2005-2006 UPDATE COURSE

SECTION 4

WHAT IS RADON?

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LEARNING OBJECTIVE: At the conclusion of this Section, licensees should have a better understanding of what radon is, what levels are considered excessive, how to test for and control indoor radon levels, and where to go for information and resources concerning radon.

What is Radon?

Radon is the only radioactive substance produced by nature in the normal order of life. It is a colorless, odorless, tasteless gas released by the natural decomposition of uranium in the earth. On January 13, 2005 the U.S. Surgeon General, Richard Carmona, issued a health advisory stating that "Indoor radon is the second-leading cause of lung cancer in the United State and breathing it over prolonged periods can present a significant health risk to families all over the country." It is estimated that approximately 12% of lung cancer deaths in the United States each year are attributable to radon, which translates to between 15,000 and 21,000 deaths annually. Further estimates are that 1 out of every 15 homes has elevated levels of radon. The good news is that the threat posed by indoor radon is readily preventable if one simply tests for it and takes steps to remediate, if necessary.

Because radon is a gas naturally produced by decaying uranium in soil and rock, it rises through cracks and fissures in the earth's surface, and enters homes through cracks or holes in the foundation or walls, in gaps around service pipes, around construction joints, and sometimes in water if the source is groundwater, rather than surface water. Uranium is found in virtually all soils; thus, radon is found in every state, though in some it is much more prevalent than others.

Permissible Levels

Theoretically, *any* amount of radon poses some health risk since it is radioactive. The danger comes more from breathing radon, rather than drinking water with radon, although if radon is in the groundwater, then the gas is released whenever you use the water in your house,

such as when you shower. However studies have not shown a corresponding increase in stomach cancer from drinking water with radon as they have with the correlation between breathing radon and lung cancer. The problem with breathing radon is that the gas decays into radioactive particles which become trapped in the lungs and as they continue to decay, they release small bursts of energy which can damage lung tissue and lead to lung cancer.

The Environmental Protection Agency recommends that indoor radon levels not exceed 4 picocuries (pCi/l) per liter of air. Sometimes test results are expressed as "working levels" (WL); 4.0 picocuries per liter of air equals 0.016 working level. The average indoor level of radon nationally is estimated to be 1.3 pCi/l and about 0.4 pCi/l is found normally in outside air. While indoor radon levels may be reduced in most homes to 2.0 pCi/l, in many geographic areas it is difficult to reduce the levels below 2.0 pCi/l.

How to Determine Radon Levels?

It is extremely easy to test for radon within a home (or business or school, for that matter). There are several "do-it-yourself") kits which may be purchased in hardware stores or from the EPA or over the internet. Alternatively, one may hire a qualified tester to conduct a test. There are both short-term and long-term tests available. Radon levels may vary from day to day and season to season and may be influenced by severe storms or high winds. Because short-term tests are just a snapshot, as it were, they are less likely to render an accurate picture of the year-round average radon level as will long-term tests, but if some idea of radon levels is needed quickly, then short-term tests will provide immediate feedback.

Short-term Tests

Obviously, short-term tests are the quickest way to test, but even so, it may take a couple of weeks before one has the results. Short-term testing devices include "charcoal canisters," ""alpha tracks," "electret ion chambers," "continuous monitors," and "charcoal liquid scintillation," among, no doubt, others. To test, one must close all windows and doors at least 12 hours prior to beginning the test and leave the doors and windows closed as much as possible throughout the test period, which may range from 2-3 days to up to 90 days, depending on the testing device employed. Heating and air-conditioning systems which recirculate air may be used during the testing period, but not systems which bring in air from the outside.

The testing device should be placed in a room on the lowest *lived-in* level in the structure, generally either the first floor or a finished basement, but *not* in a kitchen or bathroom. The device should be approximately 20 inches above the floor in a location where it will not be disturbed and not subject to drafts, high heat or humidity or exterior walls. Leave the device undisturbed for the period stated on the testing kit, and once concluded, seal the package and mail it to the laboratory stated on the kit. It may take 3-4 weeks to obtain the results.

If the results are above 4.0 pCi/l, it is recommended that a second test, either short-term or long-term be conducted. The EPA actually recommends that the higher the results from the first short-term test, the more certain one may be that one should conduct a second *short-term test*, rather then long-term. If the results of the second test, or the average of the two tests, exceeds 4.0 pCi/l, strongly consider fixing the problem.

