U.S. Housing and Urban Development Multifamily Accelerated Processing (MAP) Guide Industry Briefing, Radon

Questions?

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- Send questions to Host, Presenter, and Panelists
- Questions will be answered during the final portion webinar
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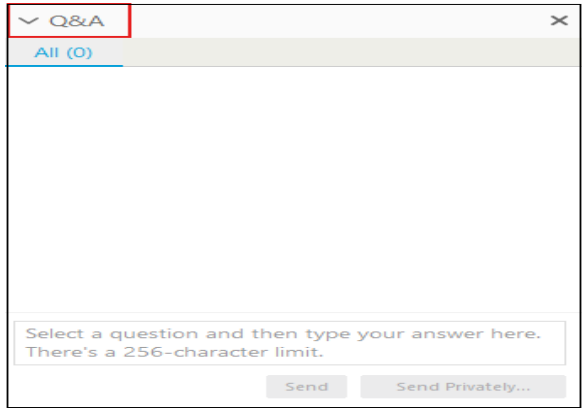
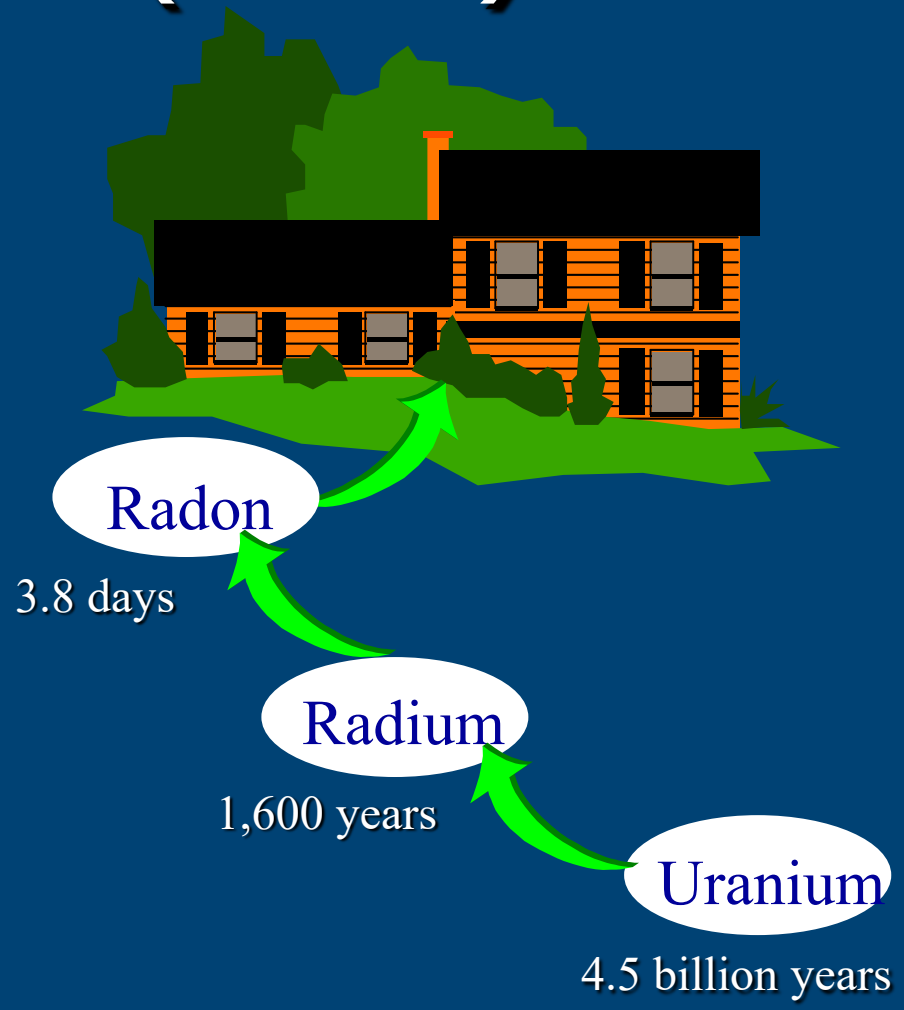


