

# Standards Update



Failure modes

Long term Risk Management Plans

Codes?

Consensus

Linear thresholds

Discharge at ground

Pipe size

Coalitions

Equilibrium Ratio

UT Ratings

Electrical loads

Study Phil Smith, ... , Bill Shawn:

ASHI and NATCH

Torresos, Paricane

CRPP?

# Standards Update



**Status report?**

**We've been getting a lot done**



## Radon Leaders Saving Lives



# Thanks

## About RadonLeaders.org

RadonLeaders.org is an online learning and action network supporting the Radon Leaders Saving Lives Campaign. Each year, the National Radon Conference is organized and sponsored by the Conference of Radiation Control Program Directors (CRCPD)\* and is held in conjunction with the International Radon Symposium, organized and sponsored by American Association of Radon Scientists and Technologists (AARST). At the 2007 meetings, leaders from CRCPD, AARST, and EPA's Radon program launched the Radon Leaders Saving Lives Campaign, with the goal of doubling the number of lives saved from radon-induced lung cancer within 5 years. **Subsequently, the organizations agreed on the need to develop an online platform to continue the collaborative efforts needed to support the Campaign goal throughout the year. CRCPD agreed to develop and host such a platform, with close collaboration from AARST and EPA on content. RadonLeaders.org was launched at the 2008 meetings.**

RadonLeaders.org connects radon stakeholders through interactive tools (e.g. [Blogs](#), [Discussion Forums](#)), and features information and resources like the [Resource Bank](#), and [Radon Change Package](#) to help facilitate action and radon risk reduction. To learn more visit the [RadonLeaders.org FAQ](#).

[Click here to share your National Radon Action Month story! »](#)

### About

- [» About RadonLeaders.org](#)
- [» About AARST](#)
- [» About CRCPD](#)
- [» About EPA](#)





# Thanks

U.S. Department of Housing and Urban Development • Office of Healthy Homes and Lead Hazard Control



HEALTHY HOMES

# RADON

*"You can't see radon. But it may  
be a problem in your home"*

U.S. Environmental Protection Agency

## Did you know...?

- Radon is the second leading cause of lung cancer, after smoking.<sup>1</sup>
- Approximately 20,000 cancer deaths each year are caused by radon.<sup>2</sup>
- Radon is the leading cause of cancer among nonsmokers.<sup>3</sup>



# Volunteered Time (e.g., SGM-SF)

Chair: Dave Kapturowski (MA)

Assistance Team: Gary Hodgden (KS)



Stakeholder Group	Delegate	Affiliation
(Educators)	Bill Angell (MN)	Midwest University Radon Consortium (MURC)
(Regulated States Rn)	Josh Kerber (MN)	Minnesota Department of Health
(Federal EPA Rn)	Jani Palmer (DC)	U.S. Environmental Protection Agency (EPA)
(Federal HUD)	Hilary Atkin (DC)	HUD Office of Housing
(Proficiency Program)	Kyle Hoylman (KY)	AARST-NRPP (Credentialing Committee)
<i>(Proficiency Program)</i>	<i>Bruce Snead (KS) Alternate</i>	<i>AARST-NRPP (Policy Advisory Board)</i>
(Mitigation Prof. Rn)	David Grammer (NJ)	Professional Service Provider
<i>(Mitigation Prof. Rn)</i>	<i>Keith Volsted (IL) Alternate</i>	<i>Professional Service Provider</i>
(Measurement Prof. Rn)	David Wilson (TN)	Oak Ridge National Laboratory
(Building Inspectors)	Nate Burden (PA)	Professional Service Provider
(Federal OHH)	Warren Friedman (DC)	HUD Office of Healthy Homes
<i>(Federal OHH)</i>	<i>Eugene Pinzer (DC) Alternate</i>	<i>HUD Office of Healthy Homes</i>
(Regional HUD)	Paul Mohr (MO)	HUD Field Representatives
<i>(Regional HUD)</i>	<i>Sam Gieryn (MO) Alternate</i>	<i>HUD Field Representatives</i>
(Federal HUD)	Nelson Rivera (DC)	HUD Community Planning and Development
<i>(Federal HUD)</i>	<i>Danielle Schopp (DC) Alternate</i>	<i>HUD Community Planning and Development</i>
(Manufacturers)	Paul Owen (MA)	Spruce Environmental
(Educators VI)	Kelly Pennell (KY)	University of Kentucky Dept. of Civil Engineering
(Regulated States VI)	David Swim (WI)	Wisconsin Department of Natural Resources
<i>(Regulated States VI)</i>	<i>Pat Troth (IN) Alternate</i>	<i>Indiana Dept. of Environmental Management</i>
(Federal EPA VI)	Henry Schuver (DC)	EPA Office of Emergency Response (OSWER)
<i>(Federal EPA VI)</i>	<i>Rich Kapuscinski Alternate</i>	<i>EPA Office of Emergency Response (OSWER)</i>
(Mitigation Prof. VI)	Tony McDonald (IN)	Professional Service Provider
<i>(Mitigation Prof. VI)</i>	<i>Tom Hatton (NJ) Alternate</i>	<i>Professional Service Provider</i>
(Building Scientist VI)	Rachel Saari (MI)	Professional Service Provider
<i>(Building Scientist VI)</i>	<i>Robert Truesdale (NC) Alternate</i>	<i>RTI (Research Triangle Institute)</i>
(Site Assessment VI)	Chris Lutes (NC)	Professional Service Provider
<i>(Site Assessment VI)</i>	<i>Eric Lovenduski (NY) Alternate</i>	<i>Professional Service Provider</i>
(Stewardship VI)	David Gillay (IN)	Professional Service Provider
<i>(Stewardship VI)</i>	<i>Chris Bonniwell (WI) Alternate</i>	<i>Professional Service Provider</i>
(Regional EPA)	Michael Murphy (IL)	USEPA Region 5 (North-Central Region)
<i>(Regional EPA)</i>	<i>Alana Lee (CA) Alternate</i>	<i>USEPA Region 9 (Pacific-Southwest Region)</i>
(Public Health NGO VI)	Lenny Siegel (CA)	Center for Public Environmental Oversight

