

# An Introduction to the ANSI-AARST Large Building Standards

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K-State Radon Programs

# History of Radon Standards

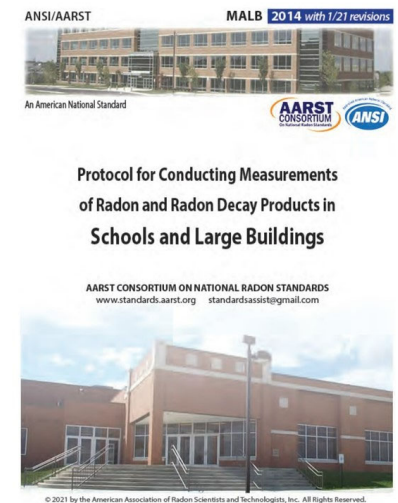
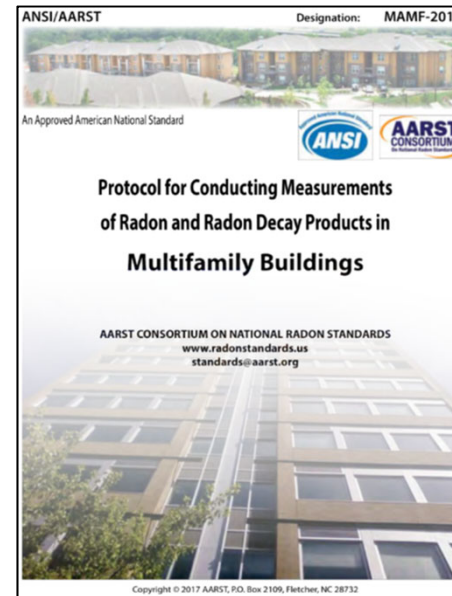
- The U.S. EPA **RECOMMENDS** no longer using the now very dated standards
  - **RECOMMENDS** using the AARST-ANSI consensus standards

# How does large building measurement differ from single-family structures?

I don't have 118 CRMS...

# AARST Radon Measurement Protocols

- AARST Protocol for Radon Measurement in Multi-family Buildings
- Protocols for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings
- AARST-ANSI Standards
  - <https://standards.aarst.org/>



