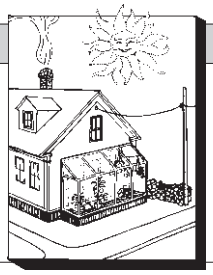

Testing for Radon

by Alex Wilson

Concern about radon gas has mushroomed with the government recommendation last September that every American home be tested for the gas. Builders, remodelers, and general contractors should be able to respond to this concern by conducting or overseeing testing and, if necessary, mitigation. An understanding of the options available is essential.

This column will focus on radon testing and test products. Radon mitigation was covered in the October 1987 issue of *NEB,* and an upcoming column will focus on products used for radon mitigation work.

From Simple to Sophisticated

Techniques for measuring radon levels range from quite simple to those requiring sophisticated and expensive equipment. To understand how these various products work, we have to know something about radon and its radioactive decay. As the radioactive elements uranium and radium decay, radon gas is formed. Radon survives but a few days or weeks and then breaks down into "radon decay products." Each time radon or one of its decay products breaks down, it releases radiation: alpha, gamma, and beta particles. From a health standpoint, alpha particles are the most dangerous.

Radon tests measure the radiation released. As radon or its decay products break down, radon concentration is measured in picocuries per liter (pCi/l). The picocurie is a measure of the rate of decay: 1 picocurie equals 2.2 decays per minute. Radiation from radon decay can also be expressed as "working levels," or WL. An older measure of radiation, WL comes from the uranium mining industry, and refers to the level of radon decay products, not radon gas itself. In practical terms radon gas concentrations (in picocuries per liter) and working-level measurements can be used interchangeably. One WL is equal to about 200 pCi/l.

The least expensive tests for radon are "passive" collectors. These devices are placed in the house for a specified period of time and then sent to a laboratory for analysis. They do not require power and are inexpensive. The most common are charcoalcanister and alpha-track detectors, but a new type of passive detector, E-PERM, looks promising. Recommendations for use are included with all products.

Charcoal Canister

Charcoal-canister test kits use activated charcoal to absorb radon gas. Gamma rays, emitted as radon further breaks down, is measured in a laboratory. Charcoal canister tests are relatively short-term, from two to seven days, and the results are quickly reported by the testing lab.

Charcoal-canister radon detectors are the least expensive of the available testing methods, and are considered very effective at providing a quick idea as to whether or not the house has a radon problem. The charcoal canister will not provide a terribly accurate figure of long-term radon exposure in a house because the collection period is short and radon levels may fluctuate considerably. There are several hundred manufacturers of charcoal-canister radon detectors, which cost, including analysis, generally in the range of $8 to $20.

Alpha Track

Alpha-track collectors operate on a very different principal. A small container with a filter allows just air and radon to enter. Alpha rays emitted by the decay of radon, "etch" a piece of polycarbonate plastic inside the collector. After alpha-track collectors have been exposed for the appropriate time, they are returned to the laboratory for analysis where etchings in the plastic film are counted automatically by a microscopic scanner. The radon concentration required to produce that number of alpha particles during that time period is calculated.

Often alpha-track detectors are used when charcoal-canister detectors indicate that a problem may exist and further testing is advised. Because radon levels in houses may fluctuate a lot, they provide a more accurate picture of radon exposure by balancing out the variations. If other tests show radon levels are low, a long exposure of an alpha-track collector is recommended; when high levels have already been detected, exposure can be shorter. Single alpha-track collectors, with laboratory analysis, cost from $20 to $50.

Electret

A third type of passive radon detector has just recently entered the market. Rad-Elec, Inc., of Fredrick, Maryland manufacturers the "EPERM," or Electret Passive Environmental Radon Monitor. An electret is a specially made material, usually Teflon, which has a permanently embedded electric field in it. Each time an alpha particle is produced in the decay of radon, it ionizes the air it passes through. When ions (charged particles) strike an electret, the electret's charge is reduced.

In the E-PERM detector, an electret is placed in an air chamber. A filter on the glass chamber allows air and radon to enter, but blocks already existing ions. When the chamber is opened, radon enters and creates ions as it decays. The ions gradually reduce the electret's charge. By sealing the glass chamber again, the drop in electret charge stops. The electret can then be analyzed and the radon level calculated. When very high radon levels exist, the electret capacity will be used up sooner, much like the charge of a battery.

