# PROJECT MANUAL

## Contract No. R25-077-04

## Multi-Family Housing & Hi-Rise Buildings Radon Mitigation

***at the***

*Prepared for:*

WESTMORELAND COUNTY HOUSING AUTHORITY
167 South Greengate Road
Greensburg, PA 15644

**December 9, 2025**

SLEIGHTER DESIGN
ENGINEERING ARCHITECTURE SURVEYING

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# PROJECT DIRECTORY

PROJECT: RADON TESTING & MITIGATION
MULTI-FAMILY HOUSING & HI-RISE BUILDINGS

OWNER: WESTMORELAND COUNTY HOUSING AUTHORITY
167 SOUTH GREENGATE ROAD,
GREENSBURG, PA 15601
CONTACT: ERIK SPIEGEL, DIRECTOR OF ARCH. &
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# NOTICE TO BIDDERS

## INVITATION TO BID

## RADON TESTING AND MITIGATION PROJECT
## FOR
## MULTI-FAMILY HOUSING – VARIOUS SITE LOCATIONS

- **MITIGATION CONTRACT – PA18.26.1.1**

**Westmoreland County Housing Authority** is requesting radon final testing and mitigation system construction bids for the referenced project through sealed bids which will be received by the **Westmoreland County Housing Authority**, until **January 12, 2026,** at **10:00 A.M.** (eastern standard time).

A **Pre-Bid Meeting** is scheduled for **December 17, 2025, at 2:00 P.M.** (eastern standard time) at the office of Westmoreland County Housing Authority – 167 South Greengate Road - Greensburg, PA 15601

Electronic Bid Documents are available for downloading at **www.wchaonline.com.** Bidders are required to register online at the **www.wchaonline.com** to view bid documents. Plan holders proposing to bid shall also register their intent to submit a bid with **Westmoreland County Housing Authority** via email to **lindam@wchaonline.com** and **eriks@wchaonline.com** in accordance with the bid requirements.

**Westmoreland County Housing Authority**,

**By: Michael L. Washowich, Executive Director / Contracting Officer**

**Advertisement Dates:**

**Tribune Review – December 9, 2025, and December 14, 2025**
**Pittsburgh Courier – December 10, 2025**
**Mon Valley Independent – December 10, 2025**

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DOCUMENT 00 0040

IMPORTANT INSTRUCTIONS TO ALL PRIME CONTRACTORS

PART 1 - GENERAL

1.01. REQUIRED BID SUBMISSION DOCUMENTS

A. The following list of documents is required to be completed and submitted by the prospective bidder with their respective bid to be considered responsive.

1. 00 0300 – BID FORM
2. 00 0730 – EQUAL EMPLOYMENT OPPORTUNITY
3. 00 0840 – NON-COLLUSIVE AFFIDAVIT
4. 00 0850 – FORM OF BID BOND

1.02. BUILDING PERMITS

A. Mitigation Company is responsible for ALL permits, fees and licenses necessary for the proper execution
and completion of the work.
B. Mitigation Company shall verify the cost of the building permit with the Construction Code Office and the local municipality, prior to the date of the bid for this project. No additional payments will be made for unanticipated fees.
C. If a re-inspection is necessary, the Mitigation Company is responsible for the re-inspection fee.

1.03. PRODUCTS OR EQUAL

A. Products specified on the contract document and specifications by manufacturer and model number are done to establish a level of quality. Similar products of equal value will be considered.

B. It is the contractor's responsibility to provide adequate detail to prove the products they plan to use meet or exceed the products that have been specified in the contract documents and specifications.

1.04. DEFINITIONS

A. "Provide": Where used in these specifications or on the drawings, means that the Mitigation Company shall "furnish and install" such item or items as may be referred to.

1.05. BID WITHDRAW

A. If a Low Bidder elects to withdraw their bid due to a "Mathematical Error" the schedule of values will be used to fully evaluate the "Error".
B. This project will follow the "Public Contract Bid Withdraw Law" Act of Jan. 23, 1974, P.L. 9, No.4.

PART 2 - PRODUCTS

NOT USED

PART 3 – EXECUTION

NOT USED

END OF SECTION 00 0040

DOCUMENT 00 0100

INSTRUCTIONS TO BIDDERS

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HUD FORM 5369
INSTRUCTIONS TO BIDDERS FOR CONTRACTS
PUBLIC AND INDIAN HOUSING PROGRAMS

(6 PAGES)

**U.S. Department of Housing and Urban Development**

Office of Public and Indian Housing

# Instructions to Bidders for Contracts Public and Indian Housing Programs

# Instructions to Bidders for Contracts

Public and Indian Housing Programs

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### 1. Bid Preparation and Submission

(a) Bidders are expected to examine the specifications, drawings, all instructions, and, if applicable, the construction site (see also the contract clause entitled **Site Investigation and Conditions Affecting the Work** of the *General Conditions of the Contract for Construction*). Failure to do so will be at the bidders' risk.

(b) All bids must be submitted on the forms provided by the Public Housing Agency/Indian Housing Authority (PHA/IHA). Bidders shall furnish all the information required by the solicitation. Bids must be signed and the bidder's name typed or printed on the bid sheet and each continuation sheet which requires the entry of information by the bidder. Erasures or other changes must be initialed by the person signing the bid. Bids signed by an agent shall be accompanied by evidence of that agent's authority. (Bidders should retain a copy of their bid for their records.)

(c) Bidders must submit as part of their bid a completed form HUD-5369-A, "Representations, Certifications, and Other Statements of Bidders."

(d) All bid documents shall be sealed in an envelope which shall be clearly marked with the words "Bid Documents," the Invitation for Bids (IFB) number, any project or other identifying number, the bidder's name, and the date and time for receipt of bids.

(e) If this solicitation requires bidding on all items, failure to do so will disqualify the bid. If bidding on all items is not required, bidders should insert the words "No Bid" in the space provided for any item on which no price is submitted.

(f) Unless expressly authorized elsewhere in this solicitation, alternate bids will not be considered.

(g) Unless expressly authorized elsewhere in this solicitation, bids submitted by telegraph or facsimile (fax) machines will not be considered.

(h) If the proposed contract is for a Mutual Help project (as described in 24 CFR Part 905, Subpart E) that involves Mutual Help contributions of work, material, or equipment, supplemental information regarding the bid advertisement is provided as an attachment to this solicitation.

### 2. Explanations and Interpretations to Prospective Bidders

(a) Any prospective bidder desiring an explanation or interpretation of the solicitation, specifications, drawings, etc., must request it at least 7 days before the scheduled time for bid opening. Requests may be oral or written. Oral requests must be confirmed in writing. The only oral clarifications that will be provided will be those clearly related to solicitation procedures, i.e., not substantive technical information. No other oral explanation or interpretation will be provided. Any information given a prospective bidder concerning this solicitation will be furnished promptly to all other prospective bidders as a written amendment to the solicitation, if that information is necessary in submitting bids, or if the lack of it would be prejudicial to other prospective bidders.

(b) Any information obtained by, or provided to, a bidder other than by formal amendment to the solicitation shall not constitute a change to the solicitation.

### 3. Amendments to Invitations for Bids

(a) If this solicitation is amended, then all terms and conditions which are not modified remain unchanged.

(b) Bidders shall acknowledge receipt of any amendment to this solicitation (1) by signing and returning the amendment, (2) by identifying the amendment number and date on the bid form, or (3) by letter, telegram, or facsimile, if those methods are authorized in the solicitation. The PHA/IHA must receive acknowledgement by the time and at the place specified for receipt of bids. Bids which fail to acknowledge the bidder's receipt of any amendment will result in the rejection of the bid if the amendment(s) contained information which substantively changed the PHA's/IHA's requirements.

(c) Amendments will be on file in the offices of the PHA/IHA and the Architect at least 7 days before bid opening.

### 4. Responsibility of Prospective Contractor

(a) The PHA/IHA will award contracts only to responsible prospective contractors who have the ability to perform successfully under the terms and conditions of the proposed contract. In determining the responsibility of a bidder, the PHA/IHA will consider such matters as the bidder's:

(1) Integrity;

(2) Compliance with public policy;

(3) Record of past performance; and

(4) Financial and technical resources (including construction and technical equipment).

(b) Before a bid is considered for award, the bidder may be requested by the PHA/IHA to submit a statement or other documentation regarding any of the items in paragraph (a) above. Failure by the bidder to provide such additional information shall render the bidder nonresponsible and ineligible for award.

