ANSI/AARST **MAH** 2014

An American National Standard

Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes

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MAH

Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes

Scope Summary and Introduction

Scope: This standard specifies procedures, minimum requirements and general guidance for measuring radon concentrations in single-family residences. The protocols included in this standard of practice apply to testing these structures whether conducted for real estate or non-real-estate purposes.

Purpose: The purpose of test protocols is to consistently produce, to the extent possible, reliable and repeatable radon measurements. Radon measurements are conducted to determine if radon mitigation is necessary in order to protect current and future occupants.

Significance of Purpose:

Radon is the leading cause of lung cancer among nonsmokers and the second leading cause of lung cancer in the general population.[1] Most people receive their greatest exposure to radon in their homes.

Radon in U.S. homes causes approximately 21,000 lung cancer deaths each year.[2] Be it at home, work or school, an individual's exposure to radon gas combines over time to increase the risk of preventable lung cancer.

This document contains a protocol and guidance designed to respond to the health threat of residential radon.

Significance of Use:

This standard of practice is intended to guide homeowners, occupants and radon measurement professionals in achieving reliable radon measurements to the need for reducing radon concentrations in homes. It thereby also helps serve the interests of health authorities, radiation control programs, consultants, regulators, radon mitigation professionals and anyone seeking reliable measurements of radon in homes.

***Applicability**:* The practices in this standard can be adopted as requirements for contractual relationships or as recommendations or requirements of a state, country, private proficiency program or other jurisdiction of authority. These practices can be used in addition to those required by local statutes, where applicable, while noting that local statutes take precedence. AARST recommends that any authority or jurisdiction considering substantial modifications of this document as a condition of its use seek consensus within the consortium process at AARST Consortium on National Radon Standards prior to adopting a modified version. This provides the jurisdiction with a higher degree of expertise and offers the Consortium on National Radon Standards an opportunity to update this document if appropriate.

[1] World Health Organization, "WHO Handbook on Indoor Radon: A Public Health Perspective" 2009

[2] National Academy of Sciences, "Biological Effects of Ionizing Radiation" (BEIR VI Report) 1999

Historical Perspective:

In the 1950s, studies confirmed increased incidence of radon-induced lung cancer for workers in underground mines.

In the 1980s, studies found that exposure to radon in homes can exceed exposures found for mine workers.

In 1988, the Indoor Radon Abatement Act authorized U.S. state and federal activities to reduce citizen risk of lung cancer caused by indoor radon concentrations. Since that time, the United States Environmental Protection Agency (USEPA) and the U.S. Surgeon General have recommended that all homes be tested for radon.

In 1999, with publication of BEIR VI[2], the National Academy of Science confirmed that any exposure to radon holds a degree of risk. In addition, the Academy's BEIR VII committee stated that exposure to radiation, including any concentration of radon, carries risk.

In 2009, the World Health Organization's *WHO Handbook on Indoor Radon* confirmed the association between indoor radon exposure and lung cancer, even at the relatively low radon concentrations found in residential buildings.[1]

Initiated in 2010, the U.S. *Federal Radon Action Plan* highlights an *ultimate* public health goal of eliminating preventable radon-induced cancer. This plan is the result of a collaborative effort led by the U.S. Environmental Protection Agency (EPA) with the U.S. Departments of Health and Human Services (HHS), Agriculture (USDA), Defense (DOD), Energy (DOE), Housing and Urban Development (HUD), Interior (DOI), Veterans Affairs (VA) and the General Services Administration (GSA).

Document History:

The USEPA developed and maintains measurement guidelines in its publications *Home Buyer's and Seller's Guide to Radon* and the *Citizen's Guide to Radon.* This standard results from efforts to compile, reconcile and clarify the guidance from all previous EPA and AARST radon measurement documents. This protocol and guidance seeks to present the best practices from those documents.

Significant Changes in this Revision

This protocol document updates and supersedes the AARST National Radon Standards document designated as MAH 2006 which was primarily derived from the U.S. Environmental Protection Agency (EPA) document titled: "*Protocols for Radon and Radon Decay Product Measurements in Homes*," Office of Air and Radiation (6609J), EPA 402-R-92-003, May 1993. This update includes a variety of changes including observance of international authorities and additional protocol for measuring radon decay products.

Keywords:

Radon Gas, Radon Test, Homes, Radon Measurement, Radon Testing, Radon Decay Products, Radon

Normative References:

- *EPA Guidance on Quality Assurance* (402-R-95-012, October 1997) See: **http://www.epa.gov/radon/pubs**

Designation: MAH
(Measurement of Air in Homes)

Metric Conversions

Conversions from English-American measurement units to the International System of Units (SI) are rendered herein with literal conversion. The conversions are not always provided in informational text or tables. It is acknowledged that rounding off to a similar numeric conversion is common for locations where the International System of Units (SI) is used in standard practice (i.e. 4.0 pCi/L rounded to 150 Bq/m^3 rather than literal conversion to 148 Bq/m^3). Conversions should apply as commonly used in such locations or jurisdictions.

