume is that if you have 10,000 picocuries of radon per liter of water, that's equal to one picocurie per liter in air. The radon prefers to be in the air and not the water. So EPA's advice, and I'm pretty sure it's New York State's advice, as well, is if you've got radon levels in your home that are of concern, you should test your well water. Radon can be an issue in well water. Again, as Gloria pointed out, if you're someone who likes to take long, hot showers, practice maybe your singing or something, the radon will come out of the water and you can be exposed to it. So if you're a heavy water user, you know, you do a lot of laundry, you have a lot of showers, and you're on well water and you have a radon problem in the air, you need to test for radon in the water.
Moderator: Well, that’s all the time we have today so thank you so much for your presentation and for taking the questions from the audience. I think it’s been a terrific show.

Gloria Linnertz: Thank you, Rachel.

Dr. Paul Locke: Thank you, Rachel, I really appreciate being here.

Gloria Linnertz: Thank you, Paul.

Moderator: And thank you very much for joining us today. Please remember to fill out your evaluations online. Your feedback is always helpful to the developments of our programs and continuing education credits are available. To obtain nurse continuing education hours, CME and CHES credits, learners must visit www.phlive.org and complete the evaluation and post-test for today’s offering. Additional information on upcoming broadcasts and relevant information can be found on our Facebook page. Like us on Facebook to stay up to date. As a reminder, you can also download the companion guide on our website www.phlive.org. The companion guide will provide you with learning activities to help further your knowledge and understanding of topics covered in today’s program. This will be available on demand within our website within two weeks and DVDs of any of our public health live broadcasts can be ordered from our website as well. Please join us on October 17th, Collecting the Data, First Steps in Achieving Health Equity, where we will look at racial and ethnic data collection initiatives under the Medicaid Redesign Team. I’m Rachel Breidster, thank you so much for joining us on Public Health Live.