## 5. Late Submissions, Modifications, and Withdrawal of Bids

(a) Any bid received at the place designated in the solicitation after the exact time specified for receipt will not be considered unless it is received before award is made and it:

(1) Was sent by registered or certified mail not later than the fifth calendar day before the date specified for receipt of offers (e.g., an offer submitted in response to a solicitation requiring receipt of offers by the 20th of the month must have been mailed by the 15th);

(2) Was sent by mail, or if authorized by the solicitation, was sent by telegram or via facsimile, and it is determined by the PHA/IHA that the late receipt was due solely to mishandling by the PHA/IHA after receipt at the PHA/IHA; or

(3) Was sent by U.S. Postal Service Express Mail Next Day Service - Post Office to Addressee, not later than 5:00 p.m. at the place of mailing two working days prior to the date specified for receipt of proposals. The term "working days" excludes weekends and observed holidays.

(b) Any modification or withdrawal of a bid is subject to the same conditions as in paragraph (a) of this provision.

(c) The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent either by registered or certified mail is the U.S. or Canadian Postal Service postmark both on the envelope or wrapper and on the original receipt from the U.S. or Canadian Postal Service. Both postmarks must show a legible date or the bid, modification, or withdrawal shall be processed as if mailed late. "Postmark" means a printed, stamped, or otherwise placed impression (exclusive of a postage meter machine impression) that is readily identifiable without further action as having been supplied and affixed by employees of the U.S. or Canadian Postal Service on the date of mailing. Therefore, bidders should request the postal clerk to place a hand cancellation bull's-eye postmark on both the receipt and the envelope or wrapper.

(d) The only acceptable evidence to establish the time of receipt at the PHA/IHA is the time/date stamp of PHA/IHA on the proposal wrapper or other documentary evidence of receipt maintained by the PHA/IHA.

(e) The only acceptable evidence to establish the date of mailing of a late bid, modification, or withdrawal sent by Express Mail Next Day Service-Post Office to Addressee is the date entered by the post office receiving clerk on the "Express Mail Next Day Service-Post Office to Addressee" label and the postmark on both the envelope or wrapper and on the original receipt from the U.S. Postal Service. "Postmark" has the same meaning as defined in paragraph (c) of this provision, excluding postmarks of the Canadian Postal Service. Therefore, bidders should request the postal clerk to place a legible hand cancellation bull's eye postmark on both the receipt and Failure by a bidder to acknowledge receipt of the envelope or wrapper.

(f) Notwithstanding paragraph (a) of this provision, a late modification of an otherwise successful bid that makes its terms more favorable to the PHA/IHA will be considered at any time it is received and may be accepted.

(g) Bids may be withdrawn by written notice, or if authorized by this solicitation, by telegram (including mailgram) or facsimile machine transmission received at any time before the exact time set for opening of bids; provided that written confirmation of telegraphic or facsimile withdrawals over the signature of the bidder is mailed and postmarked prior to the specified bid opening time. A bid may be withdrawn in person by a bidder or its authorized representative if, before the exact time set for opening of bids, the identity of the person requesting withdrawal is established and the person signs a receipt for the bid.

## 6. Bid Opening

All bids received by the date and time of receipt specified in the solicitation will be publicly opened and read. The time and place of opening will be as specified in the solicitation. Bidders and other interested persons may be present.

## 7. Service of Protest

(a) Definitions. As used in this provision:

"Interested party" means an actual or prospective bidder whose direct economic interest would be affected by the award of the contract.

"Protest" means a written objection by an interested party to this solicitation or to a proposed or actual award of a contract pursuant to this solicitation.

(b) Protests shall be served on the Contracting Officer by obtaining written and dated acknowledgement from —

Westmoreland County Housing Authority
167 South Greengate Road
Greensburg, PA 15601

[Contracting Officer designate the official or location where a protest may be served on the Contracting Officer]

(c) All protests shall be resolved in accordance with the PHA's/IHA's protest policy and procedures, copies of which are maintained at the PHA/IHA.

## 8. Contract Award

(a) The PHA/IHA will evaluate bids in response to this solicitation without discussions and will award a contract to the responsible bidder whose bid, conforming to the solicitation, will be most advantageous to the PHA/IHA considering only price and any price-related factors specified in the solicitation.

(b) If the apparent low bid received in response to this solicitation exceeds the PHA's/IHA's available funding for the proposed contract work, the PHA/IHA may either accept separately priced items (see 8(e) below) or use the following procedure to determine contract award. The PHA/IHA shall apply in turn to each bid (proceeding in order from the apparent low bid to the high bid) each of the separately priced bid deductible items, if any, in their priority order set forth in this solicitation. If upon the application of the first deductible item to all initial bids, a new low bid is within the PHA's/IHA's available funding, then award shall be made to that bidder. If no bid is within the available funding amount, then the PHA/IHA shall apply the second deductible item. The PHA/IHA shall continue this process until an evaluated low bid, if any, is within the PHA's/IHA's available funding. If upon the application of all deductibles, no bid is within the PHA's/IHA's available funding, or if the solicitation does not request separately priced deductibles, the PHA/IHA shall follow its written policy and procedures in making any award under this solicitation.

(c) In the case of tie low bids, award shall be made in accordance with the PHA's/IHA's written policy and procedures.

(d) The PHA/IHA may reject any and all bids, accept other than the lowest bid (e.g., the apparent low bid is unreasonably low), and waive informalities or minor irregularities in bids received, in accordance with the PHA's/IHA's written policy and procedures.

(e) Unless precluded elsewhere in the solicitation, the PHA/IHA may accept any item or combination of items bid.

(f) The PHA/IHA may reject any bid as nonresponsive if it is materially unbalanced as to the prices for the various items of work to be performed. A bid is materially unbalanced when it is based on prices significantly less than cost for some work and prices which are significantly overstated for other work.

(g) A written award shall be furnished to the successful bidder within the period for acceptance specified in the bid and shall result in a binding contract without further action by either party.

**9. Bid Guarantee** (applicable to construction and equipment contracts exceeding $25,000)

All bids must be accompanied by a negotiable bid guarantee which shall not be less than five percent (10%) of the amount of the bid. The bid guarantee may be a certified check, bank draft, U.S. Government Bonds at par value, or a bid bond secured by a surety company acceptable to the U.S. Government and authorized to do business in the state where the work is to be performed. In the case where the work under the contract will be performed on an Indian reservation area, the bid guarantee may also be an irrevocable Letter of Credit (see provision 10, Assurance of Completion, below). Certified checks and bank drafts must be made payable to the order of the PHA/IHA. The bid guarantee shall insure the execution of the contract and the furnishing of a method of assurance of completion by the successful bidder as required by the solicitation. Failure to submit a bid guarantee with the bid shall result in the rejection of the bid. Bid guarantees submitted by unsuccessful bidders will be returned as soon as practicable after bid opening.

**10. Assurance of Completion**

(a) Unless otherwise provided in State law, the successful bidder shall furnish an assurance of completion prior to the execution of any contract under this solicitation. This assurance may be [Contracting Officer check applicable items] —

[ X ] (1) a performance and payment bond in a penal sum of 100 percent of the contract price; or, as may be required or permitted by State law;

[ ] (2) separate performance and payment bonds, each for 50 percent or more of the contract price;

[ ] (3) a 20 percent cash escrow;

[ ] (4) a 25 percent irrevocable letter of credit; or,

[ ] (5) an irrevocable letter of credit for 10 percent of the total contract price with a monitoring and disbursements agreement with the IHA (applicable only to contracts awarded by an IHA under the Indian Housing Program).

(b) Bonds must be obtained from guarantee or surety companies acceptable to the U.S. Government and authorized to do business in the state where the work is to be performed. Individual sureties will not be considered. U.S. Treasury Circular Number 570, published annually in the Federal Register, lists companies approved to act as sureties on bonds securing Government contracts, the maximum underwriting limits on each contract bonded, and the States in which the company is licensed to do business. Use of companies listed in this circular is mandatory. Copies of the circular may be downloaded on the U.S. Department of Treasury website **http://www.fms.treas.gov/c570/index.html**, or ordered for a minimum fee by contacting the Government Printing Office at (202) 512-2168.

(c) Each bond shall clearly state the rate of premium and the total amount of premium charged. The current power of attorney for the person who signs for the surety company must be attached to the bond. The effective date of the power of attorney shall not precede the date of the bond. The effective date of the bond shall be on or after the execution date of the contract.

(d) Failure by the successful bidder to obtain the required assurance of completion within the time specified, or within such extended period as the PHA/IHA may grant based upon reasons determined adequate by the PHA/IHA, shall render the bidder ineligible for award. The PHA/IHA may then either award the contract to the next lowest responsible bidder or solicit new bids. The PHA/IHA may retain the ineligible bidder's bid guarantee.

