

Radon Mitigation Standards

Comparison of

EPA RMS
AARST ASD RMS
ASTM E 2121

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Objectives

- Participants will compare and assess three radon mitigation standards
 - US EPA, 1994, Radon Mitigation Standards
 - ASTM Standard Practice for Installing Radon Mitigation Systems in Low-Rise Residential Buildings E2121
 - AARST, 2006, ASD Radon Mitigation Standards (June 2006)



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Caution

The focus of this presentation is on differences between mitigation standards

- Only portions of the standard are discussed
- Mitigation contractors must read the standard appropriate to the job location and become knowledgeable about its contents
- Note, some states (FL, IL, PA) have their own standards



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How Developed?

- **EPA RMS**
 - Developed by consultation with state officials and mitigation contractors
- **ASTM E 2121**
 - Developed by a voluntary working group chaired by a respected state official
 - Must be ASTM members and approved for the E06 committee to join the work group
- **AARST ASD RMS**
 - Developed by a structured voluntary WG chaired by a respected mitigation contractor
 - Balance in voting members required: mitigator, 2 state officials, NEHA, NRSB, trainer



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Stated Purpose / Intent

- **EPA RMS** (Section 1.0 through 6.0)
 - Provided mitigation contractors with uniform standards
 - Set minimum standards of job quality and company operation
 - Model set of requirements for states to adopt
 - Standard tied to certifying agencies (NEHA, NRSB, etc)
- **ASTM E 2121** (Section 1.0)
 - Similar to EPA RMS but has no training or certification requirement
- **AARST ASD RMS** (Section 1.0)
 - Similar to EPA RMS, but defines two individuals
 - Contractor (anyone installing mitigation systems)
 - Qualified Contractors (training class, exam, certification)
 - Some public officials in non-certifying states commented that this is especially important



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Scope

- **EPA RMS** (Section 4.0)
 - ASD System design, installation, post testing
 - HRV and Pressurization installation
 - Worker Health
- **ASTM E 2121**
 - Same as EPA but no discussion of Pressurization
- **AARST ASD RMS** (Section 1.0, 1.7, 2.2)
 - Same as EPA but no discussion of HRV or Pressurization
 - Should follow appropriate RMS guidelines when venting other soil gases



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Contractor Definition

- **EPA RMS** (Section 9.10)
 - Contractor is person listed in RCP program or certified by state with RMS. Listing in RCP requires training & passing mitigation exam
- **ASTM E 2121**
 - Contractor is anyone who contracts for money to perform radon or radon related reduction or is an employee of one who contracts. No training or exam requirement.
- **AARST ASD RMS** (Section 1.3, 1.4)
 - Contractor is person, persons or contracting firm who installs radon reduction system
 - Qualified Contractor maintains current state radon certification or if no state certification maintains current certification with national accrediting agency.



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Application to Existing Systems

- **EPA RMS** (Section 7.4)
 - Not applicable to systems installed prior to its effective date unless system is altered. Altering does not include fan replacement. Should recommend non-compliance items be upgraded
- **ASTM E 2121**
 - No mention of applicability to existing systems
- **AARST ASD RMS** (Section 2.3)
 - Similar to EPA. Shall recommend to client in writing that non-compliance items be upgraded. Written estimate of cost should be provided



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RMS & Code Discrepancies

- **EPA RMS** (Section 7.2)
 - Local codes take precedence but should report code deviations to regulating agency
- **ASTM E 2121** - Local codes take precedence but no statement in regards to reporting any local code or non-code deviations
- **AARST ASD RMS** (Section 3.7.4)
 - Similar to EPA
 - Any RMS deviations that are not caused by local conflict shall be reported in writing to homeowner and certifying agency within 30 days and included in system documentation.