Today's HUD Presenters

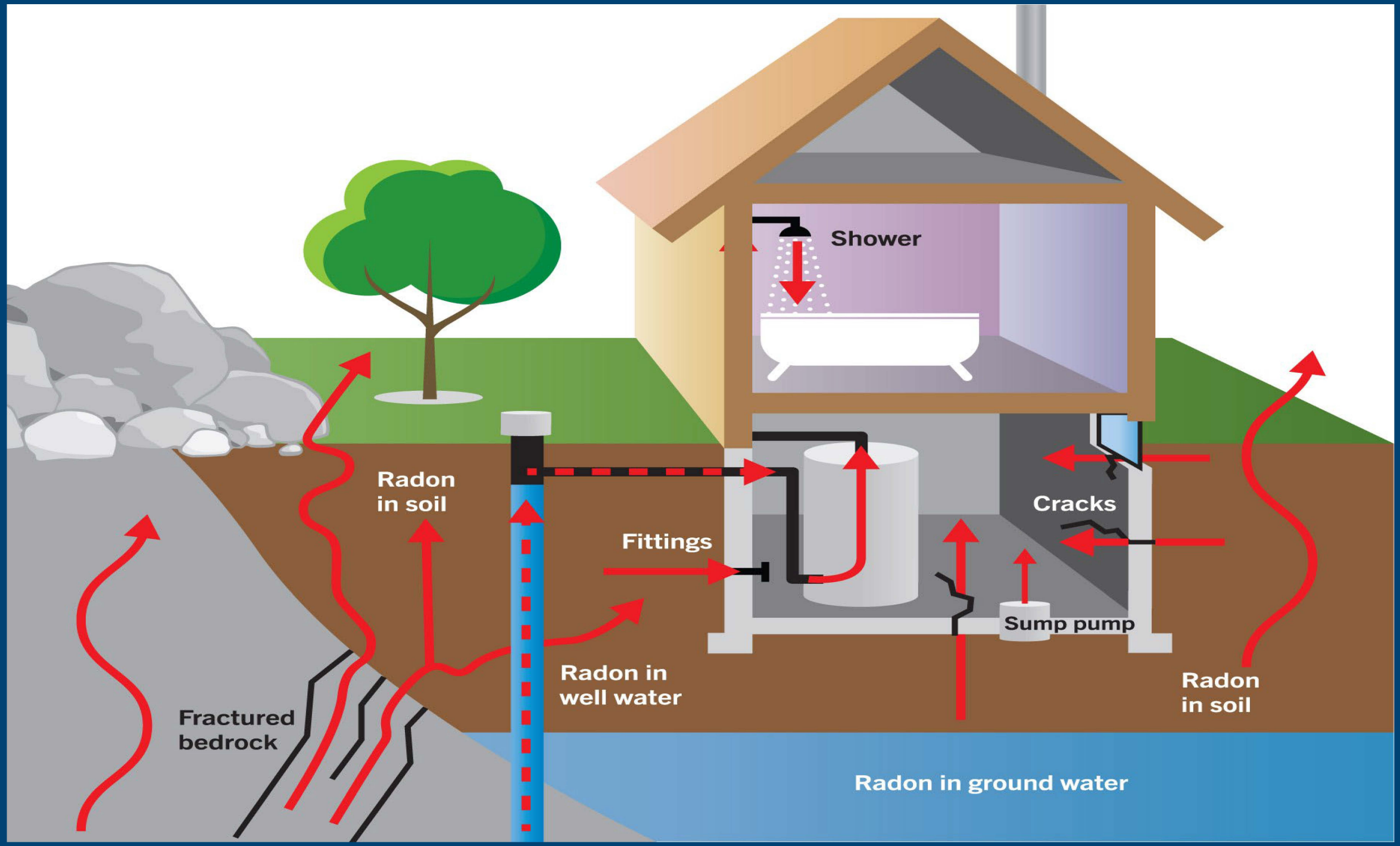
- Sara Jensen, Housing Program Environmental Clearance Officer
- Dr. Peter Ashley, Director, Policy and Standards Division, Office of Lead Hazard Control and Healthy Homes
- Kyle Hoylman, Chair of the ANSI/AARST Executive Stakeholder Committee
- *Q&A*

Radon

What Is Radon –222 (radon)?

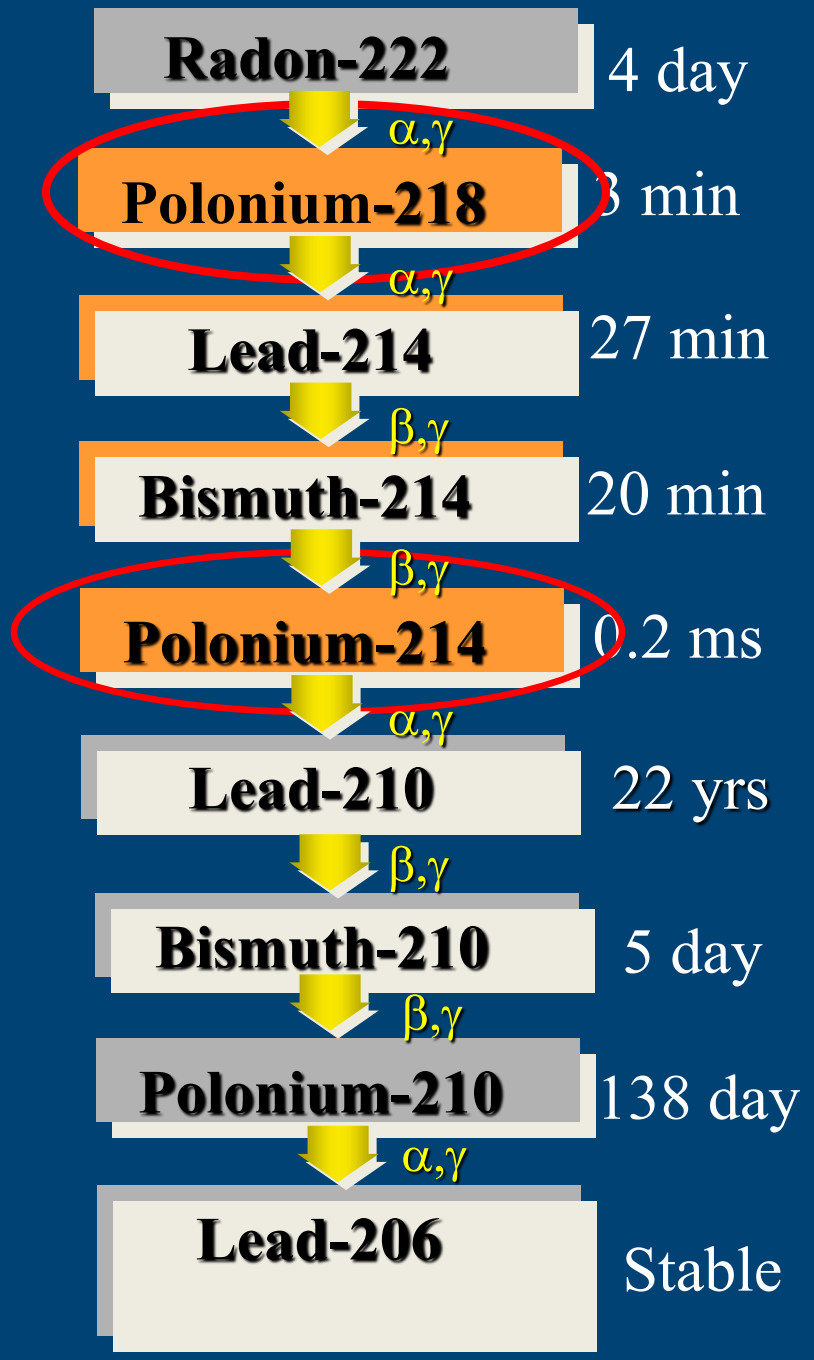


- *Radon is a gas*
- *It is naturally occurring*
- *You cannot see or smell it*
- *It enters buildings primarily from the soil*