**11. Preconstruction Conference** (applicable to construction contracts)

After award of a contract under this solicitation and prior to the start of work, the successful bidder will be required to attend a preconstruction conference with representatives of the PHA/IHA and its architect/engineer, and other interested parties convened by the PHA/IHA. The conference will serve to acquaint the participants with the general plan of the construction operation and all other requirements of the contract (e.g., Equal Employment Opportunity, Labor Standards). The PHA/IHA will provide the successful bidder with the date, time, and place of the conference.

**12. Indian Preference Requirements** (applicable only if this solicitation is for a contract to be performed on a project for an Indian Housing Authority)

(a) HUD has determined that the contract awarded under this solicitation is subject to the requirements of section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450e(b)). Section 7(b) requires that any contract or subcontract entered into for the benefit of Indians shall require that, to the greatest extent feasible

(1) Preferences and opportunities for training and employment (other than core crew positions; see paragraph (h) below) in connection with the administration of such contracts or subcontracts be given to qualified "Indians." The Act defines "Indians" to mean persons who are members of an Indian tribe and defines "Indian tribe" to mean any Indian tribe, band, nation, or other organized group or community, including any Alaska Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act, which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians; and,

(2) Preference in the award of contracts or subcontracts in connection with the administration of contracts be given to Indian organizations and to Indian-owned economic enterprises, as defined in section 3 of the Indian Financing Act of 1974 (25 U.S.C. 1452). That Act defines "economic enterprise" to mean any Indian-owned commercial, industrial, or business activity established or organized for the purpose of profit, except that the Indian ownership must constitute not less than 51 percent of the enterprise; "Indian organization" to mean the governing body of any Indian tribe or entity established or recognized by such governing body; "Indian" to mean any person who is a member of any tribe, band, group, pueblo, or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs and any "Native" as defined in the Alaska Native Claims Settlement Act; and Indian "tribe" to mean any Indian tribe, band, group, pueblo, or community including Native villages and Native groups (including

corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs.

(b) (1) The successful Contractor under this solicitation shall comply with the requirements of this provision in awarding all subcontracts under the contract and in providing training and employment opportunities.

(2) A finding by the IHA that the contractor, either (i) awarded a subcontract without using the procedure required by the IHA, (ii) falsely represented that subcontracts would be awarded to Indian enterprises or organizations; or, (iii) failed to comply with the contractor's employment and training preference bid statement shall be grounds for termination of the contract or for the assessment of penalties or other remedies.

(c) If specified elsewhere in this solicitation, the IHA may restrict the solicitation to qualified Indian-owned enterprises and Indian organizations. If two or more (or a greater number as specified elsewhere in the solicitation) qualified Indian-owned enterprises or organizations submit responsive bids, award shall be made to the qualified enterprise or organization with the lowest responsive bid. If fewer than the minimum required number of qualified Indian-owned enterprises or organizations submit responsive bids, the IHA shall reject all bids and readvertise the solicitation in accordance with paragraph (d) below.

(d) If the IHA prefers not to restrict the solicitation as described in paragraph (c) above, or if after having restricted a solicitation an insufficient number of qualified Indian enterprises or organizations submit bids, the IHA may advertise for bids from non-Indian as well as Indian-owned enterprises and Indian organizations. Award shall be made to the qualified Indian enterprise or organization with the lowest responsive bid if that bid is -

(1) Within the maximum HUD-approved budget amount established for the specific project or activity for which bids are being solicited; and

(2) No more than the percentage specified in 24 CFR 905.175(c) higher than the total bid price of the lowest responsive bid from any qualified bidder. If no responsive bid by a qualified Indian-owned economic enterprise or organization is within the stated range of the total bid price of the lowest responsive bid from any qualified enterprise, award shall be made to the bidder with the lowest bid.

(e) Bidders seeking to qualify for preference in contracting or subcontracting shall submit proof of Indian ownership with their bids. Proof of Indian ownership shall include but not be limited to:

(1) Certification by a tribe or other evidence that the bidder is an Indian. The IHA shall accept the certification of a tribe that an individual is a member.

(2) Evidence such as stock ownership, structure, management, control, financing and salary or profit sharing arrangements of the enterprise.

(f) (1) All bidders must submit with their bids a statement describing how they will provide Indian preference in the award of subcontracts. The specific requirements of that statement and the factors to used by the IHA in determining the statement's adequacy are included as an attachment to this solicitation. Any bid that fails to include the required statement shall be rejected as nonresponsive. The IHA may require that comparable statements be provided by subcontractors to the successful Contractor, and may require the Contractor to reject any bid or proposal by a subcontractor that fails to include the statement.

(2) Bidders and prospective subcontractors shall submit a certification (supported by credible evidence) to the IHA in any instance where the bidder or subcontractor believes it is infeasible to provide Indian preference in subcontracting. The acceptance or rejection by the IHA of the certification shall be final. Rejection shall disqualify the bid from further consideration.

(g) All bidders must submit with their bids a statement detailing their employment and training opportunities and their plans to provide preference to Indians in implementing the contract; and the number or percentage of Indians anticipated to be employed and trained. Comparable statements from all proposed subcontractors must be submitted. The criteria to be used by the IHA in determining the statement(s)'s adequacy are included as an attachment to this solicitation. Any bid that fails to include the required statement(s), or that includes a statement that does not meet minimum standards required by the IHA shall be rejected as nonresponsive.

(h) Core crew employees. A core crew employee is an individual who is a bona fide employee of the contractor at the time the bid is submitted; or an individual who was not employed by the bidder at the time the bid was submitted, but who is regularly employed by the bidder in a supervisory or other key skilled position when work is available. Bidders shall submit with their bids a list of all core crew employees.

(i) Preference in contracting, subcontracting, employment, and training shall apply not only on-site, on the reservation, or within the IHA's jurisdiction, but also to contracts with firms that operate outside these areas (e.g., employment in modular or manufactured housing construction facilities).

(j) Bidders should contact the IHA to determine if any additional local preference requirements are applicable to this solicitation.

(k) The IHA [ ] does [ ] does not [Contracting Officer check applicable box] maintain lists of Indian-owned economic enterprises and Indian organizations by specialty (e.g., plumbing, electrical, foundations), which are available to bidders to assist them in meeting their responsibility to provide preference in connection with the administration of contracts and subcontracts.

DOCUMENT 00 0120

REPRESENTATIONS, CERTIFICATIONS, and
OTHER STATEMENTS of BIDDERS

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HUD FORM 5369-A
REPRESENTATIONS, CERTIFICATIONS,
and
OTHER STATEMENTS of BIDDERS
PUBLIC AND INDIAN HOUSING PROGRAMS

(5 PAGES)

**U.S. Department of Housing and Urban Development**

Office of Public and Indian Housing

# Representations, Certifications, and Other Statements of Bidders

# Public and Indian Housing Programs

# Representations, Certifications, and Other Statements of Bidders

Public and Indian Housing Programs

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## 1. Certificate of Independent Price Determination

(a) The bidder certifies that--

(1) The prices in this bid have been arrived at independently, without, for the purpose of restricting competition, any consultation, communication, or agreement with any other bidder or competitor relating to (i) those prices, (ii) the intention to submit a bid, or (iii) the methods or factors used to calculate the prices offered;

(2) The prices in this bid have not been and will not be knowingly disclosed by the bidder, directly or indirectly, to any other bidder or competitor before bid opening (in the case of a sealed bid solicitation) or contract award (in the case of a competitive proposal solicitation) unless otherwise required by law; and

(3) No attempt has been made or will be made by the bidder to induce any other concern to submit or not to submit a bid for the purpose of restricting competition.

(b) Each signature on the bid is considered to be a certification by the signatory that the signatory--

(1) Is the person in the bidder's organization responsible for determining the prices being offered in this bid or proposal, and that the signatory has not participated and will not participate in any action contrary to subparagraphs (a)(l) through (a)(3) above; or

(2) (i) Has been authorized, in writing, to act as agent for the following principals in certifying that those principals have not participated, and will not participate in any action contrary to subparagraphs (a)(l) through (a)(3) above.

_____ [insert full name of person(s) in the bidder's organization responsible for determining the prices offered in this bid or proposal, and the title of his or her position in the bidder's organization];

(ii) As an authorized agent, does certify that the principals named in subdivision (b)(2)(i) above have not participated, and will not participate, in any action contrary to subparagraphs (a)(1) through (a)(3) above; and

(iii) As an agent, has not personally participated, and will not participate in any action contrary to subparagraphs (a)(1) through (a)(3) above.

(c) If the bidder deletes or modifies subparagraph (a)2 above, the bidder must furnish with its bid a signed statement setting forth in detail the circumstances of the disclosure.

