

**ANSI/AARST** **RMS-LB 2018**



An American National Standard

# Radon Mitigation Standards for Schools and Large Buildings

**AARST CONSORTIUM ON NATIONAL RADON STANDARDS**  
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## Radon Mitigation Standards for Schools and Large Buildings

### Scope Summary and Introduction

This standard specifies practices, minimum requirements and general guidance for mitigation of radon in existing schools and large buildings including both low-rise and high-rise schools and large buildings.

The techniques addressed in this standard provide whole-building consideration yet also apply when implemented to portions of a building or individual occupied spaces.

This standard is intended to:

- Provide minimum requirements and uniform standards that emphasize safety, system quality and effectiveness in the design and installation of mitigation systems for existing schools and large buildings.
- Provide a means to evaluate radon mitigation systems in schools and large buildings.

### 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.<sup>1</sup> For most school children and staff, the second largest contributor to their radon exposure is likely to be their school.<sup>2</sup> Thousands of classrooms nationwide have elevated radon levels, needlessly exposing hundreds of thousands of students and staff to this serious health risk.<sup>3</sup> With similar implications, a correlation has been observed between radon levels in homes, and workplaces in the same area.<sup>4</sup>

Radon in U.S. homes causes approximately 21,000 U.S. lung cancer deaths each year.<sup>5</sup> 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 minimum requirements and guidance designed to respond to the health threat in schools and large buildings.

### 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 in studies of mine workers.

Since 1988, the Indoor Radon Abatement Act has authorized U.S. state and federal activities to reduce citizen risk of lung cancer caused by indoor radon concentrations.

Since the early 1990s, USEPA has advised all U.S. schools to test for radon and to reduce levels to below 4 pCi/L.<sup>3</sup>

In 1999, with the publication of BEIR VI<sup>3</sup>, the National Academy of Sciences 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 levels found in residential buildings.<sup>1</sup>

Initiated in 2010, the U.S. Federal Radon Action Plan (FRAP), followed by the National Radon Action Plan (NRAP), has highlighted an ultimate public health goal of eliminating preventable radon-induced cancer. The FRAP 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). And the NRAP, led by American Lung Association, represents a collaborative effort between several federal and national organizations including American Association of Radon Scientists and Technologists (AARST) and the Conference of Radon Control Program Directors (CRCPD). (GSA).

### Document History

Previous radon mitigation standards were developed primarily for radon mitigation in single-family, detached residential buildings. They were not intended to address the wider scope of challenges associated with schools and large buildings.

### Updates for RMS-LB 2018

- Much of the content in ANSI/AARST radon mitigation standards is now harmonized with specific additional provisions relative to each documents scope. For instance, RMS-LB (schools and large buildings) includes an expanded building investigation procedure that can be helpful for any large building including mitigations installed per RMS-MF (multifamily buildings). SGM-SF (existing homes) expands with guidance and requirements when mitigating chemical vapor intrusion and provides more detail on non-ASD passive mitigation methods. SGM-SF's Companion Guidance also expands more on sub-slab diagnostics and common code requirements.
- Efforts have been made to add clarity by highlighting editorial content as informational.
- Section 1.9.2 adds reference to ANSI/AARST SGM-SF *Soil Gas Mitigation for Existing Homes* when applying radon mitigation techniques herein for other hazardous soil gasses such as for chemical vapor intrusion into buildings.

<sup>1</sup> World Health Organization, "WHO Handbook on Indoor Radon: A Public Health Perspective" 2009

<sup>2</sup> USEPA, "Radon Measurement In Schools", July 1993 (EPA-402-R-92-014)

<sup>3</sup> USEPA, "Tools For Schools", June 2010"

<sup>4</sup> Silvia Bucci, Gabriele Pratesi, Maria Letizia Viti, Marta Pantani, Francesco Bochicchio and Gennaro Venoso, "Radon in workplaces: first results of an extensive survey and comparison with radon in homes", 2011

<sup>5</sup> National Academy of Sciences, "Biological Effects of Ionizing Radiation" (BEIR VI report) 1999

- Section 7.2.2 (*Slope required*) adds flexibility when continuous downward pipe slope for active soil depressurization (ASD) systems is not achievable by requiring an alternate method for water drainage.
- Section 7.2.5 (*ASD pipe materials*) adds clarity for requirements on alternatives to Schedule 40 plastic pipe.
- Section 7.4 (*ASD Exhaust Discharge—Design and Location*) changes requirements for exhaust configurations by adding new considerations relative to the spread of exhausted air.
- Section 7.5.3.2 (*ASD fans below ground*) adds an exception for exterior fans located below ground that have reasonable access and protections for the fans and electrical components.
- Section 12.4.2 (*Statement of client obligations*) adds clarity for inherent obligations of property owners and managers when systems are not maintained by an individual who is both the owner and occupant of the building.
- Section 12.5 (*Monitoring—Retests Verify Continued Effectiveness*) adds clarity for appropriate testing protocols and general retesting guidance.

#### Adoption

The practices in this standard can be adopted as requirements for contractual relationships or adopted as recommendations or requirements of an authority or jurisdiction such as for state, private proficiency programs or governmental body. 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.