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Research Projects

- **EPA RMS** (Section 7.6)
 - Shall set a performance standard for research or evaluation projects that deviate from RMS or EPA references. Deviations shall obtain prior approval from regulating agencies and be reported to the client
- **ASTM E 2121**
 - No comment on research projects
- **AARST ASD RMS**
 - No comment on research projects



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General Practices (GP1) Review of Previous Radon Tests

- **EPA RMS** (Section 10.1)
 - Contractor shall review previous radon tests
- **ASTM E 2121**
 - No requirement to evaluating previous radon tests
- **AARST RMS** (Section 3.1)
 - Contractor shall review previous radon tests
 - If tests were not done according to applicable protocol, contractor shall recommend retesting



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GP 2 Client Notification Prior to Installation

- **EPA RMS** (Section 10.4, 18.1)
 - Shall inform client of the need to ventilate workspace before and after use of VOC containing materials
 - Recommend written information be provided before work is begun
 - Recommended items to be included are listed
- **ASTM E 2121** (Section 7.1.2)
 - Shall inform client need for ventilation but no recommendation that written information be provided before work is begun
- **AARST ASD RMS** (Section 3.3, 3.5)
 - Same as EPA RMS plus
 - shall provide MSDS when requested



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GP 3: Health Risk Communication

- **EPA RMS** (Section 10.2)
 - Contractor shall refer client to EPA's *Citizen's Guide* or state equivalent
- **ASTM E 2121**
 - Makes no reference to risk communication. Contractor can make any health claim.
- **AARST ASD RMS** (Section 3.2)
 - Communication of health risk to client based on relevant EPA or state documents



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GP 4: Temporary Mitigation Systems

- **EPA RMS** (Section 10.3)
 - Shall label as temporary and replace with permanent in 30 days unless significant renovations taking place
- **ASTM E 2121** - No guidance
- **AARST ASD RMS** (section 3.6)
 - Same as EPA RMS but adds
 - Client should sign an acknowledgement statement



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GP 5: Code Compliance

- **EPA RMS** (Section 14.1.1, 14.1.2)
 - System shall be installed in compliance with all **applicable codes and local regulations**. Shall obtain and all required licenses & permits
- **ASTM E 2121** (Section 7.1.1, 7.3.1.1)
 - Same as EPA RMS but no mention about obtaining licenses & permits
- **AARST ASD RMS** (Section 3.7.1, 3.7.5)
 - Same as EPA RMS but adds
 - Recommends abiding by national codes if more stringent
 - If no local code, shall be in compliance with national codes



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Building Investigation 1

- **EPA RMS** (Section 11.1)
 - **Prior to initiating work**, contractor shall conduct thorough visual inspection
- **ASTM E 2121** (Section 7.1.3)
 - **Prior to initiating work**, contractor or any employee should conduct visual inspection **prior to initiating work**.
- **AARST ASD RMS** (Section 4.1)
 - Qualified Contractor shall inspect prior to work **but also** recommends it be done prior to bid



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BI 2: Pre-Mitigation Diagnostics

- **EPA RMS** (Section 11.2)
 - Recommends the contractor conduct diagnostic tests **to identify radon entry points, e.g., grab samples, continuous monitoring, smoke sticks.**
- **ASTM E 2121**
 - No recommendation about diagnostics
- **AARST ASD RMS** (Section 4.2)
 - Should make diagnostic tests when necessary, **e.g., building pressure, radon measurements, sub-slab communication tests**



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BI 3: Back-Drafting Testing

- **EPA RMS** (Section 11.3, 17.3)
 - Recommends **routine** back-drafting testing before mitigation, shall do back-drafting testing at system completion. Shall correct before system is activated
- **ASTM E 2121** (Section 7.1.4)
 - If contractor is concerned about back-drafting, should recommend client contact qualified person **to inspect and should recommend** correcting any found non-compliance components.
- **AARST ASD RMS** (Section 8.5)
 - Shall inform client **of any** significant observed flue gas spillage **and shall advise** client **to have qualified person evaluate and correct problem.**
 - Should disconnect ASD wiring **if spillage persists.**
 - **Backdraft testing procedures** in Appendix A
 - **Any client statements regarding draft** should include disclaimer



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BI 4: Floor Plan Sketch

- **EPA RMS** (Section 11.5, 18.5)
 - Shall make during building investigation a floor plan sketch of foundation and should include relevant features. Sketch with system layout shall be finalized at system completion.
- **ASTM E 2121** - Has no sketch requirement
- **AARST ASD RMS** (Section 4.3, 9.4)
 - Should make during building investigation a floor plan sketch of foundation, relevant features and anticipated system layout. Sketch with system layout shall be finalized at system completion.