# Thanks



**Volunteer Committee Members:  
Please stand and raise your hand!**

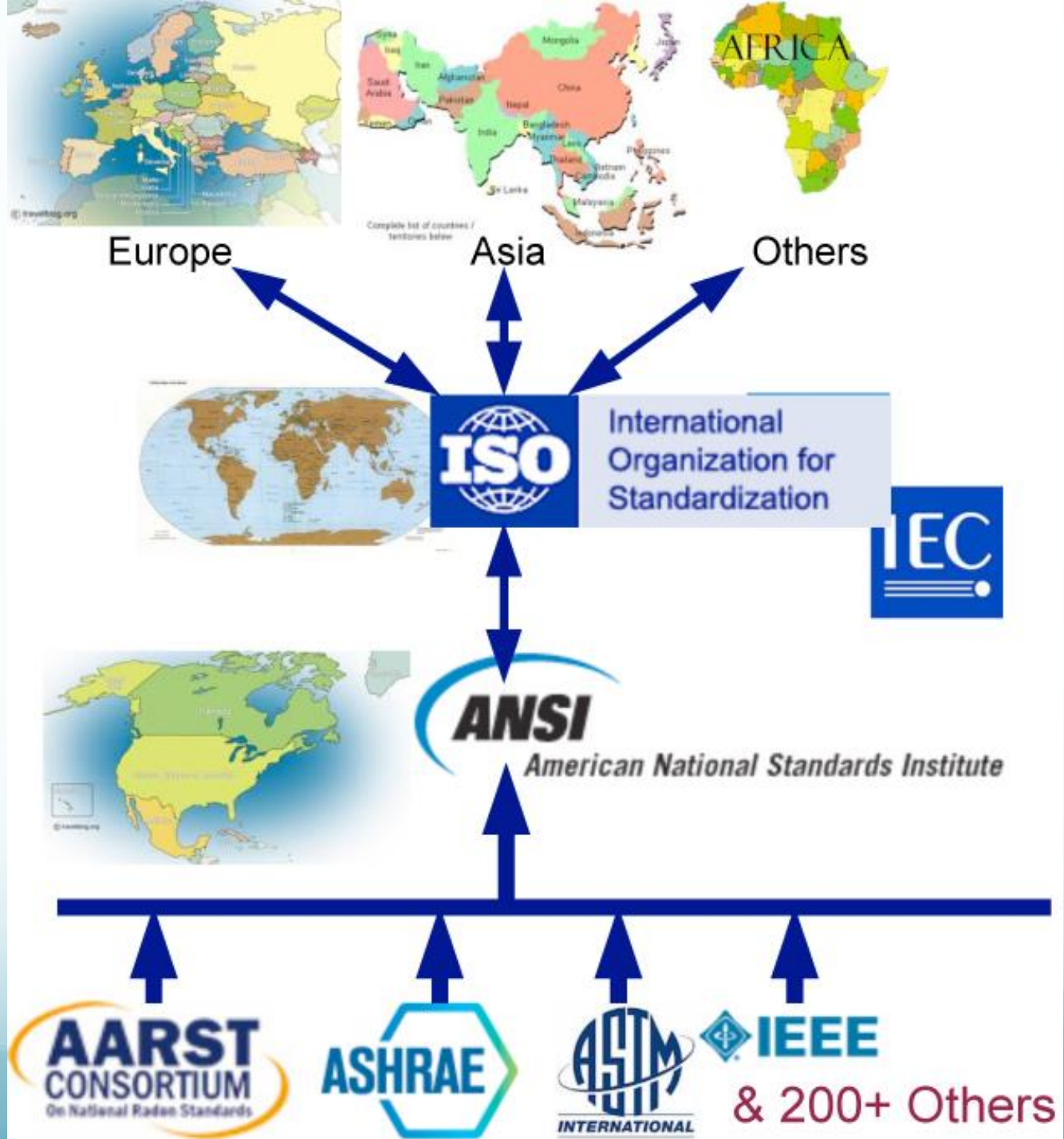


# What we do .....

We join talent and experience  
together for open and creative  
collaboration to create:

American National Standards

# Organizational Relationships







# The Big Picture

- ◆ Even though private-sector standards are voluntary unless required by contract or by local, state or federal authorities:
- ◆ American National Standards are often cited in requirements for contracts and certification programs as well as in public guidance. And they are often used in part, or referenced in whole, by regulatory bodies.

# ANSI/AARST

## As of today

# MAH 2014

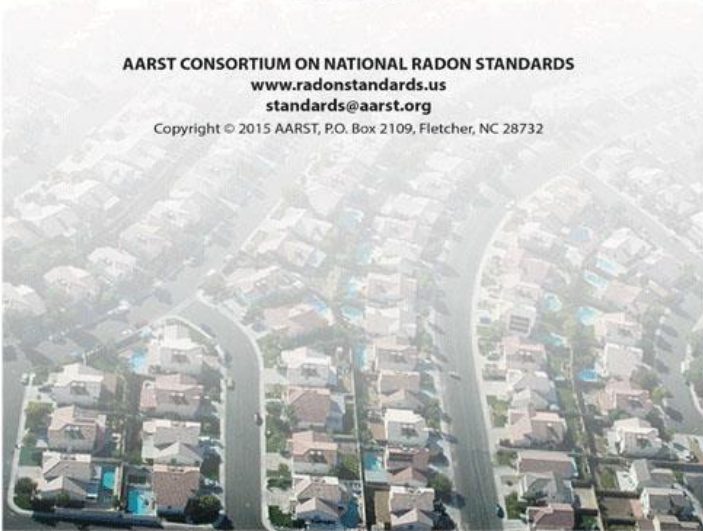
## *Home Measurement Protocols.*



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

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MAH significantly condenses older content to help reduce confusion. Each technological need is covered only once.



# MAH 2014

## Home Measurement Protocols.

### Table of Contents Page

1.0	<b>Purpose and Scope</b>	1
2.0	<b>Introduction: Before You Test</b>	1
2.1	When To Test	1
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6.0	<b>Test Result Recommendations</b>	10
7.0	<b>Additional Protocols For Professionals</b>	

Sections 1-6 are for anyone testing a home (including homeowners).

# MAH 2014

## Home Measurement Protocols.

<b>7.0</b>	<b>Additional Protocols For Professionals</b>	
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7.3	Conducting The Test	11
7.4	Test Devices, QA and Proficiency	11
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	Table: For Elevated Concentrations	13
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7.5.8	Statement of Test Limitations	13
7.6	Maintaining Records	13
8.0	Radon Decay Product Measurements	14
9.0	Definition of Terms	16
	Informational Supplements	

Section 7 and onward covers requirements of professionals.

# MAMF 2012

## Multifamily Measurement Protocols.

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*

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Consistent with an earlier EPA draft and school guidance in seeking to identify any dwelling where an occupant may be at risk.