[X] [Contracting Officer check if following paragraph is applicable]

(d) Non-collusive affidavit. (applicable to contracts for construction and equipment exceeding $50,000)

(1) Each bidder shall execute, in the form provided by the PHA/IHA, an affidavit to the effect that he/she has not colluded with any other person, firm or corporation in regard to any bid submitted in response to this solicitation. If the successful bidder did not submit the affidavit with his/her bid, he/she must submit it within three (3) working days of bid opening. Failure to submit the affidavit by that date may render the bid nonresponsive. No contract award will be made without a properly executed affidavit.

(2) A fully executed "Non-collusive Affidavit" [ ] is, [ ] is not included with the bid.

## 2. Contingent Fee Representation and Agreement

(a) Definitions. As used in this provision:

"Bona fide employee" means a person, employed by a bidder and subject to the bidder's supervision and control as to time, place, and manner of performance, who neither exerts, nor proposes to exert improper influence to solicit or obtain contracts nor holds out as being able to obtain any contract(s) through improper influence.

"Improper influence" means any influence that induces or tends to induce a PHA/IHA employee or officer to give consideration or to act regarding a PHA/IHA contract on any basis other than the merits of the matter.

(b) The bidder represents and certifies as part of its bid that, except for full-time bona fide employees working solely for the bidder, the bidder:

(1) [ ] has, [ ] has not employed or retained any person or company to solicit or obtain this contract; and

(2) [ ] has, [ ] has not paid or agreed to pay to any person or company employed or retained to solicit or obtain this contract any commission, percentage, brokerage, or other fee contingent upon or resulting from the award of this contract.

(c) If the answer to either (a)(1) or (a)(2) above is affirmative, the bidder shall make an immediate and full written disclosure to the PHA/IHA Contracting Officer.

(d) Any misrepresentation by the bidder shall give the PHA/IHA the right to (1) terminate the contract; (2) at its discretion, deduct from contract payments the amount of any commission, percentage, brokerage, or other contingent fee; or (3) take other remedy pursuant to the contract.

## 3. Certification and Disclosure Regarding Payments to Influence Certain Federal Transactions (applicable to contracts exceeding $100,000)

(a) The definitions and prohibitions contained in Section 1352 of title 31, United States Code, are hereby incorporated by reference in paragraph (b) of this certification.

(b) The bidder, by signing its bid, hereby certifies to the best of his or her knowledge and belief as of December 23, 1989 that:

(1) No Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with the awarding of a contract resulting from this solicitation;

(2) If any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress on his or her behalf in connection with this solicitation, the bidder shall complete and submit, with its bid, OMB standard form LLL, "Disclosure of Lobbying Activities;" and

(3) He or she will include the language of this certification in all subcontracts at any tier and require that all recipients of subcontract awards in excess of $100,000 shall certify and disclose accordingly.

(c) Submission of this certification and disclosure is a prerequisite for making or entering into this contract imposed by section 1352, title 31, United States Code. Any person who makes an expenditure prohibited under this provision or who fails to file or amend the disclosure form to be filed or amended by this provision, shall be subject to a civil penalty of not less than $10,000, and not more than $100,000, for each such failure.

(d) Indian tribes (except those chartered by States) and Indian organizations as defined in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 450B) are exempt from the requirements of this provision.

### 4. Organizational Conflicts of Interest Certification

The bidder certifies that to the best of its knowledge and belief and except as otherwise disclosed, he or she does not have any organizational conflict of interest which is defined as a situation in which the nature of work to be performed under this proposed contract and the bidder's organizational, financial, contractual, or other interests may, without some restriction on future activities:

(a) Result in an unfair competitive advantage to the bidder; or,

(b) Impair the bidder's objectivity in performing the contract work.

[ ] In the absence of any actual or apparent conflict, I hereby certify that to the best of my knowledge and belief, no actual or apparent conflict of interest exists with regard to my possible performance of this procurement.

### 5. Bidder's Certification of Eligibility

(a) By the submission of this bid, the bidder certifies that to the best of its knowledge and belief, neither it, nor any person or firm which has an interest in the bidder's firm, nor any of the bidder's subcontractors, is ineligible to:

(1) Be awarded contracts by any agency of the United States Government, HUD, or the State in which this contract is to be performed; or,

(2) Participate in HUD programs pursuant to 24 CFR Part 24.

(b) The certification in paragraph (a) above is a material representation of fact upon which reliance was placed when making award. If it is later determined that the bidder knowingly rendered an erroneous certification, the contract may be terminated for default, and the bidder may be debarred or suspended from participation in HUD programs and other Federal contract programs.

### 6. Minimum Bid Acceptance Period

(a) "Acceptance period," as used in this provision, means the number of calendar days available to the PHA/IHA for awarding a contract from the date specified in this solicitation for receipt of bids.

(b) This provision supersedes any language pertaining to the acceptance period that may appear elsewhere in this solicitation.

(c) The PHA/IHA requires a minimum acceptance period of [Contracting Officer insert time period] calendar days.

(d) In the space provided immediately below, bidders may specify a longer acceptance period than the PHA's/IHA's minimum requirement. The bidder allows the following acceptance period: calendar days.

(e) A bid allowing less than the PHA's/IHA's minimum acceptance period will be rejected.

(f) The bidder agrees to execute all that it has undertaken to do, in compliance with its bid, if that bid is accepted in writing within (1) the acceptance period stated in paragraph (c) above or (2) any longer acceptance period stated in paragraph (d) above.

### 7. Small, Minority, Women-Owned Business Concern Representation

The bidder represents and certifies as part of its bid/ offer that it --

(a) [ ] is, [ ] is not a small business concern. "Small business concern," as used in this provision, means a concern, including its affiliates, that is independently owned and operated, not dominant in the field of operation in which it is bidding, and qualified as a small business under the criteria and size standards in 13 CFR 121.

(b) [ ] is, [ ] is not a women-owned business enterprise. "Women-owned business enterprise," as used in this provision, means a business that is at least 51 percent owned by a woman or women who are U.S. citizens and who also control and operate the business.

(c) [ ] is, [ ] is not a minority business enterprise. "Minority business enterprise," as used in this provision, means a business which is at least 51 percent owned or controlled by one or more minority group members or, in the case of a publicly owned business, at least 51 percent of its voting stock is owned by one or more minority group members, and whose management and daily operations are controlled by one or more such individuals. For the purpose of this definition, minority group members are:

(Check the block applicable to you)

| | |
|---|---|
| [ ] Black Americans | [ ] Asian Pacific Americans |
| [ ] Hispanic Americans | [ ] Asian Indian Americans |
| [ ] Native Americans | [ ] Hasidic Jewish Americans |

### 8. Indian-Owned Economic Enterprise and Indian Organization Representation (applicable only if this solicitation is for a contract to be performed on a project for an Indian Housing Authority)

The bidder represents and certifies that it:

(a) [ ] is, [ ] is not an Indian-owned economic enterprise. "Economic enterprise," as used in this provision, means any commercial, industrial, or business activity established or organized for the purpose of profit, which is at least 51 percent Indian owned. "Indian," as used in this provision, means any person who is a member of any tribe, band, group, pueblo, or community which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs and any "Native" as defined in the Alaska Native Claims Settlement Act.

(b) [ ] is, [ ] is not an Indian organization. "Indian organization," as used in this provision, means the governing body of any Indian tribe or entity established or recognized by such governing body. Indian "tribe" means any Indian tribe, band, group, pueblo, or

community including Native villages and Native groups (including corporations organized by Kenai, Juneau, Sitka, and Kodiak) as defined in the Alaska Native Claims Settlement Act, which is recognized by the Federal Government as eligible for services from the Bureau of Indian Affairs.

**9. Certification of Eligibility Under the Davis-Bacon Act** (applicable to construction contracts exceeding $2,000)

(a) By the submission of this bid, the bidder certifies that neither it nor any person or firm who has an interest in the bidder's firm is a person or firm ineligible to be awarded contracts by the United States Government by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(b) No part of the contract resulting from this solicitation shall be subcontracted to any person or firm ineligible to be awarded contracts by the United States Government by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(c) The penalty for making false statements is prescribed in the U. S. Criminal Code, 18 U.S.C. 1001.

**10. Certification of Nonsegregated Facilities** (applicable to contracts exceeding $10,000)

(a) The bidder's attention is called to the clause entitled **Equal Employment Opportunity** of the General Conditions of the Contract for Construction.