# Table of Contents

## 1. Scope and Purpose

### 1.1 Scope

### 1.2 Applicability

## 2. Before You Test

### 2.1 Which Buildings?

### 2.2 When to Test?

### 2.3 Test Devices

### 2.4 Who Should Conduct the Testing

### 2.5 Summary of Procedures

### 2.6 Client Communications

### 2.7 Assemble Building Information

### 2.8 Test Device Quality Control

### 2.9 Coordination Notifications

## 3. Test Locations

### 3.1 Ground-contact Locations

### 3.2 Upper Floors

### 3.3 Locations Not to Test

### 3.4 Large Rooms or Open Areas

### 3.5 Multi-zone HVAC Systems

### 3.6 Inaccessible Ground-contact Locations

### 3.7 Choosing a Room

### 3.8 Choosing a Location Within a Room

# Table of Contents

## 4. Test Conditions Required

4.1 Closed Building Condition Requirements

4.2 HVAC Ventilation

4.3 Upper Floor Rooms and Dwellings

## 5. Testing Procedures

5.1 Detector Deployment Periods

5.2 Evaluation of Occupied/Unoccupied

5.3 Time-Sensitive Testing Option

5.4 Extended Testing Option

5.5 Testing a Single Room or Dwelling

5.6 New Construction

5.7 Post-mitigation Testing Protocols

## 6. Conducting the Test

6.1 Quality Control- Test Conditions

6.2 Quality Control- Valid Tests

6.3 Quality Control- Devices

6.4 Test Site Documentation

6.5 Submitting Detectors to a Laboratory

## 7. Actions Based on Test Results

7.1 Action Level Guidance

7.2 When Two Test Results Disagree

7.3 Post-Mitigation Testing Protocol

# Table of Contents

## 8. Test Reports

8.1 Conventions

8.2 Summary Reports

8.3 Summary Report Attachments

8.4 Additional Test Data

8.5 Other Reporting and Disclosures

8.6 Retention of Records

## 9. Definition of Terms

## Informative Exhibits

## Normative Appendices

A. Reporting Building Operating Conditions

B. Evaluation of Occupied v Unoccupied Concentrations

C. Radon Sources Other Than Soil Gas

## Consensus Body Members

## Companion Guidance

CG-1 Introduction to Radon

CG-2 Guidance to Building Managers

CG3-Descriptions of Test Devices

CG-4 Chain of Custody

CG-5 Average Conditions

# Measurements in Large Buildings

Primary differences between single-family and large building measurements

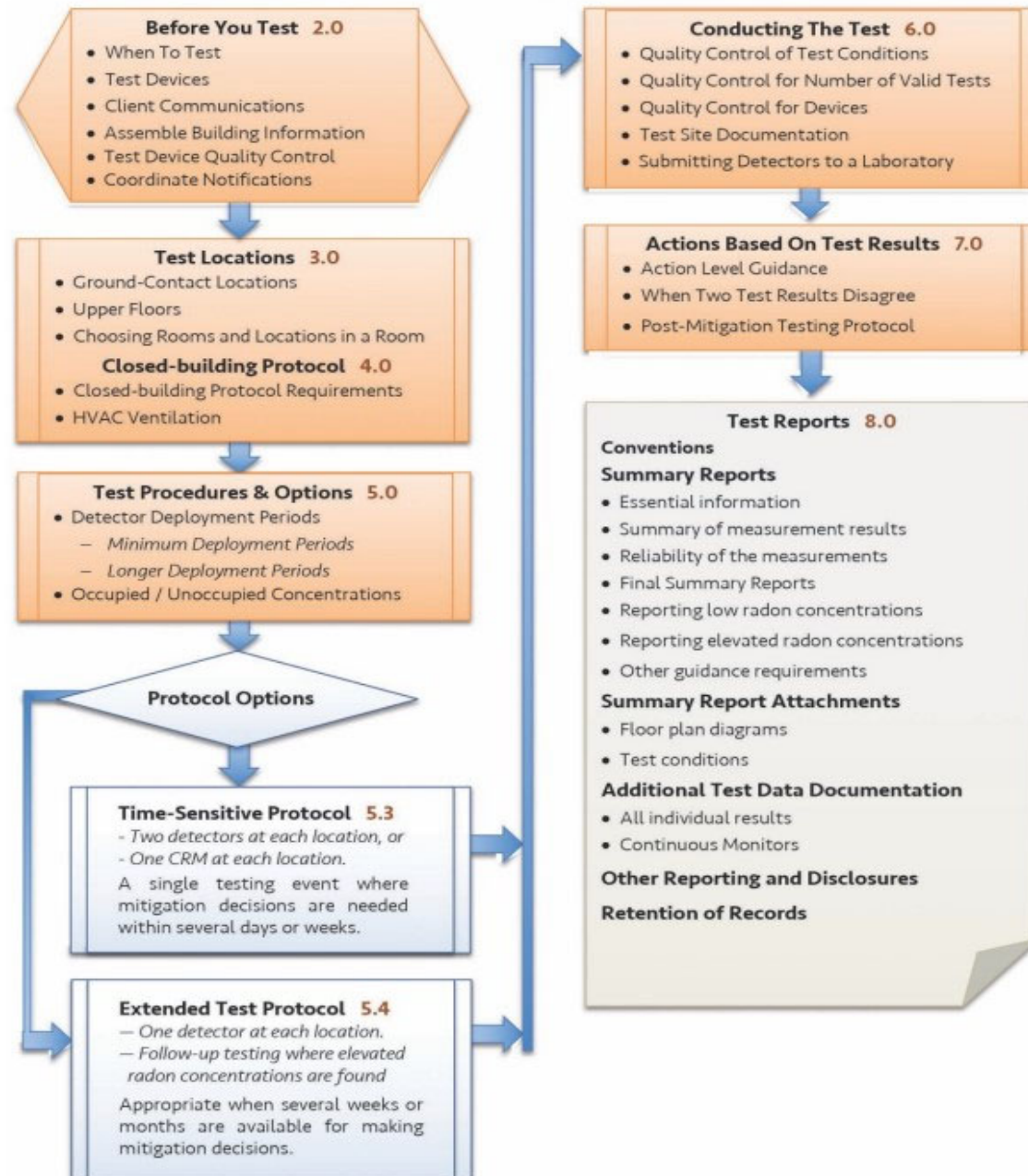
- When to test a large building
  - Buildings that **ARE** significantly occupied day and night
    - Can be tested **ANY TIME OF YEAR**
    - Residential-only or mixed use residential/other
  - Buildings that **ARE NOT** significantly occupied day and night
    - Measurements **SHALL** be conducted at a time representative of normal occupied conditions