# *MALB 2014*

## *School and Large Building Measurement Protocols*

ANSI/AARST MALB 2015



An American National Standard

### **Protocol for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings**

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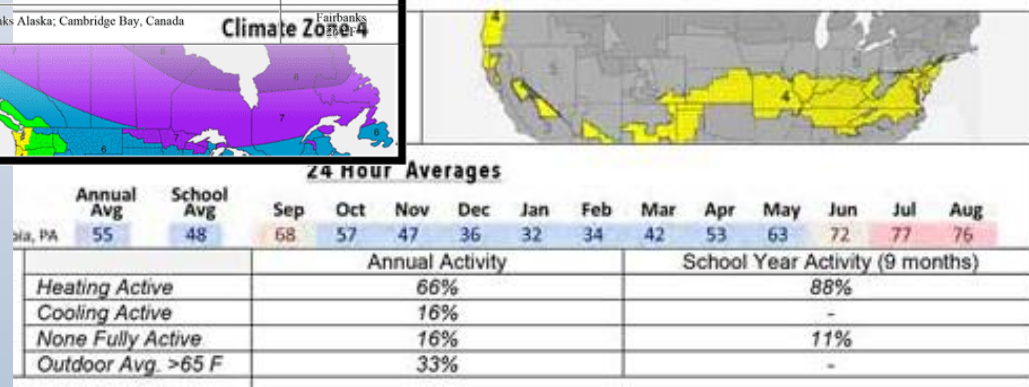
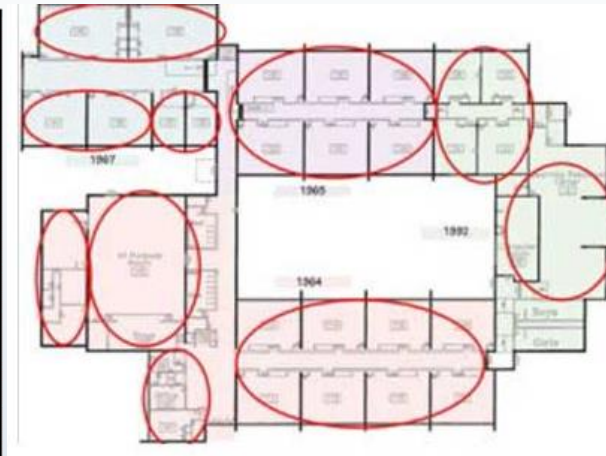
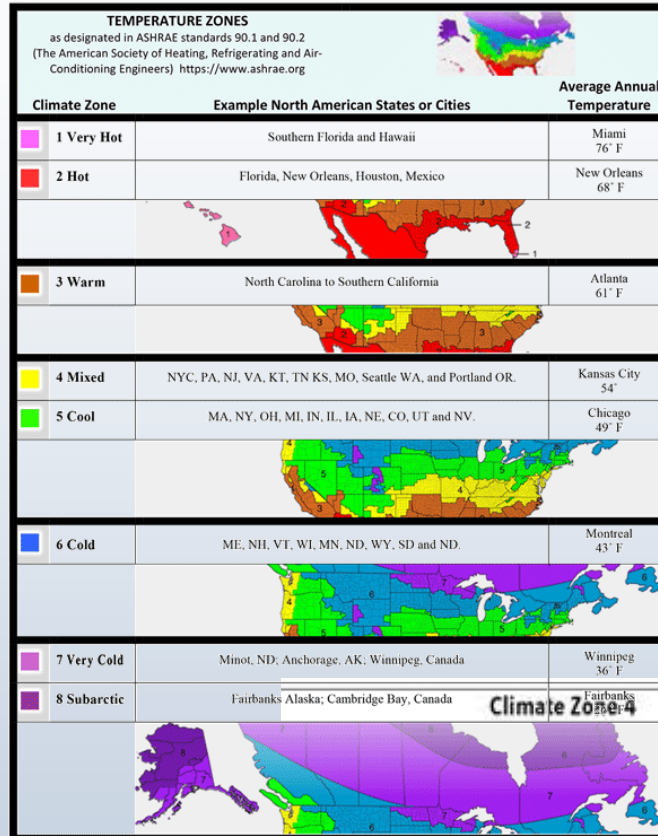
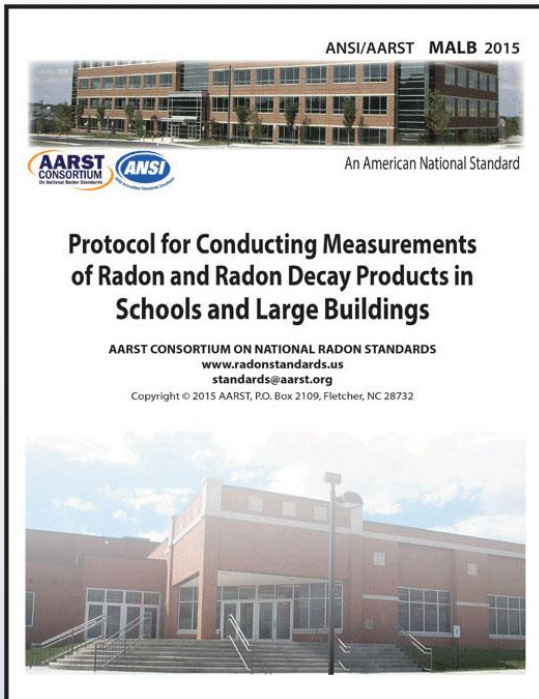
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- ◆ Tackled situations where buildings are not occupied 24/7, 365 days a year
- ◆ Testing to represent the average, occupied building condition

# Examples of tough issues tackled

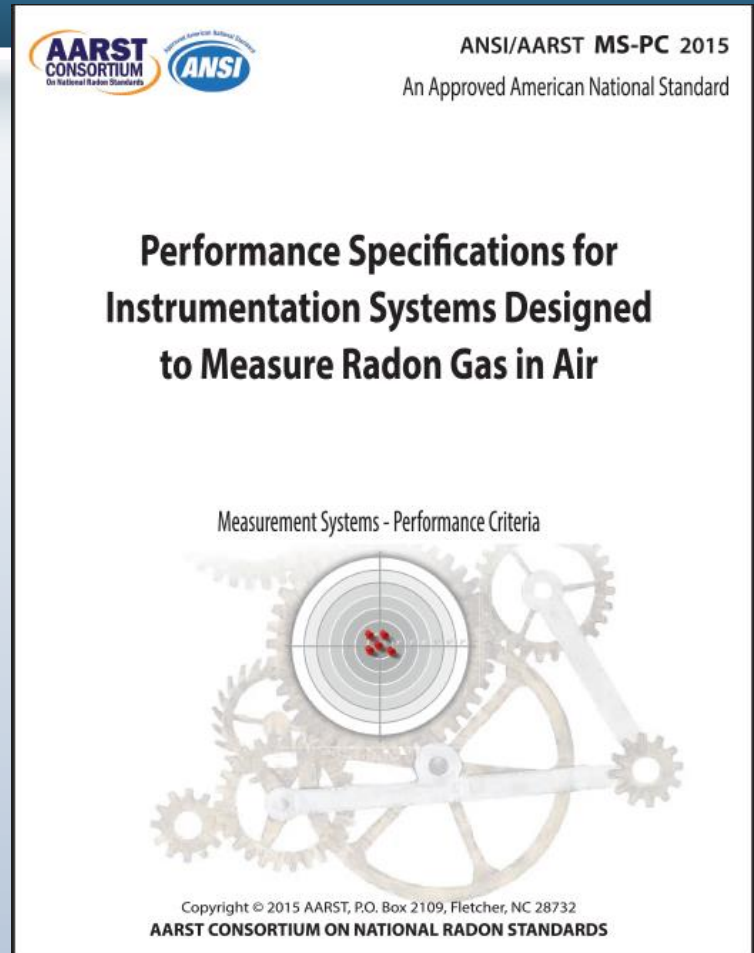
## ◆ All of this affects testing results



# *MS-PC 2015*

## *Performance Criteria for Radon Measurement Systems*

- ◆ “How accurate is the gadget?”
- ◆ Because every step of measurement and QA relies on performance of devices, it was first in line for QA documents.