(b) "Segregated facilities," as used in this provision, means any waiting rooms, work areas, rest rooms and wash rooms, restaurants and other eating areas, time clocks, locker rooms and other storage or dressing areas, parking lots, drinking fountains, recreation or entertainment areas, transportation, and housing facilities provided for employees, that are segregated by explicit directive or are in fact segregated on the basis of race, color, religion, or national origin because of habit, local custom, or otherwise.

(c) By the submission of this bid, the bidder certifies that it does not and will not maintain or provide for its employees any segregated facilities at any of its establishments, and that it does not and will not permit its employees to perform their services at any location under its control where segregated facilities are maintained. The bidder agrees that a breach of this certification is a violation of the Equal Employment Opportunity clause in the contract.

(d) The bidder further agrees that (except where it has obtained identical certifications from proposed subcontractors for specific time periods) prior to entering into subcontracts which exceed $10,000 and are not exempt from the requirements of the Equal Employment Opportunity clause, it will:

(1) Obtain identical certifications from the proposed subcontractors;

(2) Retain the certifications in its files; and

(3) Forward the following notice to the proposed subcontractors (except if the proposed subcontractors have submitted identical certifications for specific time periods):

**Notice to Prospective Subcontractors of Requirement for Certifications of Nonsegregated Facilities**

A Certification of Nonsegregated Facilities must be submitted before the award of a subcontract exceeding $10,000 which is not exempt from the provisions of the Equal Employment Opportunity clause of the prime contract. The certification may be submitted either for each subcontract or for all subcontracts during a period (i.e., quarterly, semiannually, or annually).

**Note:** The penalty for making false statements in bids is prescribed in 18 U.S.C. 1001.

**11. Clean Air and Water Certification** (applicable to contracts exceeding $100,000)

The bidder certifies that:

(a) Any facility to be used in the performance of this contract [ ] is, [ ] is not listed on the Environmental Protection Agency List of Violating Facilities:

(b) The bidder will immediately notify the PHA/IHA Contracting Officer, before award, of the receipt of any communication from the Administrator, or a designee, of the Environmental Protection Agency, indicating that any facility that the bidder proposes to use for the performance of the contract is under consideration to be listed on the EPA List of Violating Facilities; and,

(c) The bidder will include a certification substantially the same as this certification, including this paragraph (c), in every nonexempt subcontract.

**12. Previous Participation Certificate** (applicable to construction and equipment contracts exceeding $50,000)

(a) The bidder shall complete and submit with his/her bid the Form HUD-2530, "Previous Participation Certificate." If the successful bidder does not submit the certificate with his/her bid, he/she must submit it within three (3) working days of bid opening. Failure to submit the certificate by that date may render the bid nonresponsive. No contract award will be made without a properly executed certificate.

(b) A fully executed "Previous Participation Certificate"

[ ] is, [ ] is not included with the bid.

**13. Bidder's Signature**

The bidder hereby certifies that the information contained in these certifications and representations is accurate, complete, and current.

_____
(Signature and Date)

_____
(Typed or Printed Name)

_____
(Title)

_____
(Company Name)

(Company Address)

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DOCUMENT 00 0140

CONTRACT PROVISIONS
REQUIRED BY FEDERAL LAW

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HUD FORM 5369-B

CONTRACT PROVISIONS REQUIRED BY FEDERAL LAW

PUBLIC AND INDIAN HOUSING PROGRAMS

(4 PAGES)

**U.S. Department of Housing and Urban Development**
Office of Public and Indian Housing

OMB Approval No. 2577-0157 (exp. 11/30/2023)

# Contract Provisions Required by Federal Law or Owner Contract with the U.S. Department of Housing and Urban Development

# Contract Provisions Required by Federal Law or Owner Contract with the U.S. Department of Housing and Urban Development

**U. S. Department of Housing and Urban Development**
Office of Public and Indian Housing

OMB Approval No. 2577-0**157**
(exp. 3/31/2020)

Public reporting burden for this collection of information is estimated to average 3 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. HUD may not conduct or sponsor, and an applicant is not required to respond to a collection of information unless it displays a currently valid OMB control number.

These contracts between a HUD grantee (housing agency (HA)) and an architect/engineer (A/E) for design and construction services do not require either party to submit any materials to HUD. The forms provide a contractual agreement for the services to be provided by the A/E and establishes responsibilities of both parties pursuant to the contract. The regulatory authority is 2 CFR 200. These contractual agreements are required by Federal law or regulation pursuant to 2 CFR Part 200. Signing of the contracts is required to obtain or retain benefits. The contracts do not lend themselves to confidentiality.

1.0 Contract Provisions Required by Federal Law or Owner Contract with the U.S. Department of Housing and Urban Development (HUD).

1.1 Contract Adjustments. Notwithstanding any other term or condition of this Agreement, any settlement or equitable adjust-ment due to termination, suspension or delays by the Owner shall be negotiated based on the cost principles stated at 48 CFR Subpart 31.2

and conform to the Contract pricing provisions of 2 CFR 200.

1.2 Additional Services. The Owner shall perform a cost or price analysis as required by 2 CFR 200 prior to the issuance of a contract modification/amendment for Additional Services. Such Additional Services shall be within the general scope of services covered by this Agreement. The Design Profes-sional shall provide supporting cost information in sufficient detail to permit the Owner to perform the required cost or price analysis.

1.3 Restrictive Drawings and Specifications. In accordance with 2 CFR 200 and contract agreements between the Owner and HUD, the Design Professional shall not require the use of materials, products, or services that unduly restrict competition.

1.4 Design Certification. Where the Owner is required by federal regulations to provide HUD a Design Professional certification regarding the design of the Projects (24 CFR 905.312 ), the Design Professional shall provide such a certification to the Owner.

1.5 Retention and Inspection of Records. Pursuant to 24 CFR 85.26(i)(10) and (11), access shall be given by the Design Profes-sional to the Owner, HUD, the Comptroller General of the United States, or any of their duly authorized representatives, to any books, documents, papers, and records of the Design Professional which are directly pertinent to that specific Contract for the purpose of making an audit, examination, excerpts, and transcrip-tions. All required records shall be retained for three years after the Owner or Design Professional and other subgrantees make final payments and all other pending matters are closed.

1.6 Copyrights and Rights in Data. HUD has no regulations pertaining to copyrights or rights in data as provided in 24 CFR 85.36. HUD requirements, Article 45 of the General Conditions to the Contract for Construction (form HUD-5370) requires that contractors pay all royalties and license fees. All drawings and specifications prepared by the Design Professional pursuant to this contract will identify any applicable patents to enable the general contractor to fulfil the requirements of the construction contract.

1.7 Conflicts of Interest. Based in part on federal regulations (2 CFR 200) and Contract agreement between the Owner and HUD, no employee, officer, or agent of the Owner (HUD grantee) shall participate in selection, or in the award or admin-istration of a contract supported by Federal funds if a conflict of interest, real or apparent, would be involved.

Such a conflict would arise when:

(i) The employee, officer or agent,

(ii) Any member of his or her immediate family,

(iii) His or her partner, or

(iv) An organization that employs, or is about to employ, any of the above, has a financial or other interest in the firm selected for award. The grantee's or subgrantee's officers, employees or agents will neither solicit nor accept gratuities, favors or anything of monetary value from Contractors, or parties to sub-agreements. Grantees and subgrantees may set minimum rules where the financial interest is not substantial or the gift is an unsolicited item of nominal intrinsic value. To the extent permit-ted by State or local law or regulations, such standards or conduct will provide for penalties, sanctions, or other disciplinary actions for violations of such standards by the grantee's and subgrantee's officers, employees, or agents or by Contractors or their agents. The awarding agency may in regulation provide additional prohi-bitions relative to real, apparent, or potential conflicts of interest.

Neither the Owner nor any of its contractors or their subcontractors shall enter into any Contract, subcontract, or agreement, in connec-tion with any Project or any property included or planned to be included in any Project, in which any member, officer, or employee of the Owner, or any member of the governing body of the locality in which the Project is situated, or any member of the governing body of the locality in which the Owner was activated, or in any other public official of such locality or localities who exercises any responsibilities or functions with respect to the Project during his/her tenure or for one year thereafter has any interest, direct or indirect. If any such present or former member, officer, or employee of the Owner, or any such governing body member or such other public official of such locality or localities involuntarily acquires or had acquired prior to the beginning of his/her tenure any such interest, and if such interest is immediately disclosed to the Owner and such disclosure is entered upon the minutes of the Owner, the Owner, with the prior approval of the Government, may waive the prohibition contained in this subsection: Provided, That any such present member, officer, or employee of the Owner shall not participate in any action by the Owner relating to such contract, subcontract, or arrangement.