Two types of electrets that can be used in the same canisters are offered by Rad-Elec. One has a smaller charge capacity (200 pCi/l-days) and is used for short-term measurements (usually one to five days, depending on radon concentrations), and the other has a capacity of 2,000 pCi/l-days and is used for long-term measurements (usually one to twelve months).

Rad-Elec manufactures the canisters, electrets and analysis instruments, with a start-up package costing about $2,000. Extra reusable canisters cost $35 and extra electrets cost $15 (not reusable but usually good for about 10 radon tests before the charge is used up).

If you are not interested in doing it yourself or investing to this degree, but prefer the E-PERM technique, Rad-Elec can help. It is not in the business of doing individual analyses, but can refer you to customers who provide professional testing and analysis: using its product.

One testing company using Rad-Elec's product is House Analysis and Associates, of Huntington Valley, PA. Fred Power of House Analysis is very pleased with the E-PERM performance in side-bv-side comparisons with very sophisticated radon monitor instruments.

Other Radon Monitors

Most other radon measuring systems are much more sophisticated and expensive. They are self-contained (i.e., nothing is sent away to a laboratory); results are available right away; and electricity is required to operate them (either ac or battery). These more sophisticated radon monitors can be divided into instantaneous measurement devices for "grab samples" and continuous radon monitors.

Grab sample devices are sometimes used during radon mitigation work to determine the effectiveness of solutions to radon problems. They only provide a "snapshot" picture of the radon situation in a house and are not considered accurate in showing actual exposure levels over time. Other than the follow-up purpose mentioned, such monitors are not very useful.

Continuous radon measurement devices are used by radon mitigation companies and researchers to gain more precise and immediately available data. Most of these repeatedly measure air samples over short periods of time and provide a print-out of the radon levels. Changes and fluctuations in radon levels can easily be seen and results are immediately available, making such monitors excellent tools for research and radon mitigation work. To get a good idea of radon levels, continuous monitors should be operated for at least 24 hours, some for at least several days.

Continuous radon monitors range in cost from several hundred dollars to over $5,000, depending on the means of detection, precision, and instrument quality. Most continuous radon monitors use one of three different techniques to measure radon levels. The least expensive (and least accurate) technique is to use a silicon hip, which works much like a photovoltaic cell producing a pulse of electricity every time an alpha particle strikes it. Another technique relies on the fact that alpha particles ionize air as they pass through it, and measurements are made in an ionization chamber. Finally, some monitors (including the most precise) use a specially coated air chamber. As alpha particles strike its surface, photons (light particles) are generated that are then measured with light-sensing equipment.

All of these continuous radon monitors are fairly complex. Some require a skilled technician to operate properly and some require calibration. As the market expands for radon detection equipment and technology responds, prices are dropping and new products are being introduced, including some that are more "user friendly."

Some Words of Caution

Some 200 companies are already in the business of manufacturing and/or marketing radon detection equipment; as many or more offer radon testing services. Most of these companies are reliable, but some are out to take advantage of the new market and unsuspecting customers. With the latest surge of concern, we can expect a swell of opportunists trying to get a piece of the action. Keep a careful watch for fly-by-night outfits offering radon detection products and services.

Watch out for companies which offer immediate results. Beware of those who collect an air sample in your house, then take it out to the truck for "analysis." Even if their measurements are accurate, they won't be very productive-radon decay collection takes more than minutes for useful results to be obtained.

With continuous radon monitors; lower-cost units may not be very accurate. Precise radon detectors are difficult to make for less than a thousand dollars. As stated above, most are complicated, sensitive laboratory instruments not designed for rugged use, and require a skilled operator and periodic calibration to maintain accuracy. You will probably do better sticking with the passive monitors.

Be skeptical if you see "Environmental Protection Agency-approved" on radon testing equipment because the EPA does not "approve" radon testing equipment. It does carry out testing for companies under various performance criteria and it does issue lists of companies that have satisfied its criteria.

The issue of tampering with results is an interesting concern that has recently arisen in the radon testing industry. Radon testing is now a component of many real estate transactions, and for some parties it's important that high radon levels not show up. Testing results can be altered by simply covering up or otherwise modifying the collector or monitor. Because of these concerns, a number of companies now offer "tamper-resistant" radon test kits and procedures. It is likely that these concerns will lead to the rapid development of certification programs for both radon testing equipment and radon testing services. ■

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