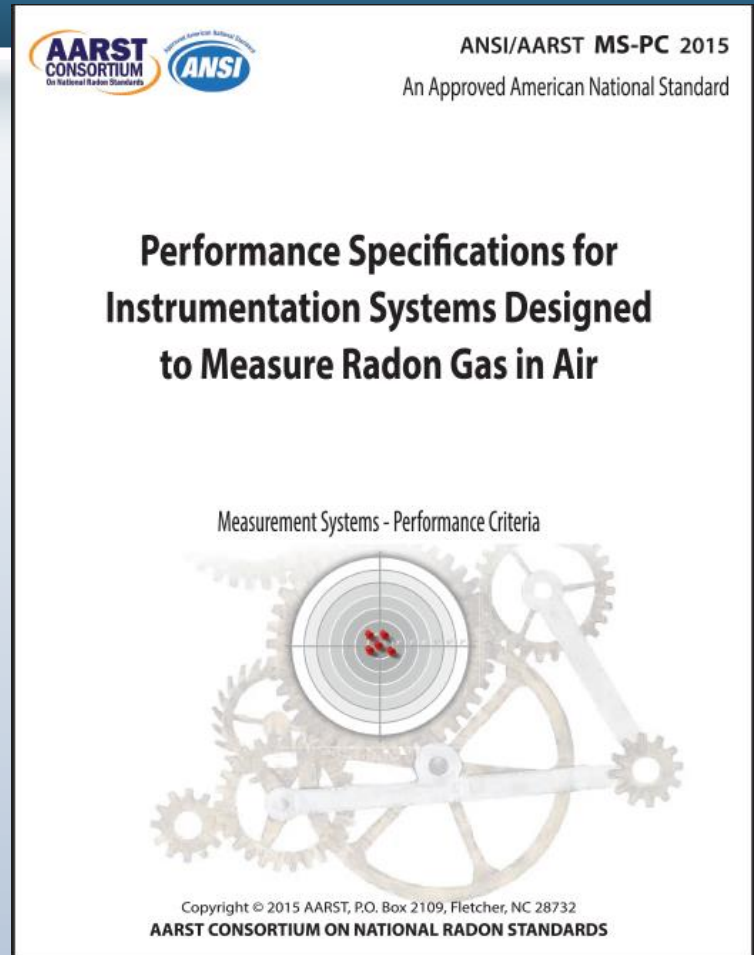




# *MS-PC 2015*

## *Performance Criteria for Radon Measurement Systems*

- ◆ Spikes, Dupes, Blanks, Performance Tests and Calibration.....  
We compare one system of gadgets to another.
- ◆ All depend upon a minimum bar for quality.



## **MS-QA** (new)

# *Quality Assurance for Radon Measurement Systems*

- ◆ Revisiting each aspect of QC for purpose and appropriate minimum standard of practice.

*Arthur*



ANSI/AARST MS-QA 2016  
An Approved American National Standard

## **Quality Assurance for Radon Measurement Systems**

Measurement Systems - Quality Assurance

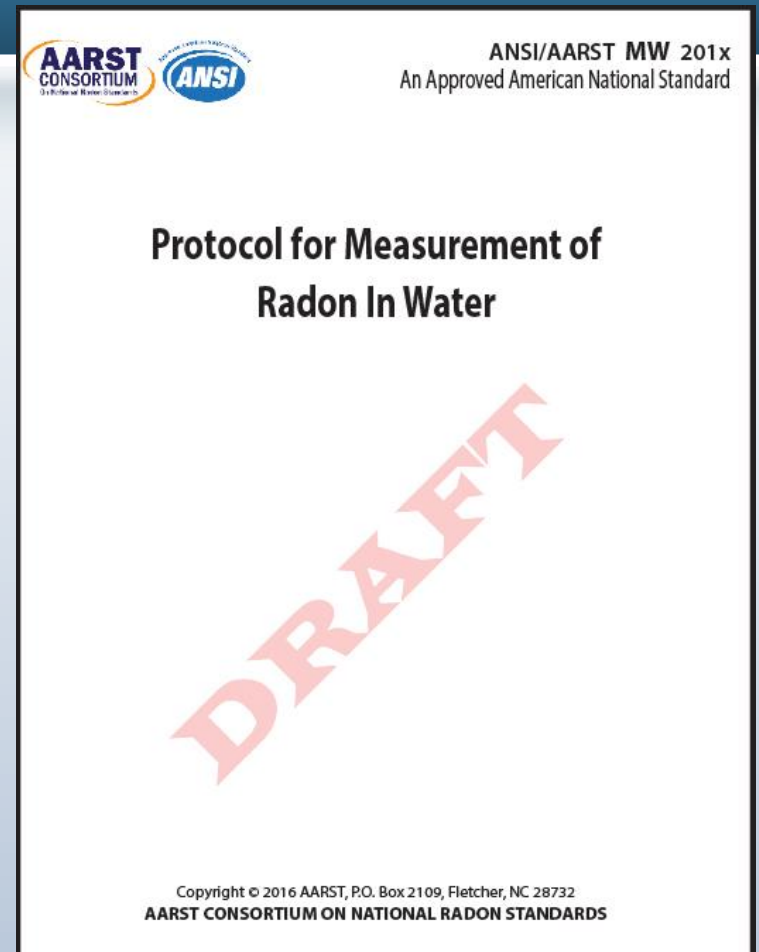


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# *MW (new)*

## *Protocol for Measurement of Radon in Water*

- ◆ Active workgroup now reviewing an initial draft that encompasses all aspects of current practice.
  - Sampling
  - Lab procedures
  - National reference





# *MITIGATION*

# *RMS-MF 2014*

## *Mitigation Standards for Multifamily Buildings*

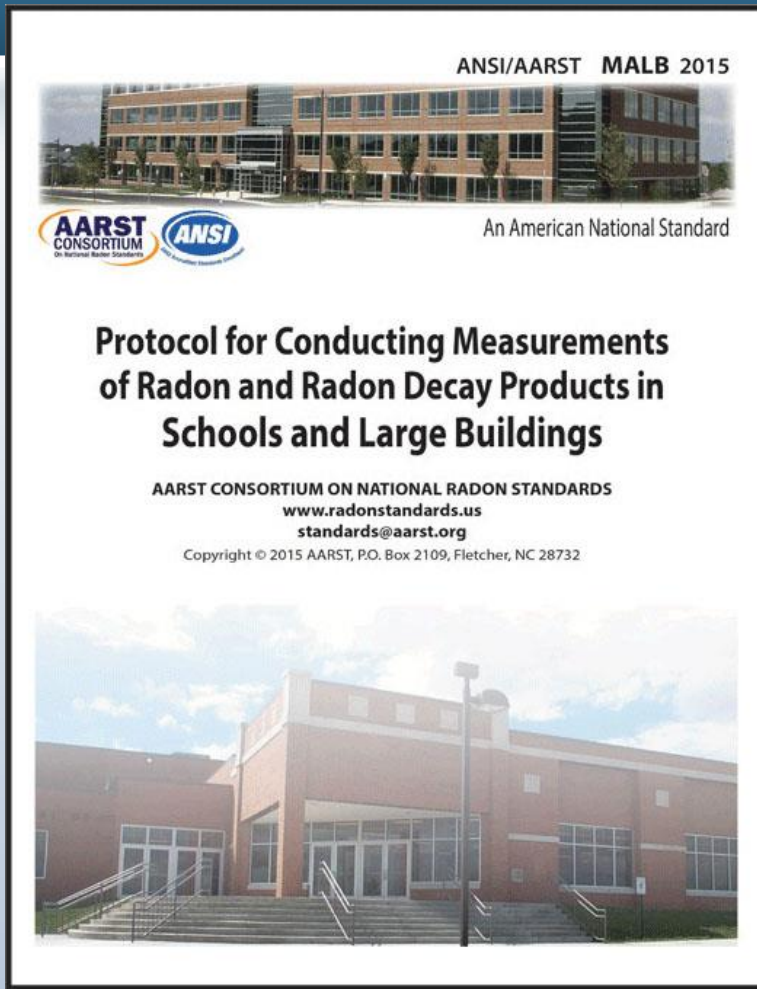
ANSI/AARST RMS-MF (P5) - 2013



- ◆ Expands beyond older standards to address more complicated buildings and situations.
- ◆ Expands to cover larger buildings .... and all mitigation methods.

