



HEALTH  
PHYSICS  
SOCIETY

## UPDATE ON PERSPECTIVES AND RECOMMENDATIONS ON INDOOR RADON

### POSITION STATEMENT OF THE HEALTH PHYSICS SOCIETY\*

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*The Health Physics Society published "Perspectives and Recommendations on Indoor Radon"—its initial position statement on indoor radon—in October 1990. Since that time, the National Academy of Sciences has reevaluated the epidemiological data on underground miners and reviewed indoor radon epidemiological studies. The Academy published its findings in 1999 in its BEIR VI Report, "Health Effects of Exposure to Radon." The U.S. Environmental Protection Agency (U.S. EPA) reevaluated its risk assessment in 2003. In addition, a significant amount of new information on residential radon studies has become available in the past few years.*

#### ***What is radon?***

Radon is a colorless and odorless radioactive gas that is produced by the radioactive decay of radium. Radium is a product of a decay chain beginning with uranium, a naturally occurring radioactive element. Radium is found in trace amounts in nearly all rocks, soils, and groundwater as well as building materials, plants, animals, and the human body.

Radon is a natural component of the air we breathe. Radon gas decays to solid particles called radon decay products. On average, inhaled radon decay products account for more than two-thirds of the natural background radiation dose to members of the public. Scientists have long known about the radiation dose from radon, particularly to miners; however, the general public in the United States became aware of the potential risk of radon in homes in the 1980s.

Radon concentration is a measurable quantity that is related to the amount of radiation that would be emitted by radon and its decay products in a liter of air. Radon concentration in air is expressed in units of becquerels per cubic meter (Bq m<sup>-3</sup>). Higher radon concentrations and smoking habits are related to a higher potential for adverse

human health effects. The concentration to which an individual is exposed can be influenced by that person's lifestyle, such as time spent indoors, building construction, local geology, and other environmental factors.

### *How does radon affect human health?*

Research on underground uranium miners has demonstrated that the risk of lung cancer increases with exposure to radon decay products. Recent residential case-control radon epidemiological studies, and the findings from three large pooled epidemiological analyses, support the projections from the miner-based studies that the levels of radon commonly found in homes cause lung cancer. The U.S. EPA estimated that out of a total of 146,400 lung cancer deaths in 1995, 21,100 (14 percent) were related to indoor radon exposure. Recent residential radon epidemiological studies support this estimate.

Radon is the second most important cause of lung cancer after cigarette smoking. Radon exposure is also considered the primary cause of lung cancer in individuals who have never smoked. The majority of radon-related lung cancers are attributable to long-term exposures at low or moderate concentrations since most of the exposures occur at these lower concentrations. Adverse health effects, other than lung cancer, have not been consistently demonstrated in epidemiological studies.

### *Recommendations*

The Health Physics Society encourages members of the public to minimize exposure to radon and its radioactive decay products to the extent reasonably achievable, taking into account applicable technical, economic, and social factors. The Society offers the following observations and recommendations to assist members of the public, educators, public officials, and the media in addressing the potential risks from exposure to radon in the indoor environment.

#### Recommendations to members of the public

1. The radon concentration in a dwelling can only be determined by testing; therefore, the Health Physics Society recommends that homes be tested. Conducting a radon test is straightforward. Approved, "do it yourself," short- or long-term radon test kits can be purchased directly from radon laboratories or from retail outlets. A qualified radon measurement specialist may be hired to conduct the test, especially if it involves a real estate transaction for which the result from an independent, third party (the tester) is needed. Appropriate radon test devices and qualified radon measurement specialists are those that have been approved by the National Environmental Health Association, the National Radon Safety Board, or a state radon program. Because radon concentrations undergo daily and seasonal variation, long-term radon tests (those detectors exposed in the home for more than 90 days) provide a better estimate of the annual average radon concentration. Whether testing one's own home or hiring a professional tester, standard procedures for the conditions of the house and the placement of the tests should be followed. The U.S. EPA's "A Citizen's Guide to Radon" is a good reference for these protocols (EPA 2005). More detailed guidance is provided in the References of this position statement (U.S. EPA 1993; AARST 2005; HPS 2009) or can be obtained from the appropriate state department of environment or health.
2. The U.S. EPA has established guidelines for exposure to radon in homes. At levels of 150 Bq m<sup>-3</sup> or more, the U.S. EPA encourages members of the public to take steps to reduce the radon

concentrations and to consider action at levels above 75 Bq m<sup>-3</sup>. The Health Physics Society concurs with the U.S. EPA's guideline of 150 Bq m<sup>-3</sup>. However, because 150 Bq m<sup>-3</sup> is not a definite line between "safe" and "unsafe," the HPS also agrees with the EPA's recommendation to consider action at levels below 150 Bq m<sup>-3</sup>. Recent residential epidemiological studies have demonstrated that there is a statistically significant increased risk of lung cancer at concentrations below the U.S. EPA's action level of 150 Bq m<sup>-3</sup>.