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Health and Safety 1

- **EPA RMS** (Section 12.1, 12.2.1, 12.2.3)
 - Shall comply with OSHA and other occupational exposure regulations +
 - Advise workers of radon exposure hazards, need for protective measures
 - Ensure protective equipment is available on the job site
- **ASTM E 2121** (Section 6.1, 6.2.1, 6.2.2)
 - Same as EPA RMS
- **AARST RMS** (Section 3.4, 10.1, 10.2.1, 10.2.4.1)
 - Same as EPA RMS
 - Contractor shall inform client of any adverse conditions that would likely be a health risk.



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HS 2: Worker Protection Plan

- **EPA RMS** (Section 12.2.2)
 - Shall have plan available to all employees
- **ASTM E 2121**
 - No worker protection plan requirement
- **AARST ASD RMS** (Section 10.2.4)
 - Shall have plan **available and shall be** reviewed with employees every year. Should have employee review signature. Plan should include jobsite safety, safe equipment use, safe crawl space work and discussion of hanta-virus symptoms



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HS 3: Work Area Ventilation

- **EPA RMS** (Section 12.2.6)
 - Work area shall be ventilated. **If work area is greater than 0.3 WL or 30 pCi/L, respiratory protection shall** conform to NIOSH
- **ASTM E 2121** (Section 6.2.3, 6.2.4, 6.2.6)
 - Work area shall be ventilated. **If work area is greater than 0.3 WL or 30 pCi/L shall provide respiratory protection** required to maintain exposure less than 4 WLM. **NIOSH approved respiratory protection should** be used.
- **AARST ASD RMS** (Section 10.2.3, 10.2.4.2)
 - Work space shall be ventilated **as practical**. No reference to respiratory protection. Practices shall be arranged **to keep Mitigation installers WLM or pCi/L/day exposure as low as can be reasonably achieved (ALARA)**.



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HS 4: Radon Exposure Monitoring

- **EPA RMS** (Section 12.2.8)
 - Shall record worker exposure based on highest pre-mitigation level or onsite measurement and ensure worker does not exceed 4 WLM for any 12 month period (50% ER used)
- **ASTM E 2121** (Section 6.2.4, 6.2.5)
 - Maximum exposure of 4 WLM or 68,000 pCi/L/hrs for any 12 month period (100% ER used). No requirement to record exposure or guidance on how exposure is to be measured.
- **AARST ASD RMS** (Section 10.2.2, 10.2.3)
 - Shall record worker exposure based on highest pre-mitigation level, onsite measurement or radon dosimeter worn by worker and ensure worker does not exceed 4 WLM or 5700 pCi/L/days (136,400 pCi/L/hrs) for any 12 month period. (50% ER used) Methods given to calculate WLM or pCi/L/days



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HS 5: Asbestos

- **EPA RMS** (Section 12.2.9)
 - Shall not do work in areas where friable asbestos is suspected and may be disturbed until accredited person determines work complies with asbestos regulations
- **ASTM E 2121** (Section 6.2.7)
 - Essentially the same as EPA RMS
- **AARST RMS** (Section 10.2.4.3)
 - Essentially the same as EPA RMS



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Mitigation System Design

- **EPA RMS** – All mitigation systems: (Section 13.1, 13.2, 13.3, 13.4)
 - Shall be permanent **additions to building**
 - Shall not create other hazards
 - Shall maximize radon reduction **and** minimize energy use
 - Shall comply applicable codes
- **ASTM E 2121** (Section 7.2.1, 7.2.2, 7.2.3)
 - Similar to EPA RMS but with additional concerns of system durability, reliability, maintainability and interior and exterior appearance.
- **AARST ASD RMS** (Section 5.1, 5.2, 5.3, 5.5, 5.6)
 - Similar to EPA **RMS but with additional concerns of system durability, ease of service, aesthetics and long term operating cost.**
 - No positive portions of system in or under building.
 - Preferred crawl space treatment is SSD or SMD



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System Installation 1: General Requirements

- **EPA RMS** (Section 14.1.3, 14.1.4, 14.1.5)
 - No more framing removed **than allowed by plumbing code**
 - Shall protect fire-rated partitions **if penetrated**
 - **If sump depressurization**, submersible pump recommended
- **ASTM E 2121** (Section 7.3.1.2, 7.2.2)
 - Similar to EPA **RMS but** no submersible recommendation
- **AARST ASD RMS** (Section 3.7.1, Appendix B, 6.3.3.1)
 - Code defining actual allowable cuts **in floor joist is** in Appendix B
 - Code defining maintaining fire rate **assembles is included in** Appendix B
 - If sump depressurization, submersible pump required