# *RMS-LB 2014*

## *Mitigation Standards for Schools and Large Buildings*



- ◆ Like RMS-MF, expands to complicated buildings and situations
- ◆ Contains more explicit detail on evaluations prior to design of mitigation systems



# Examples of tough issues tackled

## ◆ Quality Management required during installations



### Radon Mitigation Standards for Multifamily Buildings

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4.0 Quality management systems	Summary Of The Quality Plan & Control
4.2.1 Documented procedures	<ul style="list-style-type: none"> <li>Procedures (each juncture that may warrant written procedures). <i>Normally each important stage of installation would be broken out with a process or procedure that matched the quality goals.</i></li> <li>Interaction between the processes; and</li> <li>Control of documents and records (to include approvals, reviews, updates, distribution and storage).</li> </ul>
	<p>At a minimum, procedures should include recording conditions found and resulting "as installed" condition or configuration for:</p> <ul style="list-style-type: none"> <li>Each ASD suction point (See Section 7.1);</li> <li>ASD Pipe materials (See Section 7.2);</li> <li>ASD Pipe sizing (See Section 7.3);</li> <li>ASD Exhaust Discharge (See Section 7.4);</li> <li>ASD Fan and model installed (See Section 7.5);</li> <li>Sealing (Sections 8.1-8.4), Sump (Section 8.5), Membranes (Section 8.6), Drains (Section 8.7), and Sealed Assemblies (Section 8.8);</li> <li>Fan Monitors (See Section 9.2);</li> <li>Electrical (See Section 9.3);</li> <li>Labeling (See Section 9.4);</li> <li>Non-ASD Methods - <i>in detail</i> (See Section 10.0);</li> <li>Post install functional inspection (See Section 11.1);</li> <li>Post mitigation retests (See Section 11.2);</li> <li>Long-Term OM&amp;M Plans - <i>in detail</i> (See Section 12);</li> <li>Health and Safety - <i>in detail</i> (See Section 13);</li> </ul>
5.0 "Management Responsibility" (Top Management Personnel)	Develop and implement a quality management system and continually improving its effectiveness by
5.1 Management commitment	<ul style="list-style-type: none"> <li>communicating to the organization,</li> <li>conducting reviews, and</li> <li>ensuring the availability of resources.</li> </ul>
5.2 Customer focus	Ensure that customer requirements are determined and are met.

# Examples of tough issues tackled

## ◆ Requirements for long-term operation, maintenance and monitoring plans (OM&M)



### Radon Mitigation Standards for Multifamily Buildings

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Table 12.1.3 Operation, Maintenance and Monitoring		
Controls and Mechanical System Monitors	Maintenance Inspections	Frequency of Inspection
<p><b>12.1.3.1 Document Startup Details:</b> A description shall be provided for the fan monitors, control settings and other operating parameters that existed at the time successful mitigation was initially achieved. 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 for system performance, 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 Client(s) to take if fan monitor devices or other inspection procedures indicate the system(s) are not operating as designed.</li> <li>e) Documented measurements for balance of airflow in and airflow out of HVAC system(s) when HVAC is a component of a mitigation system.</li> </ul>	<p>The O&amp;M plan provided shall observe that routine inspections of controls and monitors are a minimum obligation and required component of the Long-term Risk Management Plan. The following inspections shall be written into the O&amp;M 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 the system(s) 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 for the system(s).</li> <li>c) Maintenance of records assimilated into the overall building O&amp;M documentation.</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 contractor as appropriate to the situation.</p> <p>It is recommended that the plan stipulate these inspections be conducted at least quarterly and 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>
Mechanical Equipment	Mechanical Equipment Inspections	Frequency of Inspection
<p><b>12.1.3.2 Include 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) Documentations should include exact locations of fans, electrical disconnects and other components.</li> <li>c) Include a list of appropriate actions for the Client(s) to take if the fan monitor warning device indicates system degradation or failure. A list of potential repair items for ASD systems 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;</li> <li>iv. Sealing of foundation openings to soil or piping connections.</li> </ul> </li> </ul>	<p>The O&amp;M plan provided shall observe that mechanical equipment inspections should include all seals, straps, fasteners, electrical system (including switch operation), boots, performance indicators, labels, pipe condition, and fan operation.</p> <p>If applicable, airflow in and airflow out of HVAC system(s) and duct balance should be checked to ensure that no significant changes have occurred. Examples of checks are:</p> <ul style="list-style-type: none"> <li>i. Room differential pressure test;</li> <li>ii. Fresh-air damper settings;</li> <li>iii. HVAC filters, and;</li> <li>iv. Verification for supply air into rooms of interest.</li> </ul>	<p>The plan shall stipulate that a detailed inspection of all components are to be conducted every 2 years by a qualified professional.</p>
12.1.3.3 Monitor Radon Concentrations - Retests	Frequency of Retests	
Continued follow-up verification for mitigated areas:	A retest of mitigated areas shall be conducted at least every 2 years, or more often if desired.	
Continued follow-up verification for the building:	A retest of the building shall be conducted at least every 5 years, or more often if desired.	

# *SGM-SF (new)*

## *Mitigation Standards for Existing Homes.*



ANSI/AARST SGM-SF 201x

### Soil Gas Mitigation Standards for Existing Homes

**PROPOSED  
STANDARD**

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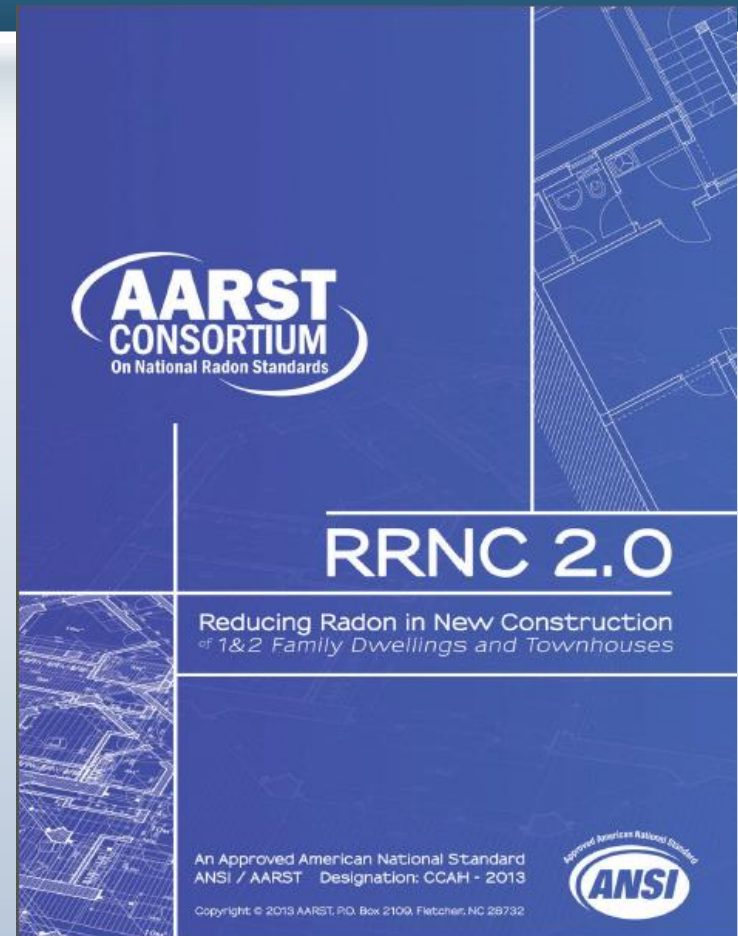
- ◆ Complete re-evaluation on all mitigation details for homes
- ◆ Expands to include all mitigation methods
- ◆ Expands to include needs when mitigating chemical vapor intrusion