No member, officer, or employee of the Owner, no member of the governing body of the locality in which the project is situated, no member of the governing body of the locality in which the Owner was activated, and no other public official of such locality or localities who exercises any functions or responsibilities with respect to the project, during his/her tenure or for one year thereafter, shall have any interest, direct or indirect, in this contract or the proceeds thereof.

1.8 Disputes. In part because of HUD regulations (2 CFR 200), this Design Professional Agreement, unless it is a small urchase contract, has administrative, contractual, or legal remedies for instances where the Design Professional violates or breaches Agreement terms, and provide for such sanctions and penalties as may be appropriate.

1.9 Termination. In part because of HUD regulations (24 CFR 85.36(i)(2)), this Design Professional Agreement, unless it is for an amount of $10,000 or less, has requirements regarding termi-nation by the Owner when for cause or convenience. These include the manner by which the termination will be effected and basis for settlement.

1.10 Interest of Members of Congress. Because of Contract agreement between the Owner and HUD, no member of or delegate to the Congress of the United States of America or Resident Commissioner shall be admitted to any share or part of this Contract or to any benefit to arise from it.

1.11 Limitation of Payments to Influence Certain Federal Transaction. The Limitation on Use of Appropriated Funds to Influence Certain Federal Contracting and Financial Transactions Act, Section 1352 of Title 31 U.S.C., provides in part that no appropriated funds may be expended by recipient of a federal contract, grant, loan, or cooperative agreement to pay any person, including the Design Professional, for influencing or attempting to influence an officer or employee of Congress in connection with any of the following covered Federal actions: the awarding of any federal contract, the making of any Federal grant, the making of any federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any federal contract, grant, loan, or cooperative agreement.

1.12 Employment, Training, and Contracting Opportunities for Low-Income Persons, Section 3 of the Housing and Urban Development Act of 1968.

A. The work to be performed under this contract is subject to the requirements of section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (section 3). The purpose of section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, par-ticularly persons who are recipients of HUD assistance for hous-ing.

B. The parties to this contract agree to comply with HUD's regulations in 24 CFR part 135, which implement section 3. As evidenced by their execution of this contract, the parties to this contract certify that they are under no contractual or other impediment that would prevent them from complying with the part 135 regulations.

C. The contractor agrees to send to each labor organization or representative of workers with which the contractor has a collec-tive bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the p contractor's commitments under this section 3 clause, and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the section 3 preference, shall set forth minimum number and job titles subject to hire, availability of apprenticeship and training positions, the qualifications for each; and the name and location of the person(s) taking applications for each of the positions; and the anticipated date the work shall begin.

D. The contractor agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR part 135, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR part 135. The contractor will not subcon-tract with any subcontractor where the contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR part 135.

E. The contractor will certify that any vacant employment positions, including training positions, that are filled (1) after the contractor is selected but before the contract is executed, and (2) with persons other than those to whom the regulations of 24 CFR part 135 require employment opportunities to be directed, were not filled to circumvent the contractor's obligations under 24 CFR part 135.

F. Noncompliance with HUD's regulations in 24 CFR part 135 may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD assisted contracts.

G. Reserved.

H. Reserved.

1.13 Reserved.

1.14 Clean Air and Water. (Applicable to contracts in excess of $100,000). Because of 24 CFR 85.36(i)(12) and federal law, the Design Professional shall comply with applicable standards, orders, or requirements issued under section 306 of the Clean Air Act (42 U.S.C. § 1857h-4 transferred to 42 USC § 7607, section 508 of the Clean Water Act (33 U.S.C. § 1368), Executive Order 11738, and Environmental Protection Agency regulations (40 CFR part 15), on all contracts, subcontracts, and subgrants of amounts in excess of $100,000.

1.15 Energy Efficiency. Pursuant to Federal regulations (2 C.F.R 200) and Federal law, except when working on an Indian housing authority Project on an Indian reservation, the Design Professional shall comply with the mandatory standards and policies relating to energy efficiency which are contained in the state energy onservation plan issued in compliance with the Energy Policy and Conservation Act (Pub. L. 94-163 codified at 42 U.S.C.A. § 6321 et. seq.).

1.16 Prevailing Wages. In accordance with Section 12 of the U.S. Housing Act of 1937 (42 U.S.C. 1437j) the Design Professional shall pay not less than the wages prevailing in the locality, as determined by or adopted (subsequent to a determination under applicable State or local law) by the Secretary of HUD, to all architects, technical engineers, draftsmen, and technicians.

1.17 Non-applicability of Fair Housing Requirements in Indian 85. Housing Authority Contracts. Pursuant to 24 CFR section 905.115(b) title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d-2000d-4), which prohibits discrimination on the basis of race, color or national origin in federally assisted programs, and the Fair Housing Act (42 c U.S.C. 3601-3620), which prohibits discrimination based on race, color, religion, sex , national origin, handicap, or familial status in the sale or rental of housing do not apply to Indian Housing Authorities established by exercise of a Tribe's powers of self-government.

1.18 Prohibition Against Liens. The Design professional is Prohibited from placing a lien on the Owner's property. This prohibition shall be placed in all design professional subcontracts.

# DOCUMENT 00 0300

## BID FORM

Westmoreland County Housing Authority
Radon Testing & Mitigation
Multi-Family Housing & Hi-Rise Buildings

Proposal from _____, hereinafter called "Bidder".

Sirs:
Having examined the site of the work and the Contract Documents as prepared by Sleighter Design including the Drawings, Advertisement for Bid, Instructions to Bidders, Representations, Certifications and Other Statements of Bidders, Statement of Bidders Qualifications, this Bid Form, Bid/Performance/Labor and Material Bonds; Insurance Certificate, General Conditions, Supplemental Conditions of the Contract for Construction, Non-Collusive Affidavit, Supplemental General Conditions, Form of Contract, and the Technical Specifications, the undersigned submits this bid and encloses herewith a Bid Guarantee in the proper amount of 10% of the bid and payable to the Westmoreland County Housing Authority. Failure to furnish approved bonds and execute the contract within ten (10) calendar days from issuance of the award, the bid guarantee will be forfeited. Should the owner fail to make an award on this contract through no fault or failure on the part of this bidder, then the owner will return the Bid Guarantee to the Bidder.

It is hereby certified that the undersigned is the only person(s) interested in this bid as principal, and that the bid is made without collusion with any person, firm or corporation. Bidder hereby agrees to execute the contract and furnish surety company bonds in the following amounts within ten (10) calendar days after mailing by the owner of notice of award.

a. Performance Bond in the amount of one hundred percent (100%) of the contract price.
b. Labor and Materialmen's/Payment Bond in the amount of one hundred percent (100%) of the contract price, conditioned that the contractor will promptly pay for all material and labor supplied or performed in the prosecution of all work, whether or not the material and labor enter into and become component parts of the project.

Bidder further agrees to begin paperwork and site organization work, scheduling, assembling shop drawings and all other work possible within ten (10) calendar days after date of receipt of the executed contract. It is understood and agreed that this proposal is effective for acceptance by the Owner for a period of sixty (60) days.

Bidder agrees that, if awarded the contract, he will furnish and deliver all materials, tools, equipment, tests and transportation, secure all permits and licenses, do and perform all labor, superintendence, and all means of construction; pay all fees and do incidental work; and to execute, construct and finish in an expeditious, substantial, and workmanlike manner, in accordance with the drawings and specifications to the complete satisfaction and acceptance of the owner for the above captioned contract, and for the price hereinafter stated.

Bidder submits this bid with the understanding that all work shall be completed within 75 calendar days per site for the base bid. All work is to be completed in 365 calendar days.