# Summary of Testing Procedures

## 2.5 Summary of Testing Procedures

Flowchart of procedures embodied in this standard



Radon

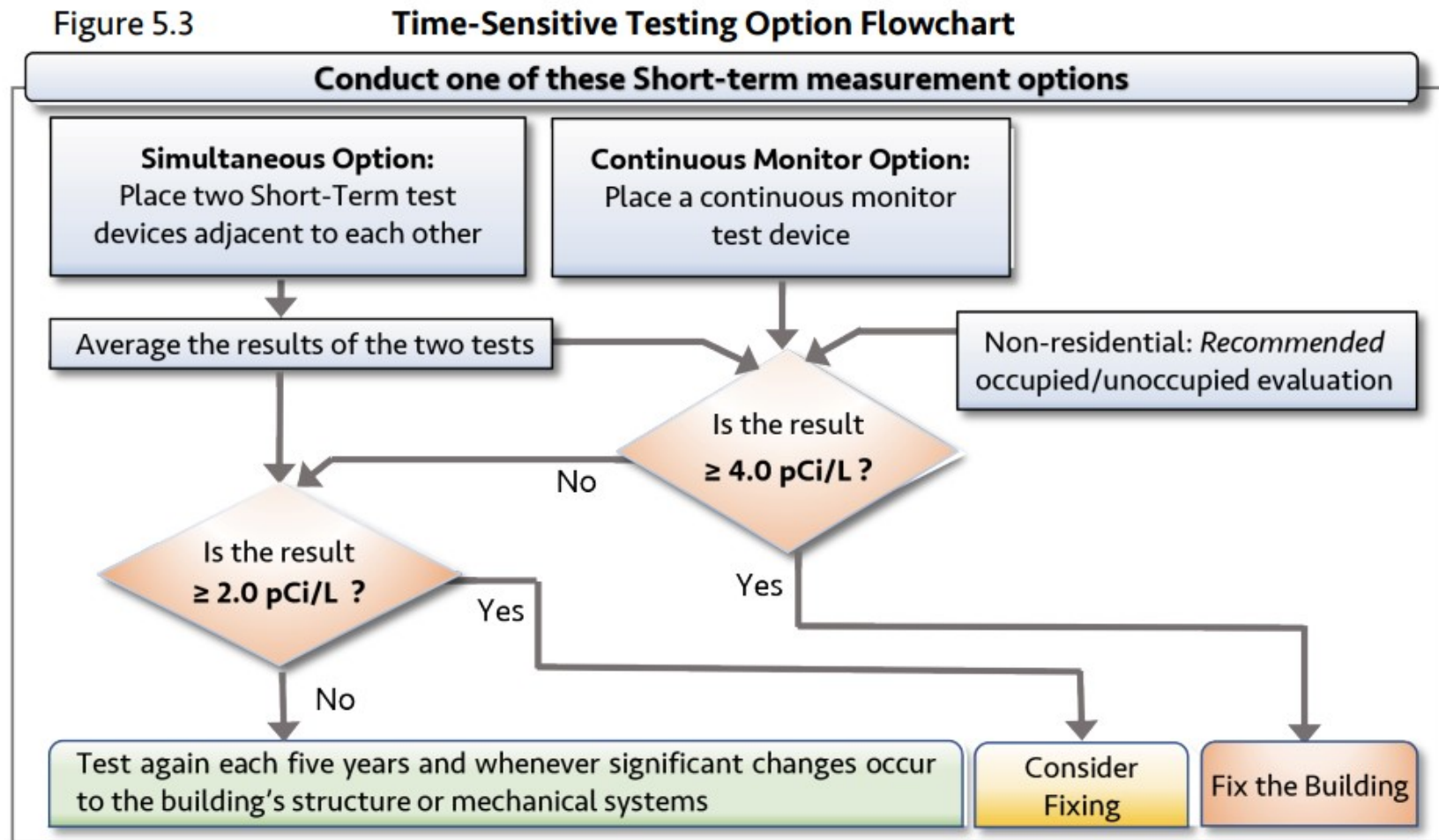
# Measurements in Large Buildings

Primary differences between single-family and large building measurements

- Client communications
  - Not only between you and your client, but **ALL** occupants of the structure being measured
- Building investigation
  - Identification of **ALL** HVAC zones
  - Identification of **ALL** identified measurement locations (and devices needed for coverage)
    - **INCLUDING** QC devices