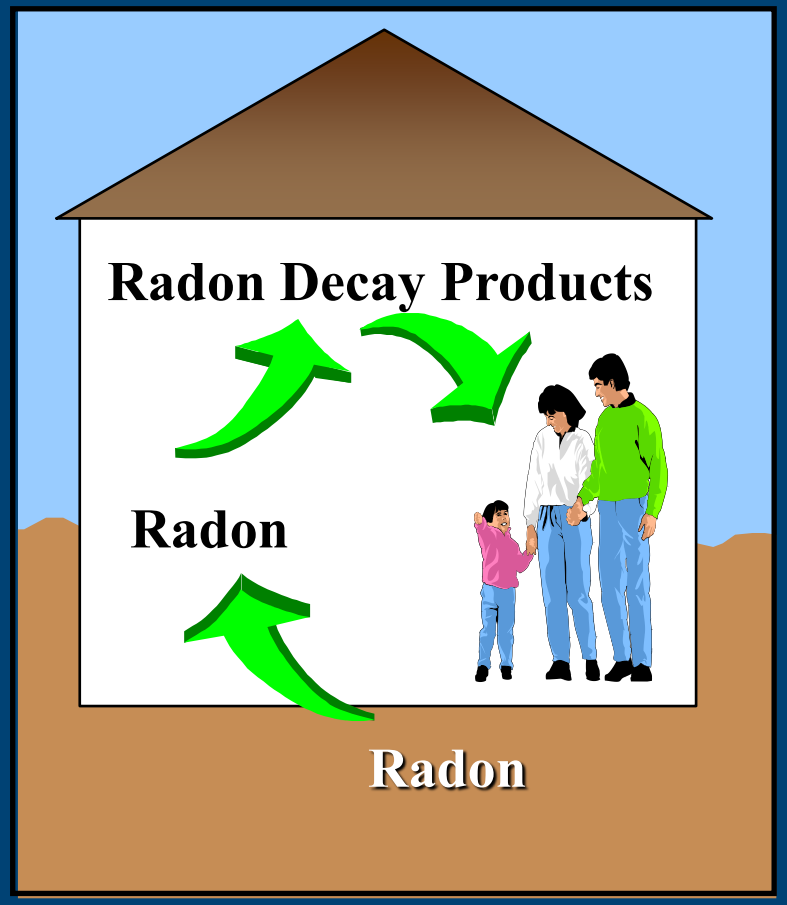

Shower
Radon
in soil
Fittings
Cracks
Sump pump
Radon in
well water
Radon
in soil
Fractured
bedrock
Radon in ground water

Radon Decay Products

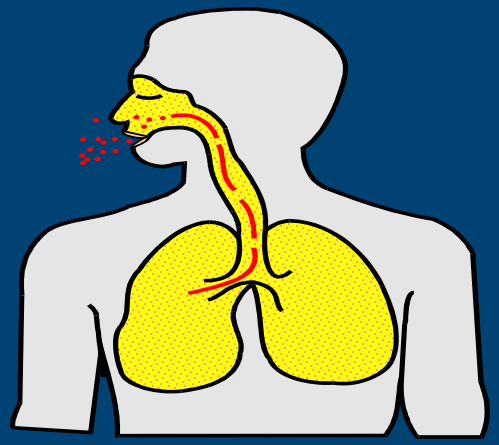
Po-218 and Po-214 deliver the majority of radiation dose to the lung.



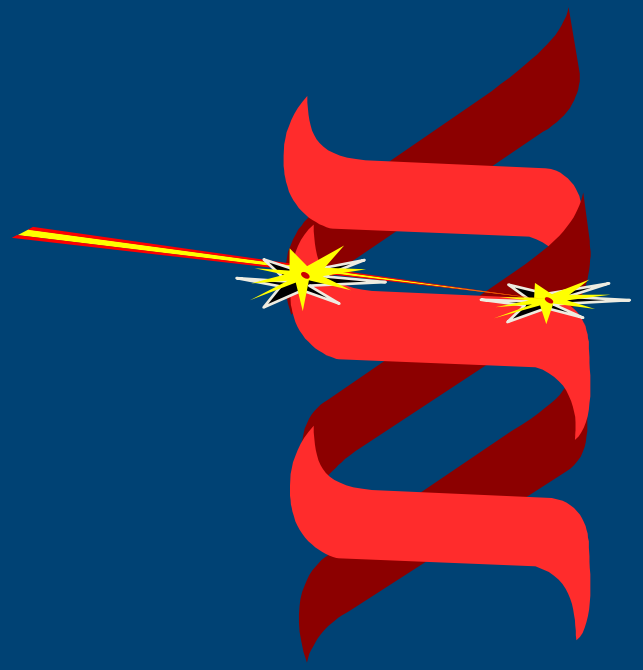
Why are radon decay products a health concern?



These particles are easily inhaled and deposited in the lungs where they can damage sensitive lung tissue.



What Happens When Radon Decay Products Are Inhaled ?