3. For existing homes with radon concentrations at or above 150 Bq m<sup>-3</sup>, proper radon mitigation can almost always reduce levels to below 75 Bq m<sup>-3</sup>. Homeowners, or others responsible for a particular building, should contact a qualified radon-mitigation specialist to determine the appropriate actions to be taken to reduce indoor radon concentrations. Confirmatory tests should be made after mitigation to ensure that the system is working properly.
4. For new construction, particularly in areas designated by the U.S. EPA or state radon programs as having the potential for indoor radon concentrations exceeding 150 Bq m<sup>-3</sup>, radon-reducing features or a full mitigation system should be installed at the time of construction. Nationwide, the average cost of installing radon-resistant systems in new construction is in the range of several hundred dollars, while the cost of mitigating an existing home often exceeds \$1,000.

#### Recommendations to Public Officials, Educators, and the Media

1. Inform homeowners, building managers, building designers, and others of the benefits of radon reduction in residences and other structures. While programs for prevention and cessation of smoking can greatly reduce the incidence of lung cancer and should receive significant focus, the beneficial effect of radon reduction should be emphasized as well.
2. Inform appropriate officials of the benefits of radon reduction in schools and other public buildings. Radon-mitigation specialists, state radon program coordinators, and other qualified experts can provide officials with information on the benefits, costs, and practicality of radon reduction in schools and other public buildings.
3. Encourage adoption, at minimum, of the ASTM E 1465-07a standard, Standard Practice for Radon Control Options for the Design and Construction of New Low-Rise Residential Buildings (ASTM 2007), with regard to radon-resistant construction in new homes in counties having a potential for high indoor radon concentrations. Information about the distribution of elevated indoor radon concentrations for specific counties can often be obtained from the various state radon programs. Where such data are not available, areas designated by the U.S. EPA as Zone 1, at minimum, should be considered as having the potential for high radon concentrations.

#### *References*

American Association of Radon Scientists and Technologists. Protocols for radon measurements in homes. AARST; September 2005.

American Society for Testing and Materials (ASTM). Standard practice for radon control options for the design and construction of new low-rise residential buildings. West Conshohocken, PA: ASTM International; ASTM E 1465-07a (EPA 402-R-93-078); 2007.

Health Physics Society. Background information on “Update on Perspectives and Recommendations on Indoor Radon.” Position Statement of the Health Physics Society. McLean, VA: HPS; 2009.

U.S. Environmental Protection Agency. Protocols for radon and radon decay product measurements in homes. Washington, DC: EPA; EPA 402-R-92-003; 1993. Available at: [http://www.epa.gov/radon/pdfs/homes\\_protocols.pdf](http://www.epa.gov/radon/pdfs/homes_protocols.pdf). Accessed 28 October 2009.

U.S. Environmental Protection Agency. A citizen’s guide to radon. Washington, DC: EPA; 402-K02-006; 2005. Available at: <http://www.msihoa.com/hoa/assn10305/images/olpcitizensguide.pdf>. Accessed 28 October 2009.

### *Resources for More Information*

American Society for Testing and Materials (ASTM). Standard practice for installing radon mitigation systems in existing low-rise residential buildings. West Conshohocken, PA: ASTM International; ASTM E 2121-03; 2003.

U.S. Environmental Protection Agency. EPA assessment of risks from radon in homes. Washington, DC: EPA; 402-R-03-003; 2003. Available at: <http://www.epa.gov/radiation/docs/assessment/402-r-03-003.pdf>. Accessed 28 October 2009.

World Health Organization. WHO handbook on indoor radon: A public health perspective. Geneva: World Health Organization; 2009.

### Internet

<http://www.epa.gov/radon/>

<http://www.aarst.org/>

<http://www.crcpd.org/radon.asp>

<http://www.radonleaders.org/>

[http://www.who.int/ionizing\\_radiation/env/radon/en/](http://www.who.int/ionizing_radiation/env/radon/en/)

### Telephone

U.S. EPA — 800-SOS-RADON

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\*The Health Physics Society is a nonprofit scientific professional organization whose mission is excellence in the science and practice of radiation safety. Since its formation in 1956, the Society has represented the largest radiation safety society in the world, with a membership that includes scientists, safety professionals, physicists, engineers, attorneys, and other professionals from academia, industry, medical institutions, state and federal government, the national laboratories, the military, and other organizations. Society activities include encouraging research in radiation science, developing standards, and disseminating radiation safety information. Society members are involved in understanding, evaluating, and controlling the potential risks from radiation relative to the benefits. Official position statements are prepared and adopted in accordance with standard policies and procedures of the Society. The Society may be contacted at 1313 Dolley Madison Blvd., Suite 402, McLean, VA 22101; phone: 703-790-1745; fax: 703-790-2672; email: [HPS@BurkInc.com](mailto:HPS@BurkInc.com).