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SI 2: Vent Pipe Size

- **EPA RMS** - No requirements
- **ASTM E 2121** (Section 7.3.2.1)
 - 3" minimum pipe **diameter**
 - Two or more suction points must connect to 4" Tee with 4" exhaust **unless documentation is left using Industrial Ventilation Guide justifying smaller size.**
- **AARST ASD RMS** (Section 6.2.2)
 - 3" minimum pipe diameter from the 1st suction hole to the exhaust point unless system effectiveness requires high airflow (e.g. greater than 60 to 80 cfm net) which requires 4" pipe size



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SI 3: Vent Pipe Insulation

- **EPA RMS** (Section 14.2.2)
 - **Attic and outdoor** pipe subject to freezing should be insulated
- **ASTM E 2121** (Section 7.3.2.3)
 - Should insulated piping if exterior condensation may damage ceiling or flooring or interior pipe condensation may freeze
- **AARST ASD RMS** (Section 6.2.7.1)
 - Should insulated **piping if exterior condensation is likely to** damage **ceiling or flooring or interior pipe condensation is likely to** freeze



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SI 4: Minimum Vent Pipe Support

- **EPA RMS** (Section 14.2.4)
 - Supports **at least** every 6' horizontally
 - Secured at penetrations of floors, **ceilings, roofs.**
 - **Secured at least** every 8' vertically **if not penetrating a floor, ceiling or roof**
- **ASTM E 2121** (Section 7.3.2.5)
 - Same as EPA **RMS**
- **AARST ASD RMS** (Section 6.2.5.2)
 - Every 6' horizontally (**Plg code is 4' horizontally & 10' vertically**)
 - Every 10' vertically (**reflects Plg code minimum**)
 - No mention **of securing at penetrations (reflects Plg code)**



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SI 12: Sealing Sumps

- **EPA RMS** (Section 14.5.1, 15.7)
 - Sumps **which allow airflow between indoors and soil shall be** sealed with durable cover. If sump provides surface water drainage, function must be maintained. **Covers sealed with non-permanent caulk or gasket.** View ports recommended.
- **ASTM E 2121** (Section 7.4.7, 7.4.8, 7.3.13.4)
 - **Sump sealing requirement** same as EPA **RMS**
- **AARST ASD RMS** (Section 6.3.3.5)
 - Same as EPA **RMS**
 - Covers shall support weight of adult **standing on cover**



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SI 5: Vent Pipe and Access

- **EPA RMS** (Section 14.2.7)
 - Vent pipe shall not block access to openings or areas needing maintenance or inspection, nor in front of or interfere with lights, doors, windows or equipment access.
- **ASTM E 2121** (Section 7.1.1, 7.3.2.4)
 - Vent pipe shall not block windows, doors or access to installed equipment
- **AARST ASD RMS** (Section 5.4, 6.2.6.1)
 - Mitigation system shall avoid blocking doorways, windows and accessibility to switches, controls, electrical boxes or equipment requiring maintenance. Vent pipe shall not block necessary access to areas requiring maintenance or inspection unless piping is designed for easy removal and airtight replacement (rubber couplings).



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SI 6: Vent Pipe installation

- **EPA RMS** (Section 14.2.1, 14.2.3, 14.2.5, 14.2.6)
 - All joints shall be made air tight
 - Vent pipe shall be adequately secured to structure
 - Vent pipe shall be supported above suction pit.
 - Vent pipes installed so any moisture in pipes drains into the ground
- **ASTM E 2121** (Section 7.1.1, 7.3.2.4, 7.3.2.6, 7.3.2.7)
 - Same as EPA RMS
- **AARST ASD RMS** (Section 6.2.1, 6.2.3, 6.2.4.2, 6.2.5.3)
 - Same as EPA RMS



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SI 6: Vent Pipe Discharge

- **EPA RMS** (Section 14.2.8)
 - Shall be above eave, **at least** 10' above ground, **at least** 10' away from openings into home unless 2' above openings, **and** 10' from adjacent home openings. Whenever possible above highest eave and as close to ridge as possible
- **ASTM E 2121** (Section 7.3.2.9)
 - Same as EPA **but states** "whenever practicable" **above highest roof & highest ridge**. Exhaust shall be outside structure, vertical & upward
 - Exterior venting 6" above roof - roof penetrations 12" above roof
- **AARST ASD RMS** (Section 6.2.8.1, 6.2.8.2)
 - Same as EPA RMS without highest roof or ridge recommendation
 - **Exterior venting just above roof - roof penetrations 12" above roof**
 - Exhaust outside the structure & should be upward (allows vent caps)



