INSULATION CONTRACTORS ASSOCIATION OF AMERICA

Technical Bulletin

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No. 16: RADON IN THE HOME: TESTING AND MITIGATION

SCOPE: This bulletin provides an overview of the problem associated with excessive concentrations of radon in conditioned living spaces. Methods for determining the levels of radon are discussed and some mitigation techniques are presented. References are listed for those interested in pursuing this subject in greater depth.

INTRODUCTION: Radon is a radioactive gas that forms when uranium present in soil and rocks decays. The gas is present in virtually all soils, but high concentrations can be found in those containing granite, phosphate, pitchblende, shale, and uranium, as well as soil contaminated with wastes from uranium or phosphate mining. As radon seeps out of the ground, most is diluted by the atmosphere and made harmless. But the gas also makes its way into buildings, where it becomes concentrated and can cause health problems.

Scientists know of just one health problem associated with exposure to radon gas, but it is one everyone dreads - lung cancer. Radon itself is relatively harmless until it decays into "daughters" that, in turn, decay rapidly and release energy. The radon daughters can readily attach themselves to dust particles floating in the air and may be inhaled deep into the lungs. As these radon daughters decay inside the body they release energy into cell tissue. A decade or more later, lung cancer can be the result.

The EPA estimate is 5,000 to 30,000 lung cancer deaths per year in this country and are directly attributed to elevate radon levels. Radon monitoring and control in homes and schools throughout the country has been recommended by the Surgeon General's office and the EPA.

RADON TESTING

Testing for radon can be accomplished by a homeowner by several methods. The most common are charcoal canisters or packets and Alpha-Track detectors.

Charcoal canisters are passive devices requiring no power to function. The passive nature of the activated charcoal allows continual absorption and desorption of radon. During the measurement period the absorbed radon undergoes radioactive decay. Therefore, the technique does not directly measure radon concentrations during the exposure period. As with all devices that store radon, the average concentration is calculated using the mid-exposure period. The average concentration calculated using the mid-exposure time is subject to error if the ambient radon concentration absorbed during the first half of the sampling period is substantially higher or lower than the average over that period.

The measurement is initiated by removing the cover to allow radon in the air to be absorbed into the charcoal. At the end of a measurement period, the canister is securely resealed and sent to a laboratory for analysis.

An Alpha-Track Detector (ATD) consists of a small piece of plastic film enclosed in a container with a filter-covered opening.

Radon diffuses through the container and alpha particles emitted by the radon and its decay products strike the detector and produce microscopic damage tracks. At the end of the measurement period, the detectors are placed in a caustic solution that accentuates the damage tracks so they can be counted using a microscope or an automated counting system. The number of tracks per unit area is correlated to the radon concentration in air, using a conversion factor derived from data generated at a calibration facility. The number of tracks produced

per unit of time is proportional to the radon concentration, so an ATD measures the average concentration over the measurement period.
Other types of radon measuring devices are
(1) Continuous Radon Monitors,
(2) Electret Ion Chamber Radon Detectors,
(3)Evacuated Scintillation Cells,
(4) Pump/Collapsible Bag Devices,
(5) Grab Sampling,
(6) Continuous Working Level Monitors, and
(7) Radon Progeny Integrating Sampling Units.

RADON MITIGATION

For reducing radon levels, source control is the preferred method and should be the first approach used. It involves stopping the radon gas before it enters a home. Common sources such as cracks, drains, and sumps can be sealed with caulking or special covers. Another approach involves "sub-slab ventilation" where air (and radon) is drawn from below basement floors and behind below grade walls before it gets into the house. Seal exterior block walls with vapor/water sealants and carefully seal around pipes that penetrate the slab.

There are several steps that can be taken during new construction to reduce the infiltration of radon gas. The most common radon entry pathways are inside perimeter floor or wall joints, control joints between separately poured slab-sections, open sump pumps, and crawl spaces. To reduce radon entry through these joints;
(1) Place a 6-mil polyethylene sheet under the slab.
(2) Minimize shrinkage and cracks in the slab by using the recommended water content in the concrete mix and keeping the slab covered and damp for several days after it is poured.
(3) Install flexible expansion joint material around the perimeter of the slab and between any slab sections.
(4) After the slab has cured for several days, remove or depress the top half inch of the material and fill the gap with caulk.
(5) Seal or cap the tops of hollow-block foundation walls.

Dilution involves the removal of both radon gas and radon progeny from the indoor air. Natural and forced ventilation (incorporating heat recovery) are the most common dilution approaches.

The U.S. Environmental Protection Agency (EPA) periodically sponsors radon testing and mitigation courses around the country. These can help interested firms add radon testing or mitigation to their specified services.

The Radon Measurement Proficiency (RMP) Program evaluates the proficiency of radon testing firms. The Radon Contractors Proficiency (RCP) Program is a training program for radon mitigators. It includes a four-day course called "Radon Technology for Mitigators," that includes training, an examination, mitigation guidelines, and continued eduction. The course informs contractors about radon properties and radon mitigation techniques. Passing the examination and meeting other program requirements can help qualify the participant for inclusion in the national RCP list. Successful participation in the RCP and RMA can fulfill part of the licensing requirements in some states and local jurisdictions.

TRAINING BY REGION

RMP training courses are offered by three regional centers:
Midwest - the Midwest Universities Radon Consortium.
Contact: Bruce Snead at the Kansas State University Engineering Extension
Telephone: 913-532-6020

East - Rutgers University in New Jersey
Contact: Alan Applebee
Telephone: 201-932-2551

West - Colorado State University
Contact: Jim Young
Telephone: 303-491-7742
The EPA has two helpful phone numbers:

The Radon Hotline: 800 SOS-RADON, and The Public information number: 202-382-2080
The public information office provides information about the RCP.

Here are some publications for further reading on the topic of radon testing and mitigation. To order, contact: National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22181, or call 703-487-4600.

(1) Radon Reduction Techniques for Detached Houses
(2) Application of Radon Reduction Methods
(3) Interim Protocols for Screening and Follow-up Radon and Radon Decay Product Measurements
(4) Radon Reference Manual
(5) Indoor Radon and Radon Decay Products Measurement Protocols
(6) EPA Citizens Guide to Radon
(7) EPA Radon Reduction Methods for Detached Houses