# *CCAH (or RRNC 2.0) 2013*

## *Construction Standards for New Homes.*

- ◆ Rendered in code style format, CCAH provides specifications that are simple and clear.

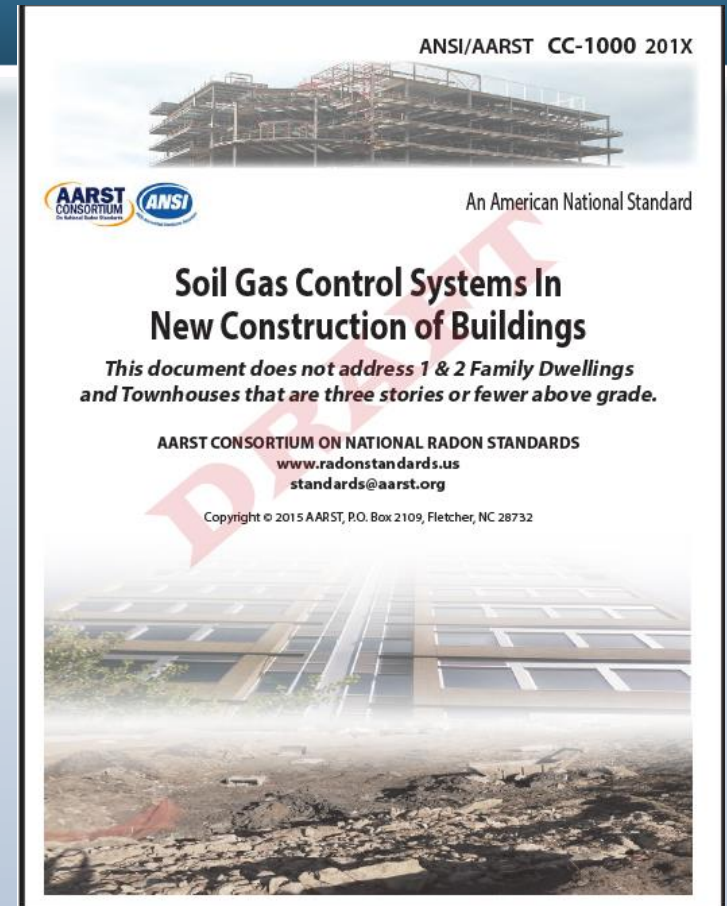




# **CC-1000** (new)

## *Soil Gas Control Systems in New Construction of Buildings*




- ◆ Buildings that are not single family homes
  - ◆ Multifamily
  - ◆ Schools
  - ◆ Commercial



# Examples of tough issues tackled

## ◆ What is a Gas Permeable Layer (new construction)

Range of Hydraulic Conductivity of Natural Soils			
USCS class	Soil Type	Hydraulic Conductivity Range gallons per day/ft <sup>2</sup>	Permeability description
GP	Uniform gravel	4,000 to 20,000	High
GW	Well-graded gravel	1,000 to 6,000	Moderate to high
SP	Uniform sand	100 to 4,000	Moderate to high
SW	Well-graded sand	20 to 2,000	Low to moderate
SM	Silty sand	20 to 100	Low
SC	Clayey sand	20 to 20	Low to very low
ML	Silt	1 to 2	Very low
CL	Clay	0.02 to 0.2	Very low to impermeable

MAJOR DIVISIONS					
COARSE-GRAINED SOILS OVER 50% > No.200 SIEVE SIZE	GRAVELS	SP	Uniform sand	1	
		SW	Well-graded sand		
	SANDS	SM	Silty sand		
		SC	Clayey sand		
		ML	Silt		
		CL	Clay		
FINE-GRAINED SOILS OVER 50% < No.200 SIEVE SIZE	SILTS & CLAYS	LIQUID LIMIT 50% OR LESS	SM		Silty sand, sand-silt mixtures
			SC		Clayey sands, sand-clay mixtures
			ML		Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			CL		Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
	SILTS & CLAYS	LIQUID LIMIT GREATER THAN 50%	OL		Organic silts and organic silty clays of low plasticity
			MH		Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
			CH		Inorganic clays of high plasticity, fat clays
			OH		Organic clays of medium to high plasticity, organic silty clays, organic silts
			HIGHLY ORGANIC SOILS		PT



## The Big Picture

- ◆ Experience in over 100,000 buildings is brought to each standards committee.
- ◆ Diverse vantage points are built into committee composition and voting rights. Public review expands openness to even more diverse points of view.



# The Big Picture

- ◆ Our collective experience is being put to use.
- ◆ Responsible standards provide a stronger and wider foundation for all to stand on.
- ◆ Tools for state, federal and other partners for use in protecting the public from preventable radon induced cancer.

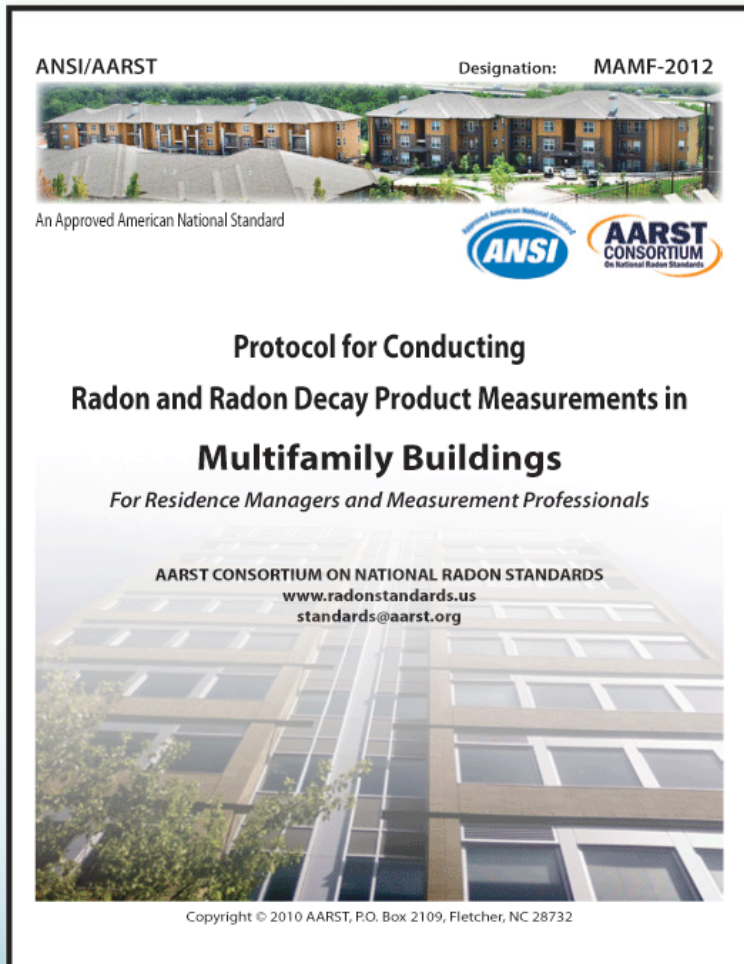




# The Big Picture

- ◆ Are they perfect? **NEVER.**
- ◆ Nobody on earth knows every side of these many coins.
- ◆ *But they're good*
- ◆ Do we have requirements and procedures to improve them?  
**YES.**