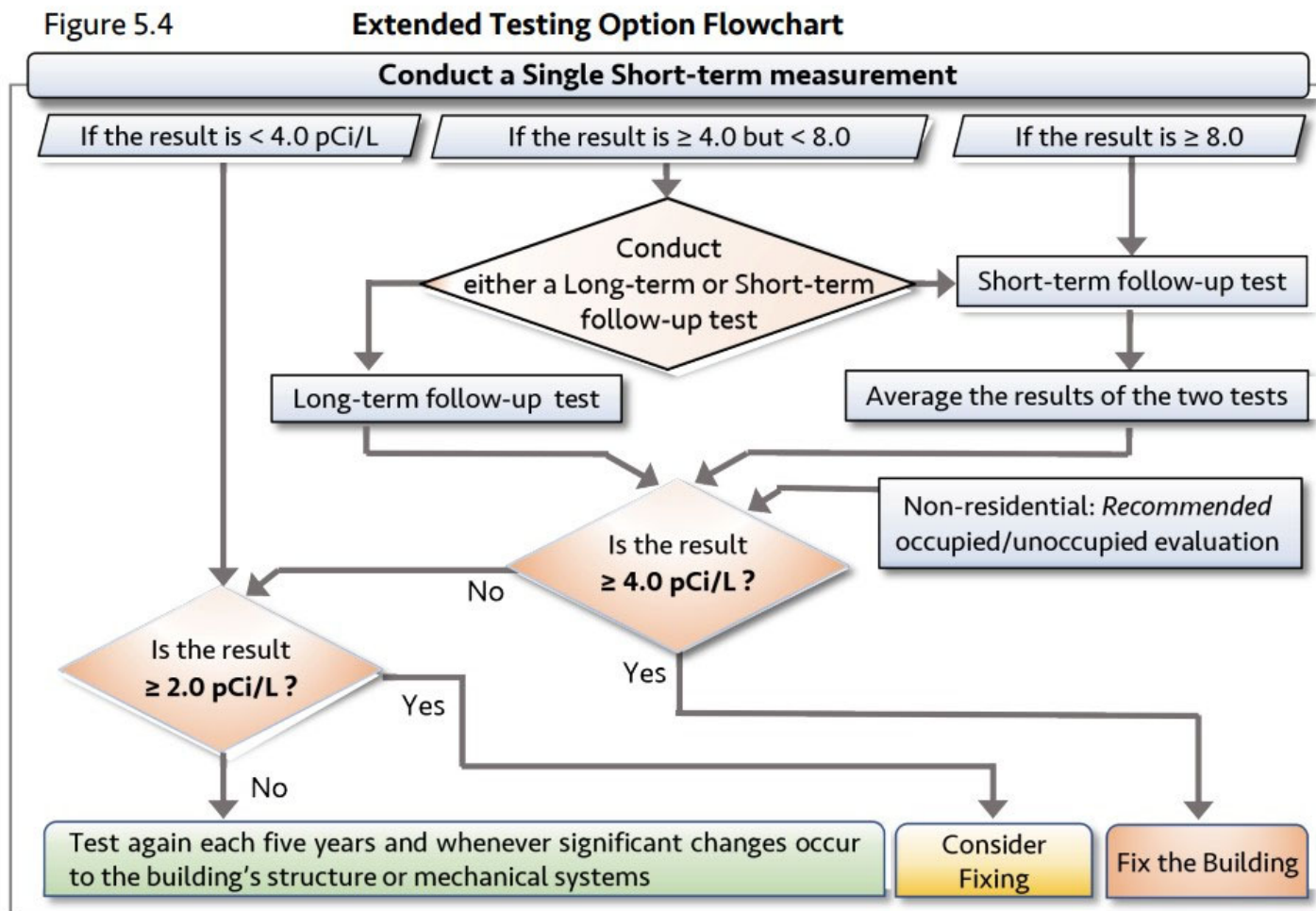
# Testing Procedures & Options

## Time-Sensitive Testing Option



# Testing Procedures & Options

## Extended Testing Option



# Actions Based on Test Results

## Action Level Guidance

### Action Level Guidance

Countries worldwide have adopted *action levels* for *radon* exposures. The *action level* observed should comply with the guidance of the country, state or local jurisdiction of authority where the test is being conducted.

**U.S. Action Level.** The following *action level* descriptions reflect guidance from the United States Environmental Protection Agency (EPA):

- **4 pCi/L or greater** ( $\geq 150 \text{ Bq/m}^3$ )

Fix the building. The higher the *radon* concentration, the more quickly action should be taken to reduce the concentrations.

- **Below 4 pCi/L** ( $< 150 \text{ Bq/m}^3$ )

Consider fixing the building if test results indicate that *radon* concentrations are greater than half the *action level*, such as between 2 and 4 pCi/L (75 and 150 Bq/m<sup>3</sup>).

With observance that hazards from *radon* are virtually the same for *radon* concentrations that are near *action level* thresholds, it is noteworthy that the World Health Organization recommends limiting *long-term* exposures to less than 2.7 pCi/L (100 Bq/m<sup>3</sup>).

When measurement devices indicate concentrations lower than about 2.0 pCi/L (75 Bq/m<sup>3</sup>), test data should normally be interpreted as being lower than the test device can accurately measure.

# Business Considerations

A non-comprehensive list of things to think about

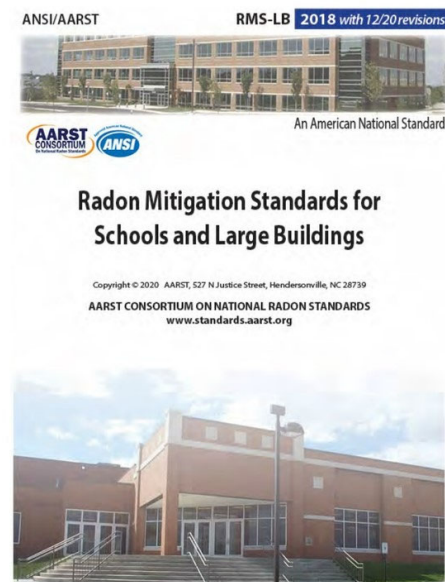
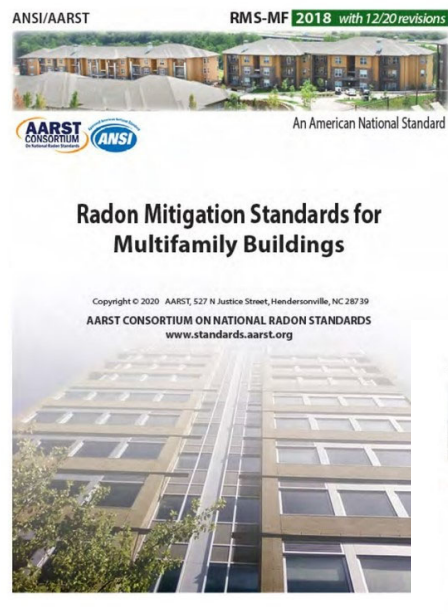
- Device types (and numbers)
  - Purchase and storage of large numbers of devices
    - QC associated with those devices
- Project bid development
  - ‘Ask me anything BUT for time!’
  - Cost projections
    - Staffing, devices, report development
- Business practice changes
  - Insurance levels
  - Permanent/temporary staffing concerns

# How does large building mitigation differ from single-family structures?

You have HOW MANY HVAC systems?!