**BASE BID GENERAL CONSTRUCTION**

| Public Housing Units | |
|---|---|
| **East Ken Manor - 200 Gardlock Ct. New Kensignton, Pa 15068** | |
| **Unit** | **Item Cost** |
| Unit 57 | $ |
| Unit 59 | $ |
| Unit 83 | $ |
| Unit 101 | $ |
| Unit 144 | $ |
| Unit 146 | $ |
| Unit 169 | $ |
| Unit 252 | $ |
| **New Stanton Manor - 118 New Stanton Manor Court, New Stanton, Pa 15672** | |
| **Unit** | **Item Cost** |
| Unit 25 | $ |
| Unit 26 | $ |
| Unit 28 | $ |
| Unit 49 | $ |
| Unit 50 | $ |
| Unit 52 | $ |
| Unit 62 | $ |
| **Park Manor - 1250 Park Manor Dr. Monessen, Pa 15062** | |
| **Unit** | **Item Cost** |
| Unit 301 | $ |
| Unit 405 | $ |
| **St. Clair Manor - 99 Kuvinka Ave. Seward, Pa 15954** | |
| **Unit** | **Item Cost** |
| Unit 167 | $ |
| **New Florence Manor - 100 Osborne St. New Florence, Pa 15944** | |
| **Unit** | **Item Cost** |
| Unit 103 | $ |
| **TOTAL COST OF ALL PUBLIC HOUSING UNITS** - $ | |

| CTSS Sites | |
|---|---|
| **Greenburg Townhomes - 320 Fox Hill Street, Greensburg, Pa 15601** | |
| **Unit** | **Item Cost** |
| Bldg. 3 - Unit 332 | $ |
| **Jeannette Townhomes - 1020 Whiteman Street, Jeannette, Pa 15644** | |
| **Unit** | **Item Cost** |
| Unit 1 | $ |
| Unit 7 | $ |
| **Latrobe Townhomes - 2507 South Ligonier Street, Latrobe, Pa 15650** | |
| **Unit** | **Item Cost** |
| 2507 S Ligonier St | $ |
| | |
| **TOTAL COST OF ALL CTSS UNITS** - $ | |

| NTSS Sites | |
|---|---|
| **Arnold Townhomes - 401 16th Street, Arnold, Pa 15068** | |
| **Unit** | **Item Cost** |
| 422 15th St. | $ |
| **Lower Burrell Townhomes - 212 MacBeth Drive, Lower Burrell, Pa 15068** | |
| **Unit** | **Item Cost** |
| 214 MacBeth Dr. | $ |
| 215 MacBeth Dr. | $ |
| 220 MacBeth Dr. | $ |
| 222 MacBeth Dr. | $ |
| **Parnassus Apartments - 431 & 437 Freeport Street, New Kensington, Pa 15068** | |
| **Unit** | **Item Cost** |
| 437 Freeport St. | $ |
| **Vandergrift Townhomes - 90 Emerson Court, Vandergrift, Pa 15690** | |
| **Unit** | **Item Cost** |
| 94B Emerson St | $ |
| 91B Emerson St | $ |
| 300B Poplar St | $ |
| | |
| **TOTAL COST OF ALL NTSS UNITS** - $ | |

For all Mitigation Company work indicated on the Contract Documents herein, the total sum of all three site types:

($_____), _____

Wage Rate Determination Used for Bid: _____
*(bidder to enter wage rate determination used)*

Schedule of Values – note that the Schedule of Values HUD Form 51000 is required to be submitted with the bid documents. Reference Section 00 0040 and Section 01 2000.

Bidder's Name:_____

Bidder's Signature:_____

Receipt of the following addenda and due consideration of their contents in the preparation of this bid is hereby acknowledged:

| Addendum No. | Contract No. | Dated |
|---|---|---|
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |
| _____ | _____ | _____ |

**Failure of Bidder to acknowledge receipt of addenda may be sufficient cause for rejection of his bid.**

Bidder's Name:_____

Bidder's Signature:_____

Date:_____

END OF DOCUMENT 00 0300

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DOCUMENT 00 0421

STATEMENT OF BIDDERS QUALIFICATIONS

(3 PAGES)

## STATEMENT OF BIDDER'S QUALIFICATIONS

All questions must be answered, and the data given must be clear and comprehensive. This Statement must be notarized.

1. Name of bidder _____
2. Business address _____
3. When organized _____
4. Where incorporated _____
5. How many years have you been engaged in the business for which this bid is intended under your present firm or trading name? _____
6. Credit available for this contract $ _____
7. Contract(s) now in hand, gross amount $ _____
8. Are you a Minority Contractor? _____
9. Are you a Female-Owned Contractor? _____
10. Number of Minority employed by your Company_____
11. Number of Females employed by your Company_____
12. Plan of organization (staffing):_____

    _____

    _____
13. Have you ever refused to sign a contract that was awarded to you? _____
14. Remarks (if any) on Item No.13:_____
15. Will you, upon request, furnish the Westmoreland County Housing Authority with a detailed Financial Statement or any other information as the Housing Authority may require?_____
16. Have you ever defaulted on a contract? _____
17. Remarks (if any) on Item No. 16: _____

    _____

18. I.R.S. REPORTING NO. OR SOCIAL SECURITY NO._____

19. List the 5 largest or most prestigious projects that you have completed in the past five years:

The undersigned hereby authorizes and requests any person to furnish any information requested by the Westmoreland County Housing Authority in verification of the recitals comprising this Statement of Bidder's Qualifications.

| Project Name | Contract Amount | Brief Description of Work Completed | Reference Name & Phone |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

Dated at _____this _____day of _____, 20_____

By _____

Title _____

State of _____)

County of _____)

_____, being duly sworn deposes and says that he/she is the

_____ of _____and that the answers to the

foregoing questions and all statements therein contained are true and correct.

Sworn to before me this _____day of _____, 20_____.

_____
NOTARY PUBLIC

My commission expires _____.

END OF DOCUMENT 00 0421

DOCUMENT 00 0700

GENERAL CONDITIONS

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HUD FORM 5370
GENERAL CONDITIONS OF THE CONTRACT
FOR CONSTRUCTION
PUBLIC AND INDIAN HOUSING PROGRAMS
(20 PAGES)

# General Conditions for Construction Contracts - Public Housing Programs

**U.S. Department of Housing and Urban Development**
Office of Public and Indian Housing
OMB Approval No. 2577-0157 (exp. 1/31/2027)

## Applicability. This form is applicable to any construction/development contract greater than $250,000.

Public reporting burden for this collection of information is estimated to average 1.0 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Comments regarding the accuracy of this burden estimate and any suggestions for reducing this burden can be sent to the Reports Management Officer, Office of Policy Development and Research, REE, Department of Housing and Urban Development, 451 7th St SW, Room 4176, Washington, DC 20410-5000. When providing comments, please refer to OMB Approval No. 2577-0157. This form includes those clauses required by OMB's common rule on grantee procurement, implemented at HUD in 2 CFR 200, and those requirements set forth in Section 3 of the Housing and Urban Development Act of 1968 and its amendment by the Housing and Community Development Act of 1992, implemented by HUD at 24 CFR Part 75. The form is required for construction contracts awarded by Public Housing Agencies (PHAs). The form is used by Housing Authorities in solicitations to provide necessary contract clauses. If the form were not used, PHAs would be unable to enforce their contracts. Responses to the collection of information are required to obtain a benefit or to retain a benefit. The information requested does not lend itself to confidentiality. HUD may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB number.


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## 1. Definitions

(a) "Architect" means the person or other entity engaged by the PHA to perform architectural, engineering, design, and other services related to the work as provided for in the contract. When a PHA uses an engineer to act in this capacity, the terms "architect" and "engineer" shall be synonymous. The Architect shall serve as a technical representative of the Contracting Officer. The Architect's authority is as set forth elsewhere in this contract.

(b) "Contract" means the contract entered into between the PHA and the Contractor. It includes the forms of Bid, the Bid Bond, the Performance and Payment Bond or Bonds or other assurance of completion, the Certifications, Representations, and Other Statements of Bidders (form HUD-5370), these General Conditions of the Contract for Construction (form HUD-5370), the applicable wage rate determinations from the U.S. Department of Labor, any special conditions included elsewhere in the contract, the specifications, and drawings. It includes all formal changes to any of those documents by addendum, change order, or other modification.

(c) "Contracting Officer" means the person delegated the authority by the PHA to enter into, administer, and/or terminate this contract and designated as such in writing to the Contractor. The term includes any successor Contracting Officer and any duly authorized representative of the Contracting Officer also designated in writing. The Contracting Officer shall be deemed the authorized agent of the PHA in all dealings with the Contractor.

(d) "Contractor" means the person or other entity entering into the contract with the PHA to perform all of the work required under the contract.

(e) "Drawings" means the drawings enumerated in the schedule of drawings contained in the Specifications and as described in the contract clause entitled Specifications and Drawings for Construction herein.

(f) "HUD" means the United States of America acting through the Department of Housing and Urban Development including the Secretary, or any other person designated to act on its behalf. HUD has agreed, subject to the provisions of an Annual Contributions Terms and Conditions (ACC), to provide financial assistance to the PHA, which includes assistance in financing the work to be performed under this contract. As defined elsewhere in these General Conditions or the contract documents, the determination of HUD may be required to authorize changes in the work or for release of funds to the PHA for payment to the Contractor. Notwithstanding HUD's role, nothing in this contract shall be construed to create any contractual relationship between the Contractor and HUD.

(g) "Project" means the entire project, whether construction or rehabilitation, the work for which is provided for in whole or in part under this contract.

(h) "PHA" means the Public Housing Agency organized under applicable state laws which is a party to this contract.

(j) "Specifications" means the written description of the technical requirements for construction and includes the criteria and tests for determining whether the requirements are met.