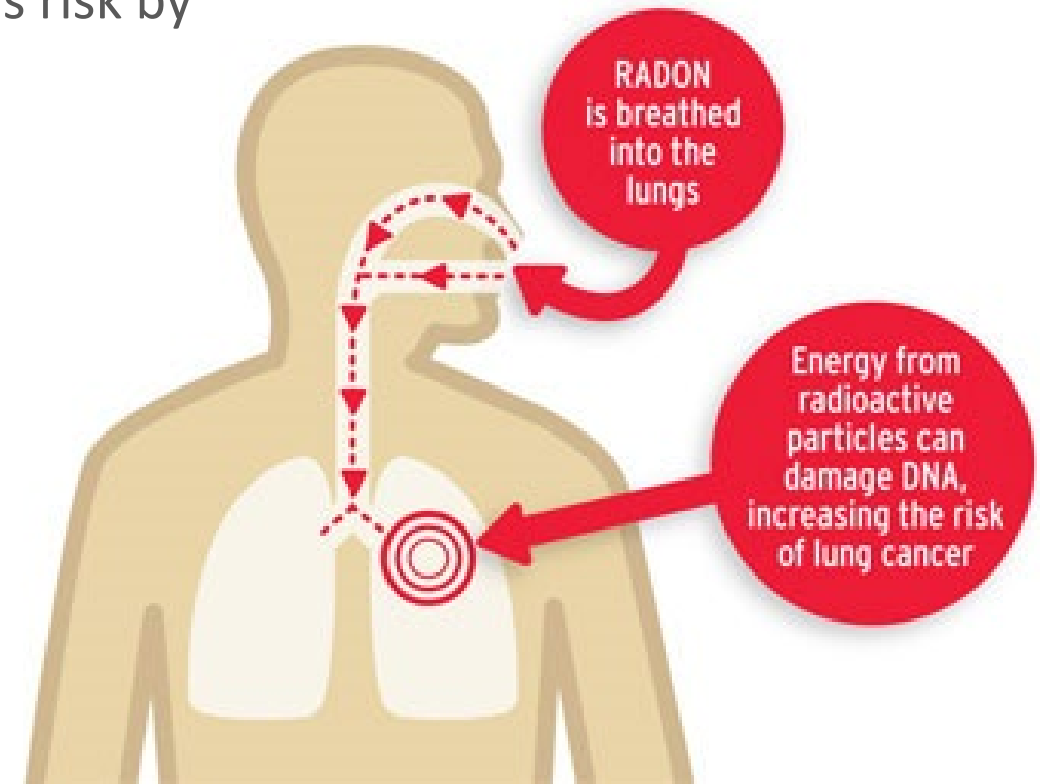
Double Strand Breaks

- Highly radioactive particles adhere to lung tissue, where they can irradiate sensitive cells.
- Radiation can alter the cells, increasing the potential for cancer.

Background

Risk factors:

- Concentration (radon level)
- Length of exposure (time in building)
- Smoking synergy – increases risk by factor of 8 to 10
- No level of exposure is safe



Background

- 21,000+ annual radon-induced lung cancer deaths in US
- Leading cause of lung cancer in non-smokers, second overall to smoking
- Leading environmental cause of cancer mortality

U.S. CANCER MORTALITY - 2008

CANCER TYPE	ESTIMATED DEATHS*
1. Lung and Bronchus	161,840
2. Colon and Rectum	49,960
3. Breast Cancer	40,930
4. Pancreas	32,290
5. Prostate	28,600
6. Leukemia	21,710
Radon-Induced Lung Cancer	21,000
7. Non-Hodgkin Lymphoma	19,160
8. Liver and Bile Duct	18,410
9 Ovary	15,520
10. Esophagus	12,280
11. Urinary Bladder	14,100
12. Kidney and Renal Pelvis	13,010
13. Stomach	10,880
14. Myeloma	10,690
15. Melanoma	8,420

* Adapted from Jemal, A et al (2008)

All Cause Estimated 2008 U.S. Cancer Mortality by Selected Cancer Types as Compared to Estimated Radon-Induced Lung Cancer Mortality.

KNOW YOUR NUMBER:

Understand your risk from elevated radon exposure

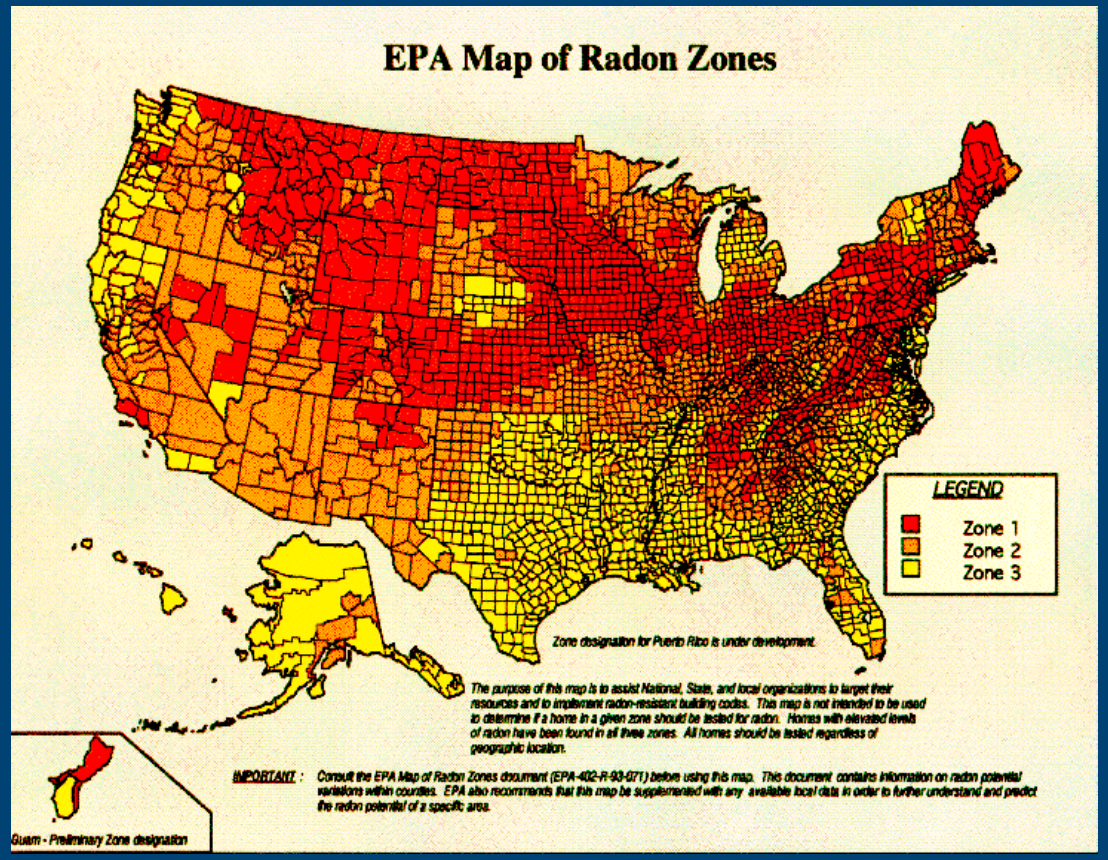
Radon Level 4.0 pCi/L	**Equals 200 chest x-rays per year OR 8 cigarettes per day. EPA Recommends: Fix your home.** 
Radon Level 8.0 pCi/L	**Equals 400 chest x-rays per year OR 16 cigarettes per day. EPA Recommends: Fix your home.**
Radon Level 20.0 pCi/L	**Equals 1,000 chest x-rays per year OR 40 cigarettes per day. EPA Recommends: Fix your home.** 

- U.S. EPA action level is 4.0 pCi/L

US Department of Health and Family Services. Public Health Service. *Toxicological Profile for Radon*. (1990).