# AARST Radon Mitigation Protocols

- AARST Radon Mitigation Standards for Multifamily Buildings
- AARST Radon Mitigation Standards for Schools and Large Buildings
- AARST-ANSI Standards
  - <https://standards.aarst.org/>





# Table of Contents

## 1. Scope

## 2. Applicability

### 2.1 Mandatory Conventions

### 2.2 Prior Systems

### 2.3 Adoption and Use

## 3. Qualified Contractors

### 3.1 Trained Professionals

### 3.2 Contractors, Teams & Qualifications

### 3.3 Quality Management

## 4. General Practices

### 4.1 Assemble Building Information

### 4.2 Proposals

### 4.3 Notification and Hazards

### 4.4 Jurisdictional Authorities

## 5. System Design

### 5.1 Health and Safety

### 5.2 Long-term Considerations

### 5.3 Appropriate Systems

### 5.4 Nondestructive Investigation

### 5.5 Diagnostic Investigation

### 5.6 Design Decisions

## 6. ASD System Installation

### 6.1 ASD Suction Points

### 6.2 ASD Piping

### 6.3 ASD Pipe Sizing

### 6.4 ASD Exhaust Discharge

### 6.5 ASD Fan Installation

# Table of Contents

## 7. Sealing

- 7.1 Background & Accessibility
- 7.2 Sealant Materials
- 7.3 Accessible Cracks
- 7.4 Other Accessible Openings
- 7.5 Sumps and Pits
- 7.6 Membranes Over Open Soil
- 7.7 Sub-membrane  
Depressurization
- 7.8 Drains
- 7.9 Sealed Isolation Assemblies

## 8. For All Systems and Methods

- 8.1 Long-Term OM&M Plan
- 8.2 System Monitors
- 8.3 Electrical
- 8.4 Labeling
- 8.5 Inspection for Compliance
- 8.6 Retention of Records

## 9. Post-Mitigation

- 9.1 Functional Evaluation
- 9.2 Initial Radon Test After  
Mitigation

# Table of Contents

## 10. Documentation & OMM

10.1 Essential Information

10.2 When Owner-Occupied

10.3 Inadvertent Collateral Mitigation

10.4 When Not Owner-Occupied

## 11. Health & Safety

11.1 Mitigation Installers

11.2 Workers and Occupants

## 12. Non-ASD Systems & Methods

12.1 For All Non-ASD Methods

12.2 Sources of Air

12.3 Indoor Air Pressurization

12.4 Soil Air Pressurization

12.5 Indoor Air Dilution

12.6 Soil Air Dilution

12.7 Controls for Variable Activation

12.8 HVAC Repairs & Modifications

12.9 Building Materials

12.10 Water

12.11 Source Removal

12.12 Air Cleaning

# Mitigation in Large Buildings

Primary differences between single-family and large building mitigation activities

- Standards' scope
  - Addresses **WHOLE** building consideration
    - Apply when implemented to **PORTIONS** of a large building, or
    - Individual unit/dwelling of a large building
  - **When building portions include**
    - Non-residential purposes and/or
    - Elaborate HVAC systems
    - Refer to RMS-LB schools/large buildings

# Mitigation in Large Buildings

Primary differences between single-family and large building mitigation activities

- Building investigation
  - Collect ALL known radon measurement reports
    - ID any measurement data insufficiencies
  - Identification of **ALL** HVAC zones
  - Identification of **ALL** foundational zones

# Mitigation in Large Buildings

## Primary differences between single-family and large building mitigation activities

- Proposal/bid issues
  - Provide the client a statement regarding extent of **ALL** building investigations needed to design an appropriate mitigation strategy/system
- Client communication

*"Occupant Advisory: Common construction sealants used to prevent radon entry at foundations and other locations will normally emit vapors that contain modest amounts of certain chemicals generally referred to as volatile organic compounds. The emissions occur mostly during application, but also to a lesser extent as they dry to form an airtight bond. While these chemicals are commonly used, some sensitive individuals may experience discomfort or other health effects when exposed to such chemicals.*

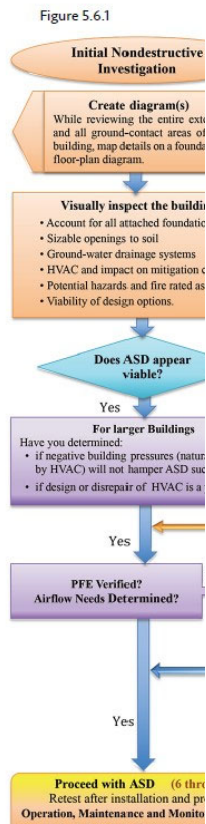
*Symptoms that may indicate sensitivity to these vapors may include: nausea, headaches, dizziness, drowsiness and/or an allergic reaction. Special consideration should be made for the very young or elderly who cannot communicate symptoms experienced. Safety Data Sheets (SDS) are available upon request.*

*If symptoms are observed: Leave the area immediately to breathe fresh air. Avoid further exposure. If symptoms persist, get medical attention."*

(See notice examples in Exhibits A-1 and A-3.)

