ANSI/AARST **Designation: MAMF-2012**

An Approved American National Standard

Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings

For Residence Managers and Measurement Professionals

AARST CONSORTIUM ON NATIONAL RADON STANDARDS
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Replication with no change from ANSI/AARST MAMF 2010

An American National Standard

SCOPE:

This standard specifies procedures, minimum requirements and general guidance for measurement of radon and radon decay product concentrations in Multifamily buildings comprised of more than three attached dwellings.

THIS DOCUMENT INCLUDES:

1) **Introduction to Radon.**
2) **Introductory Guidance for Residence Managers.**
3) **Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings.**

   Specific testing protocols that include instructions on where to test, strategies for conducting reliable tests, reporting and associated quality control measures.

Significance of Use:

This document contains protocols and guidance designed to respond to the health threat of radon in dwellings in Multifamily buildings.

Radon has been determined to be the leading cause of lung cancer among nonsmokers in the United States. It is believed that most people receive their greatest exposure to radon in their home or dwelling. The U.S. EPA and the Surgeon General state that "Indoor radon is the second-leading cause of lung cancer [after cigarette smoking] in the United States and breathing it over prolonged periods can present a significant health risk to families all over the country." *(Health Advisory, January 13, 2005)*

The purpose of conducting radon measurements is to identify locations that have elevated radon concentrations and to determine if radon mitigation is necessary in order to protect current or future occupants. The purpose of test protocols is to help achieve reliable radon measurements. This standard addresses the needs of citizens, radon measurement professionals, property owners, residence/facility managers, consultants, manufacturers and regulators concerned with radon measurements in Multifamily buildings.

Introduction

History: The United States Environmental Protection Agency (EPA) developed measurement guidelines in the *Home Buyer's and Seller's Guide to Radon* and the *Citizen's Guide to Radon.* For the current versions see: http://www.epa.gov/radon/pubs. These measurement strategies assess radon concentrations in homes for the purpose of determining the need for remedial action. Guidelines or protocols also appear in the EPA documents "Indoor Radon and Radon Decay Product Measurement Device Protocols" and "Protocols for Radon and Radon Decay Product Measurements in Homes. The protocols and guidance herein include the best practices from those documents, additional technical descriptions of requirements and recommendations, and guidelines for the interpretation of measurement results.

The Stewart McKinney Amendments to the 1988 Indoor Radon Abatement Act require U.S. Housing and Urban Development (HUD) to develop an effective departmental policy for dealing with radon contamination using available guidelines and standards to ensure that occupants of housing subsidized by HUD are not exposed to hazardous concentrations of radon. At the request of Congress, the document "Radon Measurement in HUD Multifamily Buildings" was developed to enable HUD to comply with the requirements of the legislation. The document was completed during 1995 by the EPA for HUD under interagency agreement. The American Association of Radon Scientists and Technologists document "AARST Interim Protocols for Conducting Radon Measurements in Multifamily Buildings (MAMF October, 2004)" built on that document and added consortium review and revision. The document herein reflects a significant degree of continued review and amendment.

Applicability and use of this document: If the minimum requirements of this document exceed local, state, or federal requirements for the locale in which the radon test is conducted, then this document's minimum requirements should be followed. This document is intended to aid

multifamily building owners/managers and staff, residents, owners of individual dwellings, radon measurement professionals, state radiation control programs or anyone involved in the measurement of radon in Multifamily buildings to assess the need for mitigation and to provide radon risk information for the benefit of occupants. These guidelines can be adopted as part of a state program or can be provided as recommendations by states to testing companies and interested individuals. AARST recommends that any authority or jurisdiction that is 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 an opportunity for the Consortium on National Radon Standards to update its document if appropriate.

Keywords:

Radon Gas, Radon Test, Multifamily, Radon Measurement, Radon Testing, Radon, Multifamily Housing

Normative References:

- EPA Guidance on Quality Assurance (402-R-95-012, October 1997)
- Indoor Radon and Radon Decay Product Measurement Device Protocols (EPA 402-R-92-004, July 1992)

For the latest versions of USEPA documents see:
http://www.epa.gov/radon/pubs

Referenced Publications:

- A Citizen's Guide To Radon (EPA 402/K-09/001, January 2009)
- Home Buyers and Sellers Guide to Radon (EPA 402/K-09/-002, January 2009)

For the latest versions of USEPA documents see:
http://www.epa.gov/radon/pubs

- Protocols For Radon Measurements In Homes (AARST MAH September 2005)

For the latest versions of AARST documents see:
http://www.aarst.org

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 (i.e. 4.0 pCi/L rounded to 150 Bq/m^3 rather than literal conversion to 148 Bq/m^3) for locations where the International System of Units (SI) are used in standard practice. Conversions should apply as commonly used in such locations or jurisdictions.

Consensus Process

The consortium consensus processes 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) have been applied throughout the process of approving this document. This Standard is to be reviewed and updated every five years at a minimum.