The Distribution of Radon in the U.S.

U.S. Radon Potential



- Based on geology and surveys
- Expected closed building radon (pCi/L):
  - Zone 1: 4.0 and above
  - Zone 2: between 2.0 & 4.0
  - Zone 3: 2.0 and lower

EPA Radon Action Level 4 pCi/L

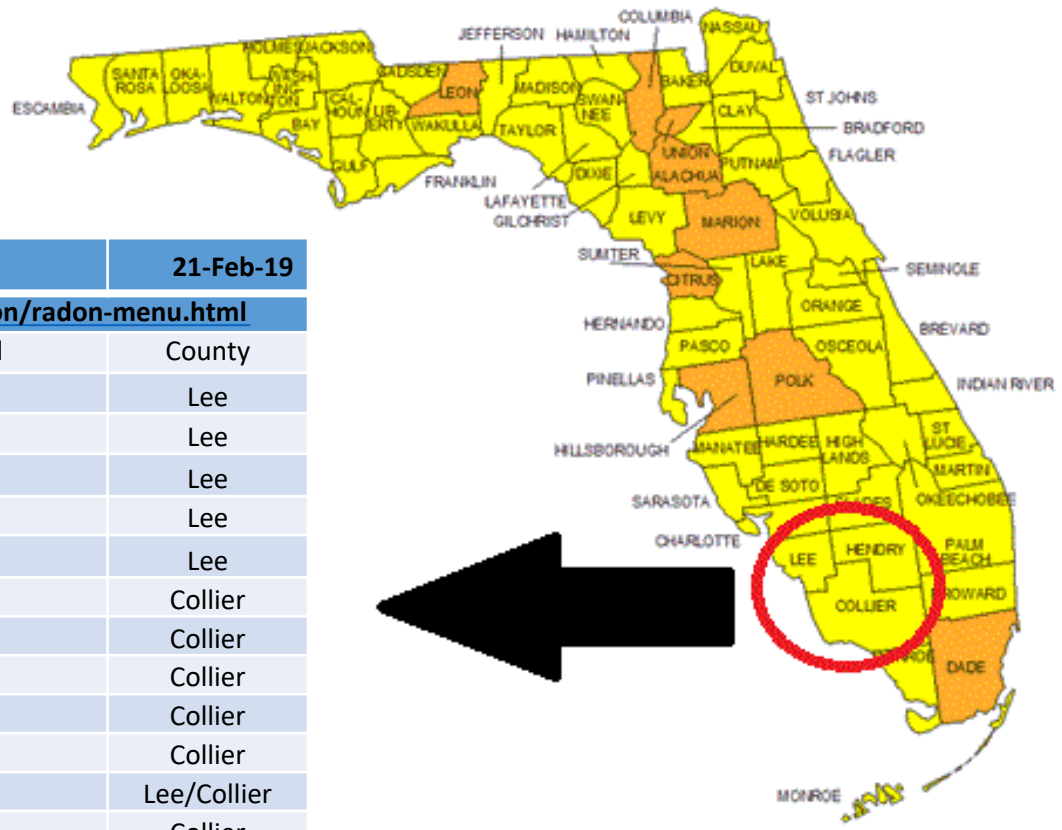
The Need to Conduct Radon Testing in Zone 3 of the EPA map:

- The EPA website indicates that: “The Map of Radon Zones should not be used to determine if individual homes need to be tested”

- This is consistent with HUD’s Healthcare FHA program (See Section 7.8 of the 232 Handbook)

Florida Radon Map

Radon Zip Code Data Results:			21-Feb-19
Source: http://www.floridahealth.gov/environmental-health/radon/radon-menu.html			
Zip	Measurements	% Elevated	County
33904	225	23.10%	Lee
33908	1925	41.10%	Lee
33919	521	28.20%	Lee
33967	273	16.80%	Lee
33990	156	26.90%	Lee
34104	1376	34%	Collier
34108	4728	27.10%	Collier
34109	3368	29.40%	Collier
34110	3713	29.50%	Collier
34112	1630	32.20%	Collier
34119	3993	24%	Lee/Collier
34120	1331	32.20%	Collier
34135	3737	27.90%	Lee



HUD-Funded Research on Radon Sampling Protocols in Multifamily Buildings: EARTH Study

EARTH Study: A 3-yr HUD funded research project to examine multifamily testing standards and protocols

Regulating Authority	2017 Radon testing protocol
Federal National Mortgage Assoc. (known as Fannie Mae)	10% of ground contact units
Federal Home Loan Mortgage Corp. (known as Freddie Mac)	10% of ground contact units
U.S. Department of Housing and Urban Development (HUD)	25% of ground contact units
ANSI-AARST MAMF Multifamily Buildings 2017	100% of ground contact units

NRPP-certified measurers and some states require 100% of ground-contact (GC) units be tested for radon

FINAL MULTIFAMILY STUDY DATA SET

- 152 Properties
- 29 U.S. States
- 687 Buildings
- 7892 Residential units
- 43% assisted living housing
- 86% “living room” measurements
- **Not necessarily representative of the nation**

Probability there are no units in the sample ≥4 pCi/L

Includes only buildings with at least one unit ≥ 4 pCi/L

		10% sampled	25% sampled	50% sampled	75% sampled	90% sampled
# Units	N	Probability %	Probability %	Probability %	Probability %	Probability%
05-06	45	58	34	19	4.7	0
07-08	71	55	36	15	4.6	0
09-10	40	63	36	22	7.5	3.3
11-12	37	52	42	21	8.4	2.8
13-14	14	48	31	17	6.7	2.0
15-16	20	46	32	15	5.0	1.3
17-18	15	65	42	22	8.1	1.9
19-20	12	70	47	24	9.2	2.6
21-26	22	52	32	16	5.4	1.8
27-77	13	56	39	23	10.9	3.7