Long-term Tests

Long-term tests remain in the home *for more than 90 days*. Typical testing devices include "alpha track" and "electret ion" detectors. Long-term tests will provide a more accurate reading of the year-round average radon level.

If one wishes to hire a professional, a list of qualified testers may be obtained from the North Carolina Department of Environment and Natural Resources, Division of Radiation Protection at www.ncradon.org or the EPA website (www.epa.gov/radon/proficieny) for a list of privately certified radon professionals in our area.

Remediation

The most common method of eliminating or reducing excessive levels of indoor radon is by installing a "soil suction radon reduction system." Basically, a vent pipe is installed leading from under the structure to the outside, in conjunction with a fan, which pulls the radon from under the structure and vents it into the outside air. Sealing any cracks or holes in the foundation or walls helps make the system more efficient and cost-effective. Costs to install such a system may range from roughly $800 to $2500, with the average cost running about $1200 (according to the EPA). Again, check with the North Carolina Division of Radiation Protection for qualified contractors to install any remediation system.

Some new construction may have radon resistant features included. Typically these features or techniques include: 1) a gas permeable layer, often gravel, beneath the slab or flooring system, 2) plastic sheeting on top of the gas permeable layer either under the slab or over the crawlspace, 3) sealing and caulking any openings in the foundation, 4) installation of a vent pipe from the gas permeable layer up through the house to the roof, and 5) installation of a junction box in case a fan is needed later. It is significantly less expensive to include these features when the house is built rather than add them later, like $350-$500 during initial construction versus $800 - $2500 later. Even with these techniques, however, the structure should be tested for radon to determine whether the measures are effective and whether the levels are safe.

If radon is found in the groundwater, two methods to remediate are "point of entry" treatments which eliminate the radon before the water enters the structure, or "point of use" treatment devices which attempt to remove radon at the tap. "Point of use" devices only treat a small portion of the water coming into the structure and are not as effective as "point of entry" treatments.

Summary

On the whole, radon is not an overwhelming problem in North Carolina. (See map below.) The lightest colored areas typically have readings of less than 2.0 pCi/l, the slightly darker areas average between 2.0-4.0 pCi/l (namely, Wake, Franklin, Warren and part of Granville Counties and most counties west of I-77), and only the darkest areas have readings in excess of 4.0 pCi/l (i.e., Rockingham, Alleghany, Watauga, Mitchell, Buncombe, Henderson, Transylvania and Cherokee). A color version of this map may be found at www.epa.gov/radon/zonemap/northcarolina.html. However, adjacent homes may have entirely

different radon levels due to a variety of factors. Thus, one should never assume that because the neighbor's house was O.K., so is mine. To be sure, ask whether and when any radon tests have been conducted and what the results were. Know that if one wants to have these results when selling a property, the test needs to be done at least 3-4 weeks before the property is advertised, given the delay between conducting the test and obtaining the results.

There is a wealth of information concerning radon and other issues at the EPA's website (www.epa.gov). There are several publications which may be downloaded or ordered, including: *Home Buyer's and Seller's Guide to Radon* (available in both English and Spanish), *Consumer's Guide to Radon Reduction*, *Buying a New Home? How to Protect Your Family from Radon*, as well as a short video titled "Breathing Easy: What Home Buyers and Sellers Should Know About Radon." Single copies are free and may be ordered from Indoor Air Quality (IAQ- Info) by telephoning 1-800-438-4318 and asking for EPA 402-V-02-003.

The National Environmental Health Association, National Radon Proficiency Program (NEHA-NRPP) just happens to be based in North Carolina and may be contacted at: NEHA-NRPP Administrative Office, P.O. Box 2109, Fletcher, NC 28732; website: www.neha-nrpp.org; telephone: 1-800-269-4174 or (828) 890-4117.

North Carolina contacts are through the Department of Environment and Natural Resources, Division of Radiation Protection, 3825 Barrett Drive, Raleigh, NC 27609-7221, Tel: (919) 571-4141; website: www.ncradon.org. The radon contact is Dr. Felix Fong and the Indoor Air Quality (IAQ) contact is Will Service at (919) 715-6431.

Map: lightest = less than 2.0 pCi/l; middle = 2.0-4.0 pCi/l; darkest = 4.0 pCi/l or more