Notice regarding unresolved objections: While each committee seeks to resolve objections, please notify the committee responsible for an action or inaction if you desire to re-circulate any unresolved objections to the committee for further consideration. **Notice of right to appeal.** (See Bylaws for the AARST Consortium on National Radon Standards - Operating Procedures for Appeals available at www.radonstandards.us, Standards Forum, Bylaws): (2.1) 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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TABLE OF CONTENTS

Section I: Introduction to Radon

(This section is intended for informational purposes only. For radon testing protocol, see Section III).

A. Radon Facts

Radon is a naturally-occurring radioactive gas which is a part of the uranium-238 decay chain. The immediate parent of radon-222 is radium-226. Radon comes from the breakdown (radioactive decay) of uranium that is found in soil and rock all over the United States. Radon is a component of the air in soil that enters buildings through cracks and other pathways in the foundation. Eventually, it decays into radioactive particles (decay products) that can become trapped in your lungs when you inhale. As these particles decay in turn, they release small bursts of radiation. This radiation can damage lung tissue and lead to lung cancer over the course of your lifetime. EPA studies have found that radon concentrations in outdoor air average about 0.4 pCi/L (picocuries per liter) of air. However, radon and its decay products can reach much higher concentrations inside a building.

Radon gas is colorless, odorless, and tasteless. The only way to know whether elevated concentrations of radon are present in any building is to test.

B. Radon's Health Effects

Radon is a known human carcinogen. Prolonged exposure to elevated radon concentrations causes an increased risk of lung cancer. Like other environmental pollutants, there is some uncertainty about the magnitude of radon health risks. EPA calculates that radon may cause 21,000 lung cancer deaths in the U.S. each year. The U.S. Surgeon General has warned that radon is the leading cause of lung cancer deaths in non-smokers in the U.S. Only smoking causes more lung cancer deaths than radon.

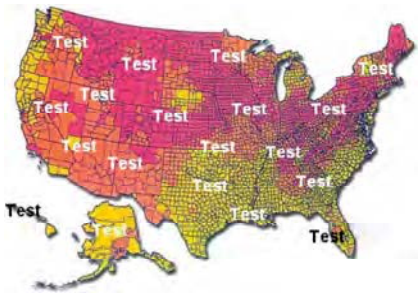
Not everyone who breathes radon decay products will develop lung cancer. An individual's risk of getting lung cancer from radon depends mostly on three factors: the concentration of radon, the duration of exposure and the individual's smoking habits. In addition, some people are more susceptible to lung cancer than others.

Risk increases as an individual is exposed to higher concentrations of radon over a longer period of time. Smoking combined with radon is an especially serious health risk. The risk of dying from lung cancer caused by radon is much greater for smokers than it is for non-smokers.

C. Radon Exposure

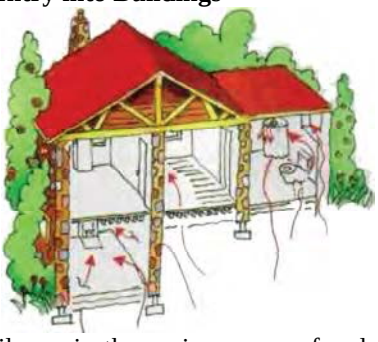
Because many people spend much of their time at home, the home is likely to be the most significant source of radon exposure. According to EPA, nearly 1 out of every 15 homes in the United States is estimated to have radon concentrations that exceed the EPA action level.

Elevated concentrations of radon have been found in homes and buildings in every state. While elevated radon may be more common in some areas, any building can have a problem. EPA recommends that ALL buildings should be tested regardless of the area of the country and that maps should not be used to determine whether to test. More specific information on the likelihood of elevated radon in your area can frequently be found at your state or county radon offices.



The concentration of radon in the air within a building should be reduced below **EPA's radon action level of 4 pCi/L.** Any radon exposure creates some risk; no concentration of radon is safe. Even radon concentrations below 4 pCi/L pose some risk, and the risk of lung cancer can be reduced by lowering indoor radon concentrations. This action level is based largely on the ability of current mitigation technologies to consistently reduce radon concentrations below 4 pCi/L. Depending on the building characteristics, radon concentrations in some buildings can be reduced well below 4 pCi/L. In others, reducing radon concentrations to below 4 pCi/L may be more difficult.

D. Radon Entry into Buildings



Radon in soil gas is the main source of radon problems. Pathways for radon to enter a building include cracks in the slabs and walls, the expansion joints between floor and walls, porous concrete block walls, open sump pits, crawlspaces and openings around utility penetrations. Some buildings have other pathways for radon to enter a building such as sub-slab utility tunnels and heating, ventilating and air conditioning (HVAC) ducts.

Radon gas may also enter buildings in well water. Radon from well water used in a building can off-gas and raise the concentrations. For dwellings or small communities serviced