The notification to *clients* regarding hazardous materials shall include: a general description of the hazardous materials; symptoms that might indicate sensitivity to the materials; and actions to take if symptoms are observed.

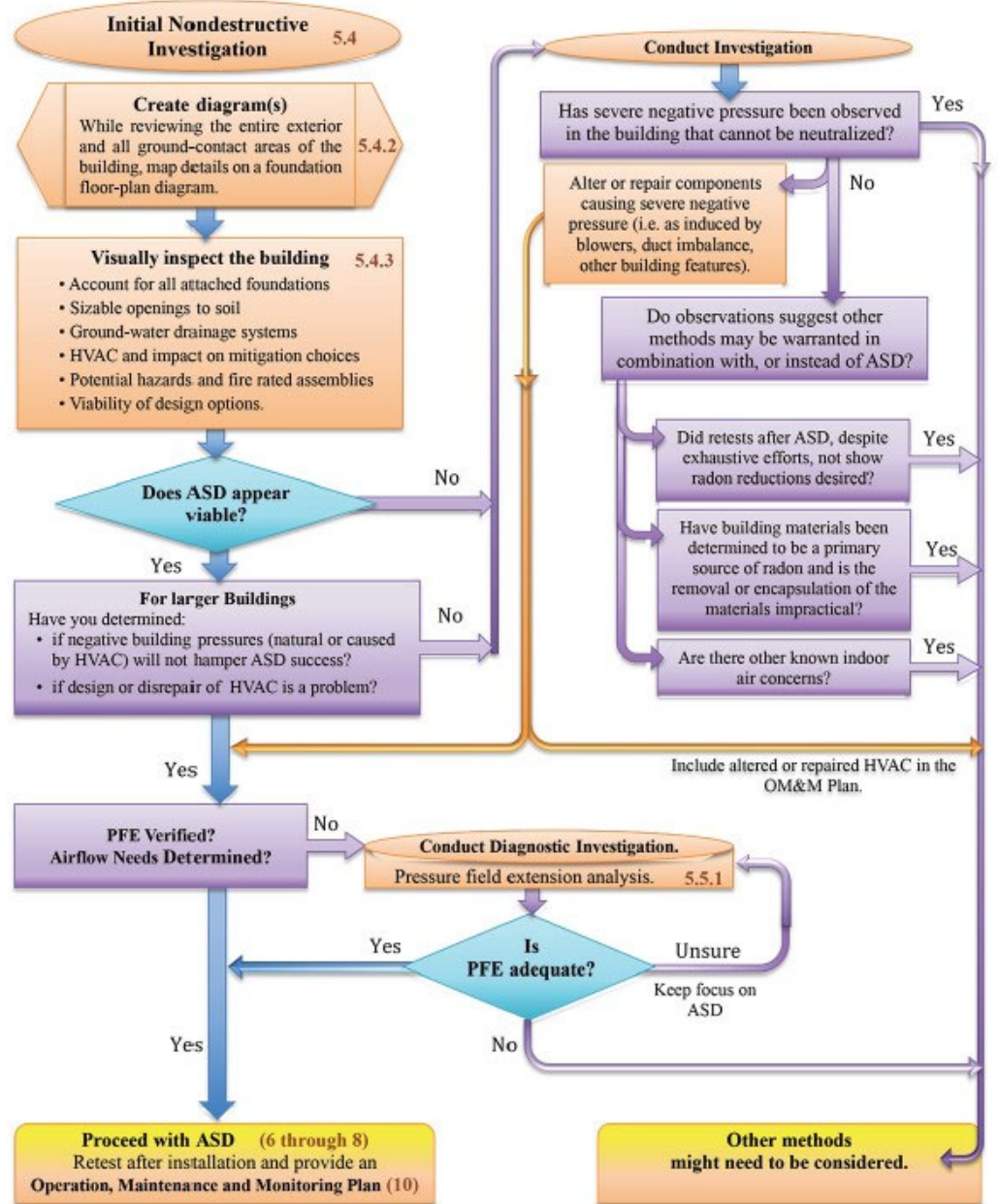
# System Design



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## Radon Program

Figure 5.6.1



# System Design

Figure 5.6.2 SGM-SF: Example Design Decision Flowchart— Non-ASD Methods

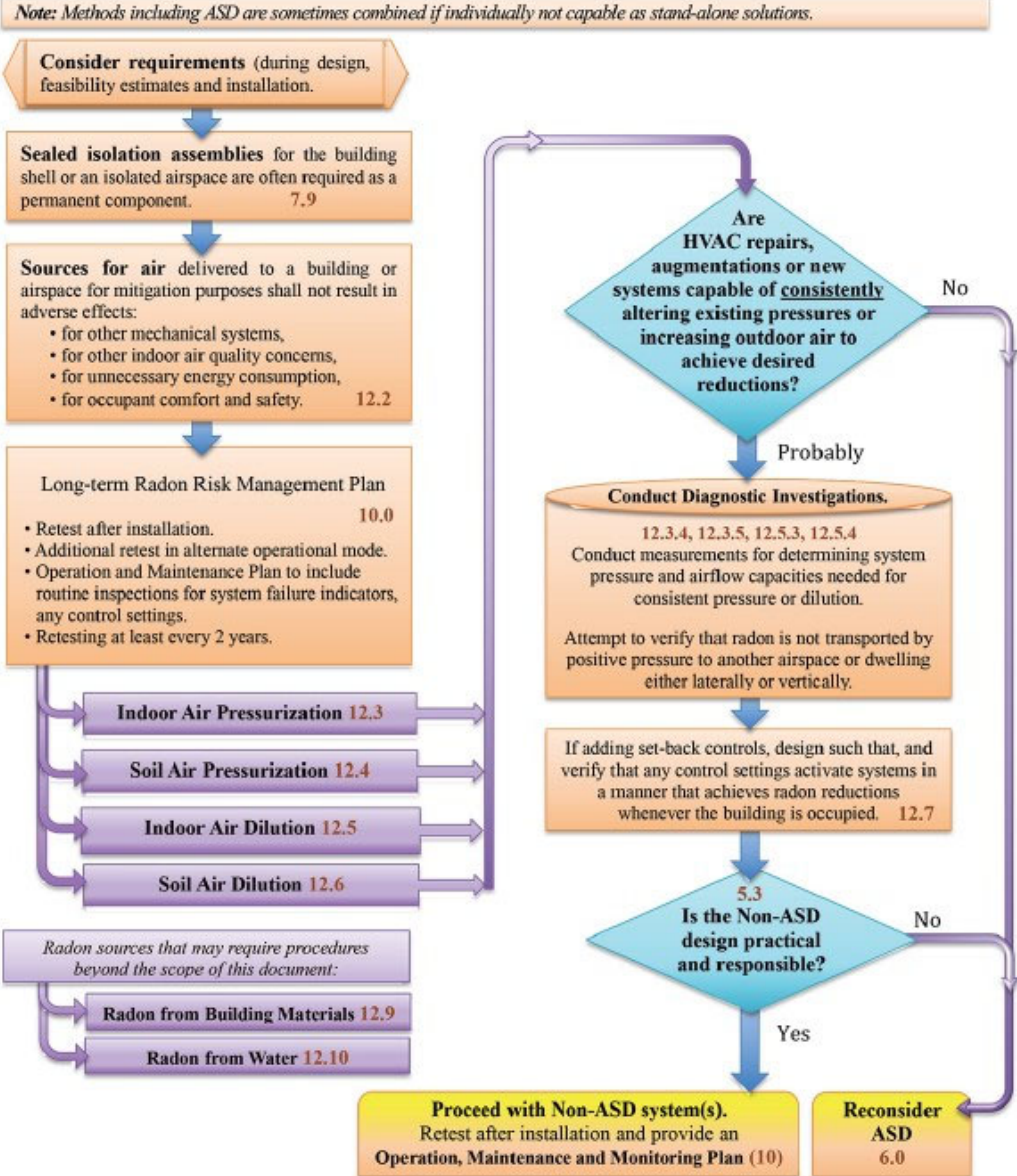


Figure 5.6.2  
*Note: Methods including ASD are sometimes combined if individually not capable as stand-alone solutions.*  
**Consider requirements** (during design, feasibility estimates and installation).  
**Sealed isolation assemblies** for the building shell or an isolated airspace are often required as a permanent component. 7.9  
**Sources for air** delivered to a building or airspace for mitigation purposes shall not result in adverse effects:  
 • for other mechanical systems,  
 • for other indoor air quality concerns,  
 • for unnecessary energy consumption,  
 • for occupant comfort and safety. 12.2  
**Long-term Radon Risk Management Plan** 10.0  
 • Retest after installation.  
 • Additional retest in alternate operational mode.  
 • Operation and Maintenance Plan to include routine inspections for system failure indicators, any control settings.  
 • Retesting at least every 2 years.  
**Indoor Air Pressurization 12.3**  
**Soil Air Pressurization 12.4**  
**Indoor Air Dilution 12.5**  
**Soil Air Dilution 12.6**  
*Radon sources that may require procedures beyond the scope of this document:*  
**Radon from Building Materials 12.9**  
**Radon from Water 12.10**