N= # of buildings

Conclusions

- A 3-year study of radon levels in multifamily housing has shown that 2017 federal radon-testing protocols were insufficient to effectively safeguard occupants

- Study included 687 buildings containing 7892 residential units, of which 85% of measured units had radon <4 pCi/L and ~ 50% of buildings had all units <4 pCi/L

- For all building sizes, 2-3% of units with radon ≥4 pCi/L would still not be identified when 90% of the units are measured, so a measurement frequency greater than 90% is needed

- The study investigators conclude that federal radon testing protocols in effect in 2017 for multifamily buildings (25% of ground contact units) are inadequate to identify units containing radon ≥4 pCi/L

Acknowledgements

Thank you to the following individuals for providing content for this section:

- Dr. Bill Field (University of Kansas)
- Kyle Hoylman
- Dr. Michael Kitto (N.Y. State Dept. of Health)

MAP 9.6.3
2020

Section 9.6.3.2.A Radon Report

MAP Requirement

- Radon report includes results of testing, details, and timing of mitigation. Signed by radon professional, follows appropriate standard.
- For existing buildings, radon report submitted at pre-application/application.
- For new construction, or substantial rehab or conversion where early testing is not feasible, radon report submitted at **final completion inspection.**

Discussion

- Phased new construction projects. HUD will require the radon report at final completion inspection of the final project phase. For intermediate project phases, HUD will accept the Pressure Field Extension Evaluation results (required under CC-1000) for each building in lieu of the radon report.

Section 9.6.3.2.A.2 Radon Report

MAP Requirement

- New Construction -- Application must include the radon mitigation system in the architectural plans. HUD relies on the Project Architect but encourages the architect to seek technical advice from a radon professional if needed or if required by the relevant standard.

Discussion

- Any needed post-construction radon mitigation MUST be complete before final endorsement.
- Upcoming standards harmonization – CC-1000 to require qualified mitigation professional to supervise design, installation, and PFE evaluation ~Q2/Q3 2021.

Section 9.6.3.2.B Radon Professional

MAP Requirement

- Radon Certification/License from NRPP or NRSB AND state if applicable
- Radon testing of existing properties, post-construction testing, and any mitigation required as a result of this testing must be performed by, or under the direct supervision of, a Radon Professional

Discussion

- MAP Guide versus state laws / regulations
- Accessibility options for COVID within the MAMF standard

COVID and the MAMF Standard

Challenge

- Building access during COVID pandemic for radon measurement

Solution

- Section 2.1.5.1 of MAMF and Section 9.6.3.2.B.1 of the MAP Guide requires direct onsite supervision by the qualified radon professional (QRP)

HOWEVER

- Section 2.1.5.2 of MAMF provides guidance for utilizing non-qualified persons for radon measurement under QRP supervision
  - may assist in the placement and retrieval of devices
  - names and qualifications recorded in project QC documentation
  - work plan assigning tasks and worker training

COVID and the MAMF Standard

In Practice

- QRP develops testing and QA plan for project
- QRP provides training on device deployment and retrieval to non-qualified persons – training log and project QC documentation updated
- QRP is onsite to provide direct supervision of device deployment and retrieval
- QRP logs devices and maintains chain of custody to lab
- QRP reviews laboratory results and develops measurement report

Notes

- Practice of utilizing non-qualified personnel is not permitted unless the QRP provides direct onsite supervision
- Verify approach meets applicable state laws / regulations

Section 9.6.3.2.C Exceptions to Radon Report

MAP Requirement (new)

- Removes exception to radon testing requirements for 223(f) projects in EPA Radon Zone 3
- Radon professional may conclude testing/mitigation not required based on exceptions laid out in relevant state or ANSI-AARST radon standard
- A radon report encouraged but not required for 223(a)(7) applications

Discussion

- Measurement and mitigation exceptions applicable to 9.6.3.2.C

Section 9.6.3.2.C Exceptions to Radon Report

Measurement Exceptions – Examples

- Testing completed within 1 year of application submission
- Properties with current OM+M program compliant with RMS-MF
- Wood frame construction on raised open air foundation (no ground contact)

New Construction Exceptions – Examples

- Fully ventilated garage meeting requirements of Section 4.8 of CC-1000
  - compliance with ANSI/ASHRAE 62.1, Sections 5.15 and 6.5 for ventilation and pressurization of enclosed spaces surrounding garage

Notes

- Exceptions must be documented in writing by QRP and reference applicable section of the reference standard

Section 9.6.3.2.D Testing Protocols

MAP Requirement (new)

- Eliminates the 25% sampling exception and requires 100% ground floor testing and 10% upper floor testing per the ANSI-AARST MAMF standard

Discussion

- NY State Department of Health "EARTH" Study found that 25% sampling results in 34 – 47% chance of missing elevated radon units
- Change protects residents
- Eliminates delay and confusion about requirement to resample 100% of ground floor units if any unit has elevated radon after 25% ground floor testing has been done

Section 9.6.3.2.D Testing Protocols

MAP Requirement

- Section 9.1.1.D of MAP Guide states that HUD requires the most recent edition in force or superseding document for all standards

Discussion

- Updated measurement standard – MAMF 2017 rev 3/2021
- Clarification of harmonization updates, occupied and non-occupied locations measurement, measurement results disagreement, and number of valid measurement results for building characterization

MAMF 2017 March 21 Revisions

Ongoing Harmonization (MAMF Sections 5.1.2 / 5.2)

- MAMF and MALB require a minimum measurement period of 48 hours
- Evaluation of occupied versus unoccupied concentrations permitted for non-residential areas as additional line of evidence relative to mitigation decisions

Occupied and Non-Occupied Locations (MAMF Section 3.0)

- Measurement is conducted in locations occupied or intended to be occupied at the time of the testing event
- Recommended that locations that may become occupied in the future are tested prior to such occupancy

Measurement Result – Disagreement (MAMF Section 7.2.2)