# Multifamily Testing



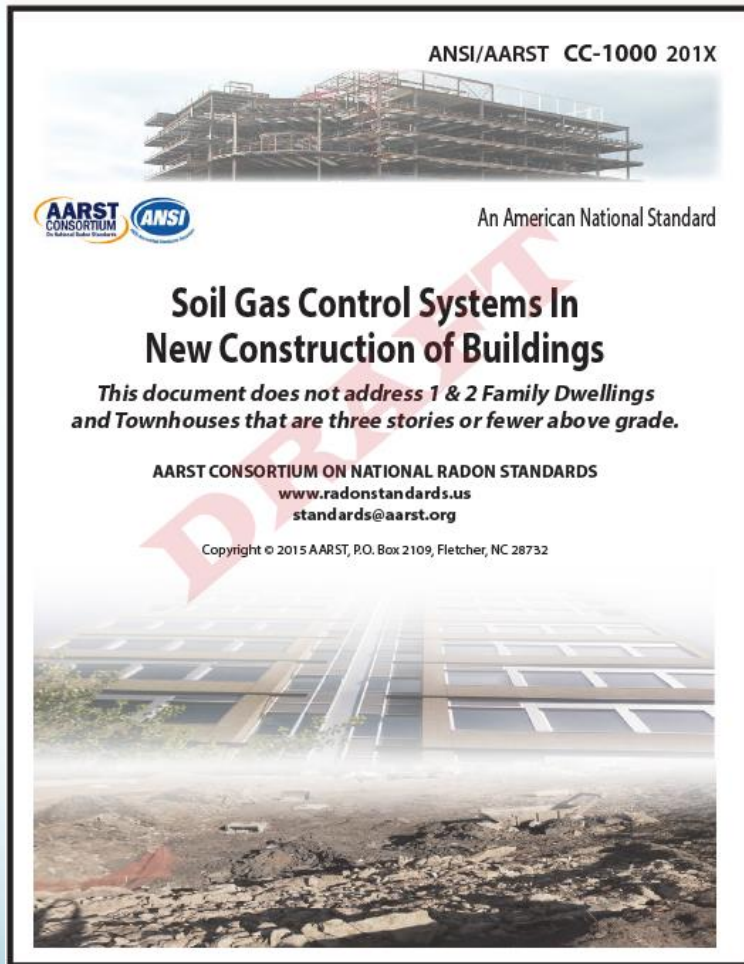
## Status report

- ◆ Scheduled 5 year Review
- ◆ Public Review will be open for comment until Nov 7

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Accounting for changes in the market and experience over the last 5 years

# CC-1000: New Construction

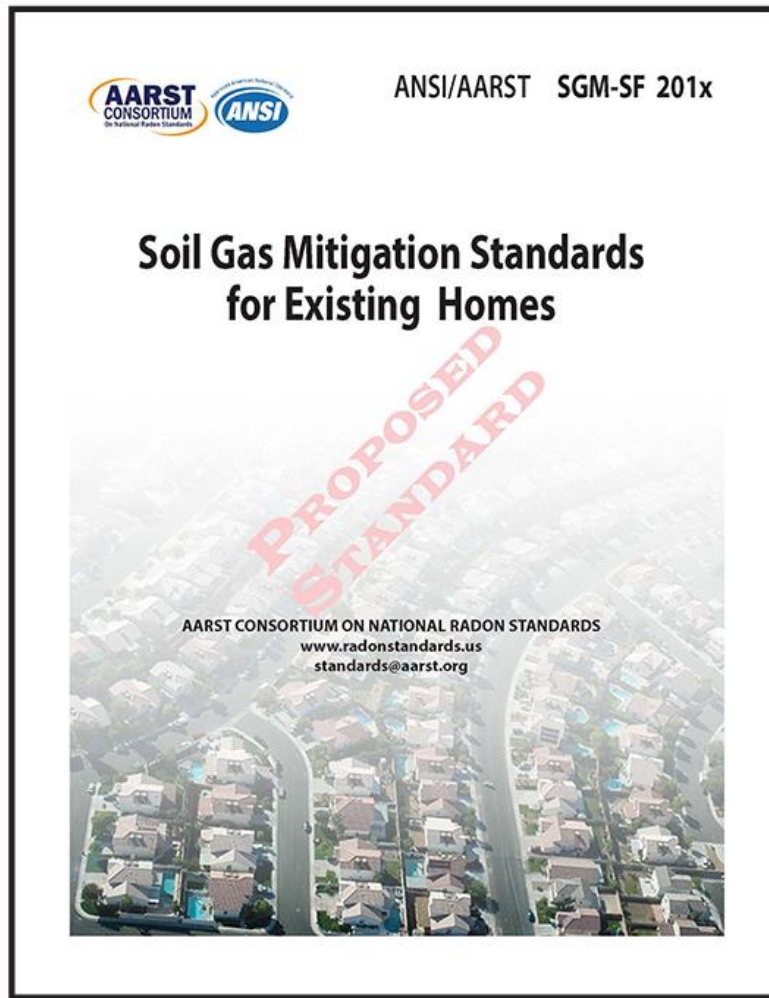


## Status report

- ◆ 1<sup>st</sup> Public Review underway as we speak.
- ◆ Comment period is open from Sept. 16-Oct. 31

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# SGM-SF: Mitigation of Existing Homes