#### Keywords

Radon, Radon Gas, Radon Mitigation, School, Large Building, Radon Test

#### Normative References

“Protocol for Conducting Measurements of Radon and Radon Decay Products In Schools and Large Buildings” (ANSI/AARST MALB).

See: [www.aarst-nrpp.com/wp/store](http://www.aarst-nrpp.com/wp/store)

#### 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 (e.g., 4.0 pCi/L rounded to 150 Bq/m<sup>3</sup> rather than literal conversion to 148 Bq/m<sup>3</sup>) for locations where SI units of measurement are used in standard practice. Conversions should apply as commonly used in such locations or jurisdictions.

#### ANSI/AARST 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.

#### Continuous Maintenance of This Standard

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 at [www.radonstandards.us](http://www.radonstandards.us)

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Notice of right to appeal: (See Bylaws for the AARST Consortium on National Radon Standards available at: [www.RadonStandards.us](http://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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## Radon Mitigation Standards for Schools and Large Buildings



### 1.0 SCOPE

**1.1** This standard specifies practices, minimum requirements and general guidance for mitigation of radon in existing Schools and Large Buildings.

This standard addresses a wide range of Schools and Large Buildings including, among others, the use of a building or structure, or a portion thereof for: Business occupancies (Group B<sup>6</sup>) including for offices, educational and training facilities, professional services or service-type transactions; and Educational occupancies (Group E) including for religious and educational purposes through the 12th grade and day care facilities.

**1.2** This standard addresses practices that are applicable to multi-use buildings or structures that are divided into any combination of occupancies including educational, commercial or residential<sup>7</sup> occupancies.

**1.3** The scope includes High-rise buildings with an occupied floor located more than 75 feet (22 860 mm) above the lowest level.

**1.4** The scope does not intend to exclude: Assembly occupancies (Group A) including for the gathering of persons for purposes such as civic, social or religious functions; Factory occupancies (Group F) including for fabrication or manufacturing, repair or processing; High-hazard occupancies (Group H); Institutional occupancies (Group I) including for where people are cared for or live in a supervised environment be it under restraint or security, detained in a penal institution, or for medical, surgical, psychiatric, nursing, custodial care or for child care facility purposes; and, Mercantile occupancies (Group M) including for the sale of merchandise, goods, wares or merchandise incidental to such purposes and accessible to the public.

**1.5** This standard addresses practices that are applicable to structures or a portion thereof be they rented, leased or owned including co-op owned buildings.

**1.6** The techniques addressed in this standard provide whole building consideration yet also apply when implemented to portions of a building or individual occupied spaces.

**1.7** This standard is intended to provide:

- a) minimum requirements and uniform standards that emphasize safety, system quality and effectiveness in the design and installation of mitigation systems for existing Schools and Large Buildings; and
- b) a means to evaluate mitigation systems in Schools and Large Buildings.

<sup>6</sup> As point of reference, see the International Building Code (IBC) (as published by the International Code Council).

<sup>7</sup> For residential dwellings, see ANSI/AARST RMS-MF "Radon Mitigation Standards for Multifamily Buildings".

**1.8** Significance of use: This document is intended to assist in the installation of mitigation systems by radon mitigation professionals, and to assist in the inspection of mitigation systems by citizens, property owners, residence/facility managers, residents, consultants, regulators, state radiation control programs and anyone concerned with efforts to reduce indoor radon concentrations in schools and large buildings.

### 1.9 Limitations

#### 1.9.1 *Design and warranties*

This standard is not intended to be used as a design manual, and compliance with its provisions will not guarantee reduction of indoor radon to any specific concentration.

#### 1.9.2 *Mitigation of other soil gasses (e.g., chemical vapors)*

When applying radon mitigation techniques herein for other hazardous soil gasses such as for chemical vapor intrusion into buildings, applicable requirements are found in ANSI/AARST **SGM-SF Soil Gas Mitigation for Existing Homes** with special attention to Section 11 (Additional Requirements), Section 12 (Documentation Required) and Annex B (Health and Safety).

#### 1.9.3 *Safety*

This standard is not intended to address all of the safety concerns associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices. It is the responsibility of the user of this standard to determine the applicability of regulatory limitations prior to use.

#### 1.9.4 *Code compliance*

This standard does not contain all code or other requirements of the jurisdictions where the radon mitigation system is being installed. Although the provisions in this standard have been reviewed for potential conflicts with other regulatory requirements, adherence to this standard does not guarantee or supersede compliance with the applicable codes or regulations of any federal, state or local agency with jurisdiction.

#### 1.9.5 *Less common sources of radon gas*

This standard does not address all mitigation techniques such as may be needed for airborne radon that results from radon in water, building materials or other less common sources of radon gas.

## 2.0 APPLICABILITY

### 2.3 Adoption and use

These standards of practice can be adopted as requirements for contractual relationships or adopted as recommendations or requirements of an authority or jurisdiction.

To the extent the minimum requirements of this document exceed local, state or federal requirements for the locale in which the mitigation is conducted, then this document's minimum requirements shall be followed.

### 2.2 Mandatory Provisions

The term "shall" indicates those 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.