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SI 7: ASD Fan Installation 1

- **EPA RMS** (Section 14.3.1, 14.3.2)
 - Fan shall be sealed **to reduce soil gas leakage**
 - Fan shall be sized **to provide needed ΔP and airflow to achieve specific radon reduction goal**
- **ASTM E 2121** (Section 7.3.3.1)
 - No recommendation for fan leakage sealing
 - **Fan sizing same as EPA RMS**
- **AARST ASD RMS** (Section 6.5.1, 6.5.2)
 - Fan shall be sealed to reduce soil gas or water leakage
 - **Fan sizing same as EPA RMS**



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SI 8: ASD Fan Installation 2

- **EPA RMS** (Section 14.3.3)
 - Fan shall not be installed in or below the conditioned space or below ground
- **ASTM E 2121** (Section 7.3.3.2)
 - Same as EPA
- **AARST ASD RMS** (Section 6.5.3)
 - Same as EPA RMS but adds “..only in attics with “adequate” ventilation,..” (adequate not defined)



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SI 9: ASD Fan Installation 3

- **EPA RMS** (Section 14.3.4, 14.3.5, 14.3.6, 14.3.7)
 - Fans shall be installed to minimize condensation buildup
 - **If installed outdoors, shall be rated for outdoors or protective housing**
 - Shall be mounted to minimize vibration **transfer to building**
 - Shall be connected to pipe with rubber couplers **or equivalent**
- **ASTM E 2121** (Section 7.3.3.3, 7.3.3.4, 7.3.3.5, 7.3.3.6)
 - Essentially same as EPA **RMS**
- **AARST ASD RMS** (Section 6.5.4, 6.5.5, 6.5.7, 6.5.8)
 - Same as EPA **RMS but recommends** fan installed vertical **or according to manufacturers recommendations**



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SI 10: Pressurization systems

- **EPA RMS** (Section 14.3.8)
 - Intake grills for crawl space or building pressurization shall be screened
 - **Screens or filters shall be removable for cleaning**
- **ASTM E 2121** (Section 7.3.3.7)
 - Essentially same as EPA **RMS**
- **AARST ASD RMS**
 - Does not address non-ASD systems



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SI 11: Block Wall Depressurization

- **EPA RMS** (Section 14.5.3)
 - **Foundation openings & top of wall** shall be sealed
 - Shall report **to client** openings that cannot be sealed
- **ASTM E 2121** (Section 7.3.9.1)
 - **Foundation openings & top of wall** should be sealed
 - Should report **to client** openings that cannot be sealed
- **AARST ASD RMS**
 - **Does not address non-ASD systems**



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SI 10: Suction Pits

- **EPA RMS** (Section 14.4.1)
 - Adequate subslab material shall be removed **to obtain optimal pressure field extension**
- **ASTM E 2121** (Section 7.3.5.1)
 - For poor permeability it is helpful to excavate 1 ft³ of sub-slab material and one pipe diameter deep for high permeability
- **AARST ASD RMS** (Section 6.1.1)
 - **To increase pressure field extension**, a minimum of 1/3 ft³ of void space should exist



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SI 11: Sealing Floor Wall Joint

- **EPA RMS** (Section 14.5.4)
 - Shall seal slab wall-floor joint. Shall disclose **to client and in documentation** unsealed openings **that are not accessible**. Should seal other openings **in slab**.
- **ASTM E 2121** (Section 7.3.4.2)
 - Sometimes appropriate to seal slab floor wall. **Non-sealing may cause noise or contribute to backdrafting**. Desirable for BWD, CSM and passive systems
- **AARST ASD RMS** (Section 6.3.4)
 - Shall seal floor wall joint if open to sub-slab. Shall seal other slab openings that compromise **the pressure field extension**.