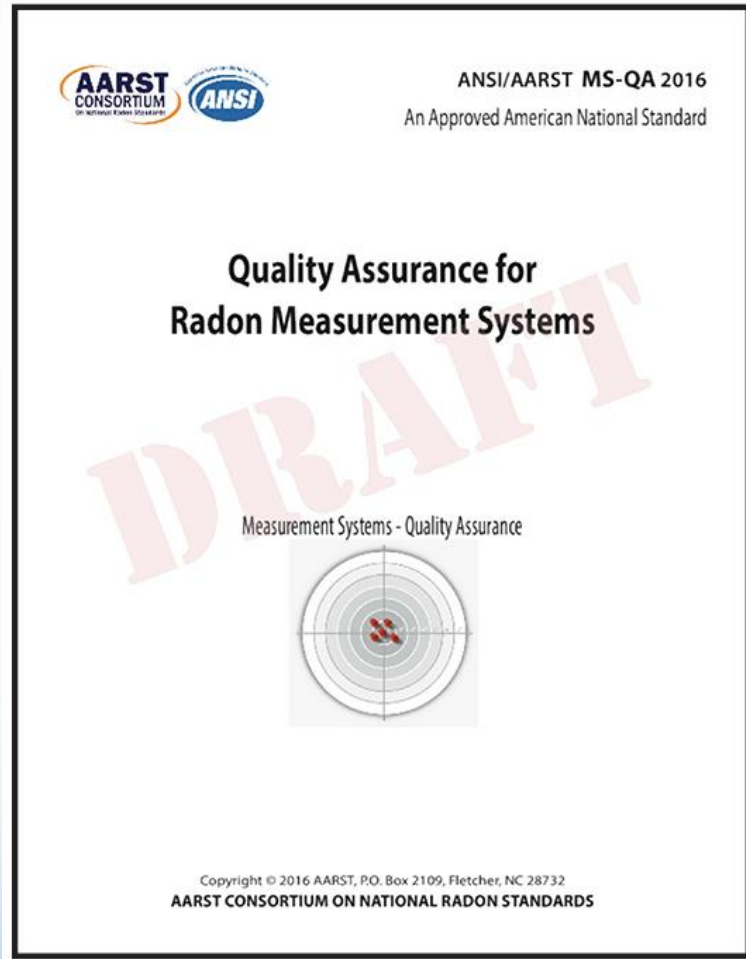


## Status report

- ◆ 2<sup>nd</sup> Public review period has concluded
- ◆ Now we review and *resolve* those comments that might warrant substantive change



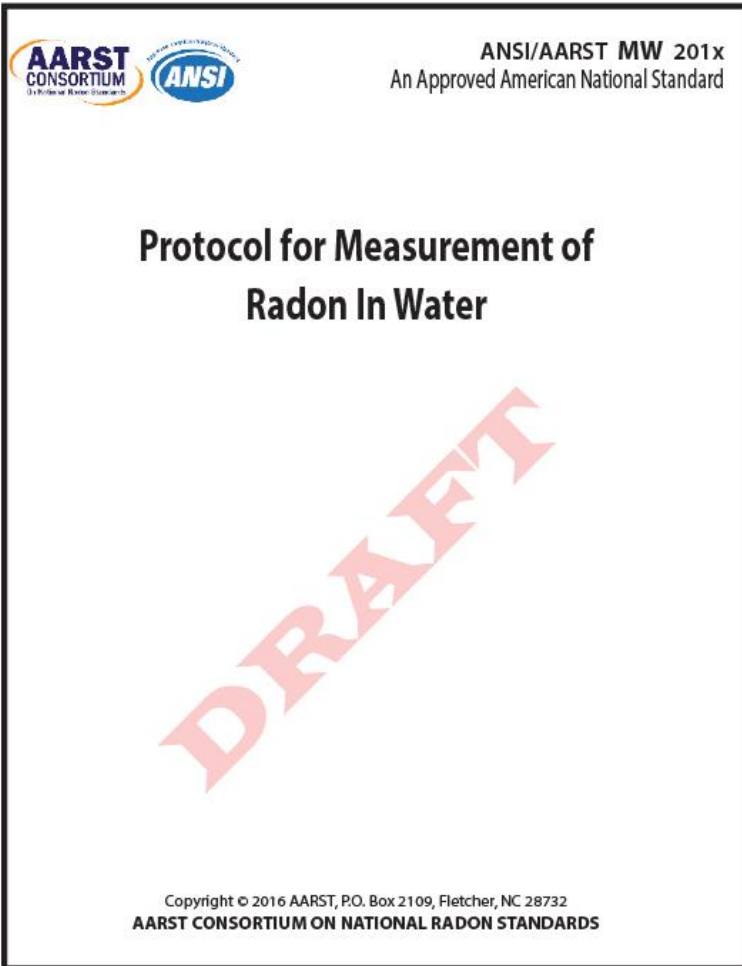
# MS-QA: Testing Quality Assurance



## Status report

- ◆ Several more months before it's 1<sup>st</sup> public review
- ◆ A great group of PHD's and other idiots. (Many MS-PC volunteers showed up)

# Radon In Water



## Status report

- ◆ Eyes are set on mid-2017 for it's 1<sup>st</sup> public review
- ◆ Draft content is excellent
- ◆ Formal ANSI processes and announcements have not yet begun.

# Active Projects This Year



<b>SGM-SF</b>	Mitigation of Existing Homes
<b>CC-1000</b>	New Construction Bigger Bldgs
<b>MAMF</b>	Scheduled update
<b>MS-QA</b>	Quality Assurance
<b>MW</b>	Water measurement

# ANSI/AARST Standards

Focus	Topic	Standards	Older
<b>Radon Measurement</b>	1 Homes	MAH <b>2014</b> (AARST/ANSI)	EPA 1993
	2 Multifamily	MAMF <b>2012</b> (AARST/ANSI)	--- none ---
	3 Schools-Large Buildings	MALB <b>2014</b> (AARST/ANSI)	--- none ---
	4 Measurement System Performance	MS-PC <b>2015</b> (AARST/ANSI)	EPA 1992
	Quality Assurance	MS-QA <b>201X</b> (AARST/ANSI)	EPA 1996
	Measurements in Water	MW <b>201X</b> (AARST/ANSI)	--- none ---



# ANSI/AARST Standards

Focus	Topic	Standards	Older
<b>New Construction</b>	5 Homes	CCAH <b>2013</b> (AARST/ANSI)	EPA 1992 E1465
	Large Buildings	CC-1000 <b>201X</b> (AARST/ANSI)	--- none ---
<b>Mitigation</b>	Homes	SGM-SF <b>201X</b> (AARST/ANSI)	EPA 1994 E2121
	6 Multifamily	RMS-MF <b>2014</b> (AARST/ANSI)	--- none ---
	7 Schools-Large Buildings	RMS-LB <b>2014</b> (AARST/ANSI)	EPA 1994 Guidance
	Water	<i>After water measurement standards are established</i>	--- none ---

# ANSI/AARST Standards

- Like radon policy coalitions that work on legislation:
  - Nobody can push these balls forward alone.
- If you concerns or feel you can contribute, get involved.

# Chairs gave countless hours

◆ Trudy Smith	<i>MAMF</i>
◆ John Mallon	<i>RMS-MF</i>
◆ Dave Kapturowski	<i>CAAH and SGM-SF</i>
◆ Dr. Darioush Ghahremani	<i>MALB</i>
◆ Dr. Phil Jenkins	<i>MS-PC</i>
◆ Melinda Ronca-Battista	<i>MS-PC and MS-QA</i>
◆ Shawn Price	<i>MAH and MAMF</i>
◆ Dallas Jones	<i>CC-1000</i>
◆ Dr. Mike Kitto	<i>Water Measurement</i>
◆ Bill Brodhead	<i>ASD-RMS &amp; E2121 Harmonization</i>
◆ Jack Hughes	<i>Effort on E2121 Harmonization</i>

# Standards Update



Failure modes

Long term Risk Management Plans

Codes?

Consensus

Linear thresholds

Pipe size

Coalitions

Equilibrium Ratio

Discharge at ground

Electrical loads

Unattached working level

John, Phil, John, ... , Billy, Shawn:

ASHRAE and NACHC

Torricelli, Torricelli

CRPDP?