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## Radon Program



# Documentation

Table 10.5 Part 1

Table 10.5 Operation, Maintenance and Monitoring (OM&M) Plan Requirements		
Documentation Controls and Mechanical System Monitors	Maintenance Inspections of Controls and Monitors	Frequency of Inspection
<p><b>Document Startup Details</b></p> <p>A description shall be provided for the fan monitors, control settings and other operating parameters that existed at the time successful <i>mitigation</i> was initially achieved.</p> <p>Note—The description should include explicit detail for comparison during inspections and repair, including:</p> <ul style="list-style-type: none"> <li>a) descriptions of equipment labeling and annotations for fan monitors, control settings and other operating parameters;</li> <li>b) exact locations of fan monitors, electronic telemetry/monitoring equipment, electrical disconnects and other components;</li> <li>c) instructions for equipment sufficient to interpret labels, annotations and the designed operating parameters for the equipment. When applicable, include manufacturer instructions;</li> <li>d) a list of appropriate actions for the <i>client(s)</i> to take if fan monitor devices or inspections indicate a system is not operating as designed; and</li> <li>e) documented measurements for balance of airflow in and airflow out of HVAC system(s) when a component of a <i>mitigation</i> system.</li> </ul>	<p>The following inspections shall be written into the <i>OM&amp;M</i> plan as required actions:</p> <ul style="list-style-type: none"> <li>a) inspection of fan monitors, control settings and other operating parameters to ensure systems are operating as designed;</li> <li>b) investigation and correction of any conditions that are found to indicate component failure or inconsistencies with designed operating parameters;</li> <li>c) recording and maintenance of records that are to be assimilated into the overall building <i>OM&amp;M</i> documentation; and</li> <li>d) The plan shall stipulate that a qualified professional should perform these inspections and if performed by in house maintenance staff, such staff shall be trained in system operations.</li> </ul>	<p>The plan shall stipulate recommendations and any requirements for the frequency of inspections, as deemed by the <i>contractor</i> as appropriate to the situation.</p> <p>Note 1—It is recommended that the plan stipulate inspections be conducted at least quarterly of all fan monitors, controls, and as applicable, filters and vent openings.</p> <p>Note 2—The plan should recommend inspections subsequent to:</p> <ul style="list-style-type: none"> <li>a) system shutdown due to building power failure or emergency; and</li> <li>b) any catastrophic event that could damage system components.</li> </ul>

# Documentation

Table 10.5 Part 2

Documentation Mechanical Equipment	Mechanical Equipment Inspections	Frequency of Inspection
<p><b>Equipment Details and Instructions</b></p> <ul style="list-style-type: none"> <li>a) Include manufacturer instructions and instructions specific to design configurations, as appropriate;</li> <li>b) Include exact locations of fans, electrical disconnects and other components; and</li> <li>c) Include a list of appropriate actions for the <i>client(s)</i> to take if the fan monitor warning device indicates system degradation or failure.</li> <li>d) Include a list of potential repair items for <i>ASD</i> systems that should include:               <ul style="list-style-type: none"> <li>i. fan monitor repair or replacement (e.g., reconnect or replace oil in U tube);</li> <li>ii. electrical repair;</li> <li>iii. fan or boot replacement; and</li> <li>iv. sealing openings to soil or piping connections.</li> </ul> </li> </ul>	<p>The <i>OM&amp;M</i> plan shall observe that mechanical equipment inspections should include all seals, straps, fasteners, electrical system (including switch operation), boots, performance indicators, labels, pipe condition, filters, inlet grills and fan operation.</p> <p>When <i>HVAC</i> is a component of the <i>mitigation</i> system(s), provide a list of inspection items that includes:</p> <ul style="list-style-type: none"> <li>i. <i>HVAC</i> airflow in and airflow out of the air handler;</li> <li>ii. functionality of <i>HVAC</i> filters;</li> <li>iii. room differential pressure test;</li> <li>iv. fresh-air damper settings; and</li> <li>v. verification for supply air into rooms of interest.</li> </ul>	<p>The plan shall stipulate that a detailed inspection of all components is to be conducted at least every 2 years by a qualified professional.</p>
<p><b>Monitoring Continued Effectiveness</b></p> <p>The plan shall include notice of applicable retesting guidance found in ANSI/AARST publication MAMF: <i>Protocol for Conducting Measurements of Radon and Radon Decay Products In Multifamily Buildings</i>.</p>		

# Business Considerations

A non-comprehensive list of things to think about

- Project bid development
  - ‘Ask me anything BUT for time!’
  - Costs of bid production
  - Cost projections
    - Staffing, devices, report development
- Business practice changes
  - Insurance levels
  - Permanent/temporary staffing concerns

# Questions?

Cause, boy do I have answers...

We're From the Government, We're Here  
to Help

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Kansas Radon Chamber

[www.ksuradonchamber.org](http://www.ksuradonchamber.org)

National Radon Program Services

[www.sosradon.org](http://www.sosradon.org)

Kansas Radon Program

[www.kansasradonprogram.org](http://www.kansasradonprogram.org)

MURC Radon Training

<https://radoncourses.com/>

# Resources for You

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- Call Kansas Radon Program
  - **800.693.5343**
  - <https://kansasradonprogram.org/home>
- Brian Hanson
  - 785.532.4996
  - [bhanson@ksu.edu](mailto:bhanson@ksu.edu)