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SI 12: Sealing Sumps

- **EPA RMS** (Section 14.5.1, 15.7, 15.8)
 - Sumps which allow airflow between indoors and soil shall be sealed with durable cover. Shall be a durable cover sealed with non-permanent caulk or gasket. View ports recommended.
- **ASTM E 2121** (Section 7.4.7, 7.4.8)
 - Sump sealing requirement same as EPA RMS
- **AARST ASD RMS** (Section 6.3.3.5)
 - Same as EPA RMS
 - Covers shall support weight of adult standing on cover



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SI 12: Sump Drains

- **EPA RMS** (Section 14.7.4)
 - If sump provides only surface water drainage, cover shall be recessed and fitted with trapped drain.
- **ASTM E 2121** (Section 7.3.13.4)
 - Similar to EPA RMS but no requirement to recess cover.
- **AARST ASD RMS** (Section 6.3.3.6)
 - Same as EPA RMS but allows drain to be in slab rather than in the cover.



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SI 14: Sealing 5: Membranes

- **EPA RMS** (Section 14.5.6, 15.9)
 - **Seams in soil gas membranes shall be overlapped 12" and should be sealed. Membrane 6 mil or 3 mil cross laminated and should be sealed to walls and around posts.** Any wood used shall be rot resistant.
- **ASTM E 2121** (Section 7.3.8.1, 7.3.8.3, 7.4.9, 7.4.10)
 - Similar to EPA RMS but requires sealing around posts and to walls to the extent possible. Offers suction point detail to reduce noise.
 - Any wood in contact with masonry or soil shall be decay resistant
- **AARST ASD RMS** (Section 6.3.7, 6.3.7.1, 6.3.7.2)
 - Similar to EPA RMS but requires to the extent practical sealing to walls and around posts
 - Any wood in contact with masonry or soil shall be decay resistant



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SI 15: Electrical Requirements

- **EPA RMS** (Section 14.6.1, 14.6.2, 14.6.5)
 - **Wiring shall** comply with NEC
 - **Wiring shall not** be in ASD piping or HVAC ducts
 - Exterior fans must be hard wired
- **ASTM E 2121** (Section 7.3.12.1, 7.3.12.2, 7.3.12.5)
 - **Same as EPA RMS except**
 - Fans greater than 93 watts must have switch within eyesight
 - Can use exterior rated plug & outlet (**recommend hardwiring**)
- **AARST ASD RMS** (Section 6.6.1, 6.6.2, 6.6.3)
 - Fan disconnect either plug or switch must be within eyesight
 - **No wiring in mitigation piping**
 - Recommend external wiring be in conduit
 - **Additional electrical** requirements in Appendix B



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SI 16: Drain Installation

- **EPA RMS** (Section 14.2.9, 14.7.1, 14.7.2, 14.7.3)
 - Should trap soak-away drains with drain tile suction
 - Drains to soil or daylight should have a trapped drain
 - **Condensation drains shall have minimum 6" trap**
 - Shall seal perimeter channel drains in manner to retain drainage properties
- **ASTM E 2121** (Section 7.3.71, 7.3.13.2, 7.3.13.3, 7.3.13.4)
 - Essentially same as EPA **RMS but**:
 - Shall trap soak-away drains with drain tile suction
- **AARST ASD RMS** (Section 6.4.1, 6.4.2, 6.4.3, 6.4.4)
 - Similar to EPA **RMS but**:
 - 6" trap only if condensation drains on return side of HVAC
 - Should install radon resistant drain if water collects in CSM



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SI 17: HVAC Installation 1

- **EPA RMS** (Section 14.8.1, 14.8.2)
 - Mechanical contractor should approve modifications **to HVAC**
 - Foundation vents shall be non-closing type **& should consider protecting water pipes**
- **ASTM E 2121** (Section 7.3.14.1, 7.3.14.2)
 - **Mechanical contractor shall** approve modifications **to HVAC**
 - Foundation vents shall be non-closing type **& shall protect water lines**
- **AARST ASD RMS**
 - No mention **because HVAC modification is not ASD**



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SI 18: HVAC Installation 2: HRVs

- **EPA RMS** (Section 14.8.3, 14.8.4, 14.8.5, 14.8.6)
 - HRVs shall not be in rooms with friable asbestos
 - Minimum supply to exhaust port - 10' exterior & 12' interior
 - Must verify airflow is balanced
 - Inlets & outlets shall have wire mesh or screen
- **ASTM E 2121** (Section 7.3.15.1, 7.3.15.2, 7.3.15.3, 7.3.15.4)
 - Essential same as EPA **RMS** but:
 - exterior ports minimum 12" above grade & away from blockages or vehicle exhaust
- **AARST ASD RMS**
 - No mention because HRV **installation is not ASD**