- When higher result is above the action level and 2X greater than lower result below action level – additional testing required unless proceeding with mitigation

MAMF 2017 March 21 Revisions

Quality Control – Number of Valid Results (MAMF Section 6.2)

- Recognizes extenuating factors and provides guidance for clearance of a building with invalid measurement results
- The building may be cleared when all locations in the building with a valid result of ≤ 2.0 and the number of invalid ground locations is ≤ than:

Table 6.2

Ground-contact Test Locations:	4-7	8-11	12-15	16-19	20 or more
Allowance:	1	2	3	4	5

- Proceeding with mitigation is also an option

Section 9.6.3.2.E Occupant Notification

MAP Requirement

- Occupants must be notified of testing as required in the MAMF standard
- Occupants must be informed both prior to and after mitigation activities
- Incoming occupants for new construction shall be informed of radon mitigation activities

Discussion

- No changes from 2016

Section 9.6.3.2.F Mitigation Standards

MAP Requirement

- MAP guide updates all cited radon standards
- Remember 9.1.1.D states that HUD requires the most recent edition in force or superseding document for all standards

Discussion

- Updated mitigation standard – RMS-MF 2018 rev 3/2021
- Harmonization includes chemical vapor intrusion – mitigation and OM+M
- Clarification of diagnostic testing and system design, active notification monitors, below roof exhaust points, electrical requirements, and post-mitigation functional evaluation

RMS-MF 2018 rev 3/2021

Diagnostic Testing, Building Investigation, System Design (RMS-MF Section 5.4-5.5)

- Investigation to identify building characteristics that may impact system design and effectiveness – conducted by QRP
- Diagnostic procedures may include PFE testing, pressure differential characterization, and diagnostic measurement – conducted to develop effective design
- For ASD design, PFE testing and analysis is required – like structures on same property may utilize same data
- A design diagram is required – details system routing and location of components and specifications, such as suction points, fans, and piping

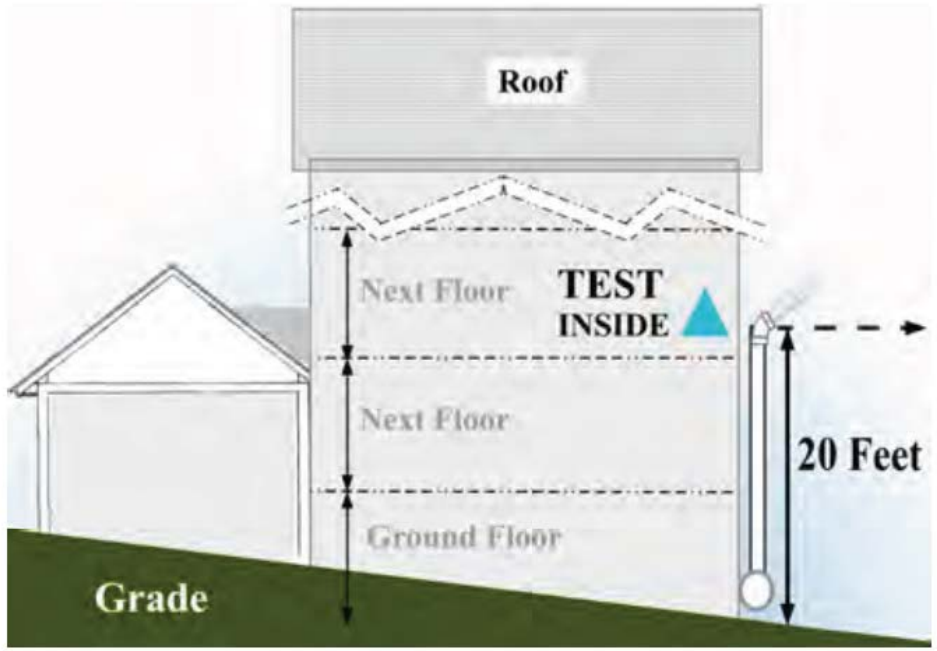
Active Notification Monitors (RMS-MF Section 8.2.2)

- Required – alerts occupants or responsible party of system failure
- Must include one of the following: audible, visual, or telemetric notification

RMS-MF 2018 rev 3/2021

Below Roof Exhaust Point (RMS-MF Section 6.4.11)

- Permitted to be below edge of roof – requires:
  - compliance with all other requirements of Section 6.4
  - justification for discharge recorded in OM+M documentation: inability to comply with 6.4 if located above edge of roof OR edge of roof ≥ 20-feet nearest to exhaust point
  - exhaust point ≥ 20-feet
  - occupiable locations must be tested that adjoin immediate exhaust point



RMS-MF 2018 rev 3/2021

Electrical Requirements (RMS-MF Section 8.3)

- Requirements include:
  - disconnect required to be located within 6-feet and line of sight of fan
  - when outdoors – conduit protection required, no plugged disconnect
  - may not be chased through system piping
  - for intentional collateral mitigation, electric must be metered independent of individual unit OR located on common building power source

RMS-MF 2018 rev 3/2021

Post-Mitigation Functional Evaluation (RMS-MF Section 9.1)

- QRP to complete compliance inspection detailed in Section 8.5
- Active ASD systems – record system operating pressure AND a minimum of 1 PFE measurement at a distance from each suction point to verify intended design
- Active non-ASD systems – measurements of flow, pressure, or other system parameters specific to methodology
- QRP to conduct short-term measurement in accordance with MAMF to verify system effectiveness (when exhaust point is below roof edge, additional test of adjoining location at point of exhaust is required)

Section 9.6.3.G Mitigation Timing

MAP Requirement

- For new construction and sub rehab, all mitigation reports, including follow-up testing and a certification of completion, must be submitted to HUD before final endorsement
- For 223(f)s, radon mitigation must be completed as quickly as practicable and no later than 12 months after closing

Discussion

- December 2020 MAP posting said final completion inspection—make sure to follow the March 18th updated version

Section 9.6.3.I Operations and Maintenance Plans

MAP Requirement (new)

- An operations, maintenance, and monitoring (OM+M) plan required under the appropriate ANSI-AARST standard for any mitigation project
- Also required when an existing active mitigation system present on the property