Consensus Process

The consensus process developed for the AARST Consortium on National Radon Standards and as accredited to meet essential requirements for American National Standards by the American National Standards Institute (ANSI) has been applied throughout the process of approving this document.

This standard is under continuous maintenance by the AARST Consortium on National Radon Standards for which the Executive Stakeholder Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard. The change submittal form and instructions may be obtained in electronic form from at www.radonstandards.us.

Notice of right to appeal: (See Bylaws for the AARST Consortium on National Radon Standards available at **www.RadonStandards.us** .) Section 2.1 of Operating Procedures for Appeals (Appendix B) states, "Persons or representatives who have materially affected interests and who have been or will be adversely affected by any substantive or procedural action or inaction by AARST Consortium on National Radon Standards committee(s), committee participant(s), or AARST have the right to appeal; (3.1) Appeals shall first be directed to the committee responsible for the action or inaction."

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1.0 PURPOSE AND SCOPE

1.1 Scope: This standard specifies procedures, minimum requirements and general guidance for measuring radon concentrations in single-family residences. The protocols included in this standard of practice apply to testing structures whether conducted for real estate or non-real-estate purposes.

1.2 Purpose: The purpose of test protocols is to consistently produce, to the extent possible, reliable and repeatable radon measurements. Radon measurements are conducted to determine if radon mitigation is necessary in order to protect current and future occupants.

1.1.2 ***Radon Action Levels:*** Countries worldwide have adopted Action Levels for radon exposures. Most are similar to the 4 pCi/L (148 Bq/m^3) recommended by the United States Environmental Protection Agency (EPA).

The Action Level cited should, at a minimum, comply with guidance of the country, state or other local jurisdiction of authority where the test is being conducted. There are benefits to having exposures as low as reasonably achievable.

1.3 Limitations: Suggested best practices to help ensure testing quality are included, however:

1.3.1 This document is not intended to address all detailed technical aspects of measurement device technology or quality assurance.

1.3.2 When testing is being conducted for more than one dwelling of a shared building, conduct tests in accordance with the "*Protocol for Conducting Radon and Radon Decay Product Measurements In Multifamily Buildings*" (ANSI/AARST MAMF) in addition to, or as otherwise required by, local statutes.

1.3.3 The standard does not address measurement techniques to specifically identify radon sources such as radon concentrations in water supplies; the possession or handling of radioactive materials; or building materials.

1.4 **Conventions:** The term "shall" and phrases that stipulate a prescribed action are provisions herein that are considered mandatory, while terms such as "should" or "recommended" indicate provisions considered helpful or good practice, but which are not mandatory.

2.0 INTRODUCTION: BEFORE YOU TEST

Any home can have a radon problem. Every home should be tested for radon including: new and old homes, well sealed and drafty homes, and homes with or without basements. Radon concentrations cannot be predicted based on state, local, or neighborhood radon measurements. Testing is the only way to find out whether a home has elevated radon concentrations.

2.1 When to Test

2.1.1 ***Real Estate Transactions:*** Testing for radon is recommended prior to every transfer of a residential dwelling to a new owner. Even if a building has been tested before, additional measurements help to ensure that conditions, such as changes to a structure and ventilation, have not changed the radon concentration. (Note that disclosure regarding inspections and radon test results are usually required during real estate transactions.) New owners should also consider testing again once they occupy the home and property owners should consider testing in advance of initiating a real estate sale so that the transaction will not be delayed.

2.1.2 ***Testing Not Associated With A Home Sale*:** Although radon testing can begin at any time during the year, consider testing when required closed-building conditions are the normal conditions. For example: In cooler climates testing is recommended during the colder months of the year (e.g. heating seasons such as October through March).

2.1.3 ***Post-Mitigation*:** To provide an initial measure of radon reduction system effectiveness, conduct a short-term measurement no sooner than 24 hours after a radon reduction system is operational and within 30 days after installation of the system. Additional testing should be performed at least every two years to ensure that the system remains effective and may be performed as often as desired.

2.1.4 ***New Construction****:* Newly constructed homes should be tested prior to occupancy after the building is sufficiently complete to meet closed-house conditions. (See Table **5-C** for a list of additional conditions required when testing newly constructed homes.)

2.1.5 ***Shared Or Multifamily Buildings:*** When testing an individual dwelling that is part of a shared or multifamily building, (e.g., condominiums or co-op):

2.1.5.1 Choose test periods when closed conditions exist for the whole building, if possible, when short-term detectors are deployed.

2.1.5.2 When heating and cooling systems add outdoor air ventilation to the building or where a single air handler distributes air to multiple dwellings, conduct tests in accordance with the "*Protocol for Conducting Radon and Radon Decay Product*