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Materials

- **EPA RMS** (Section 15.1, 15.2, 15.3, 15.4.)
 - **Electrical components** shall be UL listed or equivalent
 - **Pipe** shall be minimum schedule 20 or equivalent
 - **Garage pipe** should be minimum schedule 40 or eq.
 - **Pipe fittings** shall be same material as pipe
- **ASTM E 2121** (Section 7.4.1, 7.4.2, 7.4.3)
 - Similar to EPA **RMS** but can use any piping under slab or membrane **but crush strength is important.**
- **AARST ASD RMS** (Section 6.2.4.1, 6.2.4.3)
 - Similar to EPA **RMS** but clarifies just plastic pipe fittings same materials as pipe. Can use corrugated or perforated pipe below slab or membrane



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Monitors 1

- **EPA RMS** (Section 16.1, 16.2, 16.3)
 - Shall have mechanism to monitor ASD system **performance**
 - Non-switched electrical monitors **or low battery indicator**
 - Indicate initial pressure reading
- **ASTM E 2121** (Section 7.5.1, 7.5.2, 7.5.3)
 - Same as EPA **RMS**
- **AARST ASD RMS** (Section 7.1, 7.1.1, 7.1.2)
 - Same as EPA **RMS and** mentions electrical amperage gauges.



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Labeling 1

- **EPA RMS** (Section 16.4, 16.5)
 - **Descriptive visible** label shall be placed on system, **service panel or other prominent location**
 - One label on each floor & label on circuit breaker
- **ASTM E 2121** (Section 7.5.4, 7.5.5)
 - Same as EPA **RMS but allows equivalent wording on labels**
- **AARST ASD RMS** (Section 7.2, 7.3, 7.4, 7.5, 7.6)
 - **In addition to EPA RMS requirements**, labels shall be placed on disconnect switch, sump pit covers, entrance to crawl space **with CSM or CSD. Labels can have equivalent wording.**



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Post-Mitigation System Check

- **EPA RMS** (Section 6.2, 17.1, 17.2)
 - Contractor **shall** personally inspect all systems for RMS compliance
 - Contractor **shall** verify integrity of seals and joints
 - **Shall** measure airflow or system pressure (PFE is good practice)
- **ASTM 2121** - No similar requirements
- **AARST ASD RMS** (Section 8.1, 8.2, 8.3, 8.4)
 - Qualified Contractor **shall** personally inspect within 30 days all systems changed from original design & at least 20% of non-changed systems
 - **Shall** bring into compliance **any item not in compliance**
 - **Measure suction or flow in piping** (PFE measurement is recommended)



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Post-Mitigation Testing 3: Radon

- **EPA RMS** (Section 17.4, 17.5)
 - Should conduct test 24 hours to 30 days **after system activated**
 - **If test done by mitigator, shall** recommend independent or client test
 - **Shall** recommend retesting every 2 years **and if building significantly altered**
- **ASTM E 2121** (Section 7.6.1)
 - Mitigator **shall** leave test kit **with building operator or hire a certified or licensed tester or use relocation company test**
 - No requirement to recommend independent or client test
 - No recommendation to retest **every 2 years**
- **AARST ASD RMS** (Section 8.6, 8.7, 8.8)
 - Same as EPA RMS **but adds**
 - **Shall** also test in room above CSM or CSD
 - **Recommends** additional measurements **in livable levels above each unique structural area**



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Records & Information Package

- **EPA RMS** (Section 18.1, 18.2, 18.3, 18.4)
 - Should keep mitigation records **3 years or period of the warranty**
 - Shall maintain records required by governmental agencies
 - Should keep health and safety records **for 20 years**
 - Shall provide client with system information package
- **ASTM E 2121** (Section 7.7.1, 7.7.2, 7.7.3)
 - Shall keep mitigation records **3 years or period of the warranty**
 - Shall keep health and safety records **for 20 years**
 - Shall provide client with information package (fewer items in package)
- **AARST ASD RMS** (Section 9.1, 9.2, 9.3)
 - Same as EPA **RMS** but information packet shall be securely attached to ASD system