Discussion

- Condition to Firm requiring the borrower to operate and maintain as per the OM+M plan for duration of insured mortgage
- Final OM+M plan submitted to HUD after radon mitigation system installed
- OM+M requirements (RMS-MF Section 10.0)

Section 9.6.3.I Operations and Maintenance Plans

OM+M Program Plan Requirements (RMS-MF Section 10.0)

- QRP responsible for direct supervision of OM+M program
- OM+M program plans to include:
  - system design and specifications – fan specifications, system description and routing details, warranty information, service contact information
  - other information – measurement results, contracts and warranties, applicable building permits, estimated cost of operation
- Ongoing obligations include:
  - routine maintenance and inspections – quarterly system monitor (site personnel)
  - equipment inspection – ongoing mechanical inspections (QRP)
  - non-routing maintenance – as needed (QRP/site personnel)
  - monitoring (measurement) – 2-year for mitigation locations, 5-year for property (QRP)

Section 9.6.3.J Existing Mitigation Systems

MAP Requirement (new)

- All existing mitigation systems installed at the property must be evaluated to ensure that they function properly
- If applicable, corrective action must be taken by a qualified radon professional

Discussion

- Evaluate either against the standard under which the system was installed (if known and documented) or the current standard
- Defective systems (venting radon gas into units or outdoor areas of congregation) must be fixed
- No units over 4 pCi/L
- OM+M program plan required (RMS-MF)

Section 9.6.3.J Existing Mitigation Systems

Section 9.6.3.K Cost Estimates

MAP Requirement (updated)

- The lender must provide the cost estimate for radon mitigation into the overall construction cost and include ongoing OM+M costs

Discussion

- Mitigation design (RMS-MF Section 5.4-5.5) and firm budget required for closing
- OM+M budget (RMS-MF Section 10.0) for the duration of the insured mortgage required for closing

Section 9.6.3.3 Requirements for 223(f)

MAP Requirement

- All 223(f) projects must be tested for radon (unless CENST and these encouraged)
- Testing must be performed no earlier than one year prior to application submission
- Exception—applicant may proceed directly to mitigation without prior testing

Discussion

- Report date – anchor for determining 1-year application submission compliance

Section 9.6.3.4 Requirements for Sub Rehab and Conversion

MAP Requirement

- All substantial rehab and conversion projects must test for radon
- Early testing may not be feasible

Discussion

- Clarification of determining early testing feasibility and MAP Guide options for completing sub-rehab and conversion projects

Section 9.6.3.4 Requirements for Sub Rehab and Conversion

Early Testing Feasibility – Determination (MAP 9.6.3.4.B)

- Early testing is feasible if scope of rehab does not impact building envelope or mechanicals
  - building envelope – door/window replacement, roof replacement, other building envelope components impacting ACH and attenuation factor
  - mechanicals – HVAC replacement, ERV/HRV installation, other mechanical components impacting ACH and attenuation factor
- If early testing is feasible, measurement results determine need for mitigation
  - $\geq$ 4.0 pCi/L – mitigation included in sub rehab, active mitigation (RMS-MF) requirements
  - < 4.0 pCi/L – no additional action is required
  - early testing must be conducted within 1 year of application submission

Section 9.6.3.4 Requirements for Sub Rehab and Conversion

Early Testing Feasibility – Determination (MAP 9.6.3.4.B)

- If early testing is not feasible, options include
  - implement mitigation into sub rehab project (MAP 9.6.3.4.C.1)
    - active mitigation (RMS-MF) requirements
    - post-mitigation measurement (MAMF), OM+M program plan required (RMS-MF)
  - do not implement mitigation into sub rehab project (MAP 9.6.3.4.C.2)
    - post-rehab measurement required - $\geq$ 4.0 pCi/L requires retrofit mitigation
    - retrofit mitigation – active mitigation (RMS-MF) requirements
    - Retrofit mitigation – post-mitigation measurement (MAMF), OM+M program plan required (RMS-MF)

Section 9.6.3.5

MAP Requirement (updated)

- All new construction projects must follow radon resistant construction requirements
- Post construction testing required prior to final completion inspection
- If post construction testing results are above 4 pCi/L, the project must be brought into compliance by activating the mitigation system or through retrofit mitigation
- All testing and mitigation must be performed by or under the direct supervision of a Radon Professional.

Discussion

- Application of reference standard – CC-1000-2018 versus CCAH-2020
- Harmonization includes chemical vapor intrusion – mitigation and OM+M
- Clarification of exemptions, PFE evaluation requirements, and OM+M requirements

Section 9.6.3.5

New Construction Exemption (CC-1000 Section 4.8)

- New construction projects with ventilated garages do not require a passive soil gas control system if compliant with ANSI/ASHRAE 62.1, Sections 5.15 and 6.1 – ventilation and pressurization of enclosed spaces surrounding garage
- Document exemption via engineer confirmation and QRP letters

Pressure Field Extension (PFE) Evaluation (CC-1000 Section 7.0)

- After slab has been cast and prior to vertical piping being installed – soil gas plenums must be evaluated for effectiveness through PFE testing
- PFE testing includes connection of fan to exhaust risers and to measure induced vacuum at pre-determined sub-slab points – required at each exhaust riser on each foundation
- PFE results recorded to verify system effectiveness or determine corrective actions

Section 9.6.3.5

OM+M Program Plan Requirements (CC-1000 Section 12.0)

- QRP responsible for direct supervision of OM+M program
- OM+M program plans to include:
  - system design and specifications – fan specifications (if active), system design and specifications, warranty information, service contact information
  - other information – measurement results, PFE evaluation results, contracts and warranties, applicable building permits, estimated cost of operation (if active)
- Ongoing obligations include:
  - Routine maintenance and inspections – quarterly system monitor (site personnel, if active)
  - equipment inspection – ongoing mechanical inspections (QRP, if active)
  - routine and non-routing maintenance – as needed (QRP/site personnel, if active)
  - monitoring (measurement) – seasonal verification (if passive), 2-year for mitigation locations (if active), 5-year for property (QRP)

Questions

Thank You