(l) "Work" means materials, workmanship, and manufacture and fabrication of components.

## 2. Contractor's Responsibility for Work

(a) The Contractor shall furnish all necessary labor, materials, tools, equipment, and transportation necessary for performance of the work. The Contractor shall also furnish all necessary water, heat, light, and power not made available to the Contractor by the PHA pursuant to the clause entitled Availability and Use of Utility Services herein.

(b) The Contractor shall perform on the site, and with its own organization, work equivalent to at least [ ] (12 percent unless otherwise indicated) of the total amount of work to be performed under the order. This percentage may be reduced by a supplemental agreement to this order if, during performing the work, the Contractor requests a reduction and the Contracting Officer determines that the reduction would be to the advantage of the PHA.

(c) At all times during performance of this contract and until the work is completed and accepted, the Contractor shall directly superintend the work or assign and have on the work site a competent superintendent who is satisfactory to the Contracting Officer and has authority to act for the Contractor.

(d) The Contractor shall be responsible for all damages to persons or property that occur as a result of the Contractor's fault or negligence, and shall take proper safety and health precautions to protect the work, the workers, the public, and the property of others. The Contractor shall hold and save the PHA, its officers and agents, free and harmless from liability of any nature occasioned by the Contractor's performance. The Contractor shall also be responsible for all materials delivered and work performed until completion and acceptance of the entire work, except for any completed unit of work which may have been accepted under the contract.

(e) The Contractor shall lay out the work from base lines and bench marks indicated on the drawings and be responsible for all lines, levels, and measurements of all work executed under the contract. The Contractor shall verify the figures before laying out the work and will be held responsible for any error resulting from its failure to do so.

(f) The Contractor shall confine all operations (including storage of materials) on PHA premises to areas authorized or approved by the Contracting Officer.

(g) The Contractor shall at all times keep the work area, including storage areas, free from accumulations of waste materials. After completing the work and before final inspection, the Contractor shall (1) remove from the premises all scaffolding, equipment, tools, and materials (including rejected materials) that are not the property of the PHA and all rubbish caused by its work; (2) leave the work area in a clean, neat, and orderly condition satisfactory to the Contracting Officer; (3) perform all specified tests; and, (4) deliver the installation in complete and operating condition.

(h) The Contractor's responsibility will terminate when all work has been completed, the final inspection made, and the work accepted by the Contracting Officer. The Contractor will then be released from further obligation except as required by the warranties specified elsewhere in the contract.

## 3. Architect's Duties, Responsibilities, and Authority

(a) The Architect for this contract, and any successor, shall be designated in writing by the Contracting Officer.

(b) The Architect shall serve as the Contracting Officer's technical representative with respect to architectural, **Schedule** engineering, and design matters related to the work performed under the contract. The Architect may provide direction on contract performance. Such direction shall be within the scope of the contract and may not be of a nature which: (1) institutes additional work outside the scope of the contract; (2) constitutes a change as defined in the Changes clause herein; (3) causes an increase or decrease in the cost of the contract; (4) alters the Construction Progress Schedule; or (5) changes any of the other express terms or conditions of the contract.

(c) The Architect's duties and responsibilities may include but shall not be limited to:

(1) Making periodic visits to the work site, and on the basis of his/her on-site inspections, issuing written reports to the PHA which shall include all observed deficiencies. The Architect shall file a copy of the report with the Contractor's designated representative at the site;

(2) Making modifications in drawings and technical specifications and assisting the Contracting Officer in the preparation of change orders and other contract modifications for issuance by the Contracting Officer;

(3) Reviewing and making recommendations with respect to - (i) the Contractor's construction progress schedules; (ii) the Contractor's shop and detailed drawings; (iii) the machinery, mechanical and other equipment and materials or other articles proposed for use by the Contractor; and, (iv) the Contractor's price breakdown and progress payment estimates; and,

(4) Assisting in inspections, signing Certificates of Completion, and making recommendations with respect to acceptance of work completed under the contract.

### 4. Other Contracts

The PHA may undertake or award other contracts for additional work at or near the site of the work under this contract. The Contractor shall fully cooperate with the other contractors and with PHA employees and shall carefully adapt scheduling and performing the work under this contract to accommodate the additional work, heeding any direction that may be provided by the Contracting Officer. The Contractor shall not commit or permit any act that will interfere with the performance of work by any other contractor or by PHA employees

## Construction Requirements

### 5. Pre-construction Conference and Notice to Proceed

(a) Within ten calendar days of contract execution, and prior to the commencement of work, the Contractor shall attend a preconstruction conference with representatives of the PHA, its Architect, and other interested parties convened by the PHA. The conference will serve to acquaint the participants with the general plan of the construction operation and all other requirements of the contract. The PHA will provide the Contractor with the date, time, and place of the conference.

(b) The contractor shall begin work upon receipt of a written Notice to Proceed from the Contracting Officer or designee. The Contractor shall not begin work prior to receiving such notice.

### 6. Construction Progress

(a) The Contractor shall, within five days after the work commences on the contract or another period of time determined by the Contracting Officer, prepare and submit to the Contracting Officer for approval three copies of a practicable schedule showing the order in which the Contractor proposes to perform the work, and the dates on which the Contractor contemplates starting and completing the several salient features of the work (including acquiring labor, materials, and equipment). The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion by any given date during the period. If the Contractor fails to submit a schedule within the time prescribed, the Contracting Officer may withhold approval of progress payments or take other remedies under the contract until the Contractor submits the required schedule.

(b) The Contractor shall enter the actual progress on the chart as required by the Contracting Officer, and immediately deliver three copies of the annotated schedule to the Contracting Officer. If the Contracting Officer determines, upon the basis of inspection conducted pursuant to the clause entitled Inspection and Acceptance of Construction, herein that the Contractor is not meeting the approved schedule, the Contractor shall take steps necessary to improve its progress, including those that may be required by the Contracting Officer, without additional cost to the PHA. In this circumstance, the Contracting Officer may require the Contractor to increase the number of shifts, overtime operations, days of work, and/or the amount of construction plant, and to submit for approval any supplementary schedule or schedules in chart form as the Contracting Officer deems necessary to demonstrate how the approved rate of progress will be regained.

(c) Failure of the Contractor to comply with the requirements of the Contracting Officer under this clause shall be grounds for a determination by the Contracting Officer that the Contractor is not prosecuting the work with sufficient diligence to ensure completion within the time specified in the Contract. Upon making this determination, the Contracting Officer may terminate the Contractor's right to proceed with the work, or any separable part of it, in accordance with the Default clause of this contract.

### 7. Site Investigation and Conditions Affecting the Work

(a) The Contractor acknowledges that it has taken steps reasonably necessary to ascertain the nature and location of the work, and that it has investigated and satisfied itself as to the general and local conditions which can affect the work or its cost, including but not limited to, (1) conditions bearing upon transportation, disposal, handling, and storage of materials; (2) the availability of labor, water, electric power, and roads;(3) uncertainties of weather, river stages, tides, or similar physical conditions at the site; (4) the conformation and conditions of the ground; and (5) the character of equipment and facilities needed preliminary to and during work performance. The Contractor also acknowledges that it has satisfied itself as to the character, quality, and quantity of surface and subsurface materials or obstacles to be encountered insofar as this information is

reasonably ascertainable from an inspection of the site, including all exploratory work done by the PHA, as well as from the drawings and specifications made a part of this contract. Any failure of the Contractor to take the actions described and acknowledged in this paragraph will not relieve the Contractor from responsibility for estimating properly the difficulty and cost of successfully performing the work, or for proceeding to successfully perform the work without additional expense to the PHA.

(b) The PHA assumes no responsibility for any conclusions or interpretations made by the Contractor based on the information made available by the PHA. Nor does the PHA assume responsibility for any understanding reached or representation made concerning conditions which can affect the work by any of its officers or agents before the execution of this contract, unless that understanding or representation is expressly stated in this contract.

## 8. Differing Site Conditions

(a) The Contractor shall promptly, and before the conditions are disturbed, give a written notice to the Contracting Officer of (1) subsurface or latent physical conditions at the site which differ materially from those indicated in this contract, or (2) unknown physical conditions at the site(s), of an unusual nature, which differ materially from those ordinarily encountered and generally recognized as inhering in work of the character provided for in the contract.

(b) The Contracting Officer shall investigate the site conditions promptly after receiving the notice. Work shall not proceed at the affected site, except at the Contractor's risk, until the Contracting Officer has provided written instructions to the Contractor. If the conditions do materially so differ and cause an increase or decrease in the Contractor's cost of, or the time required for, performing any part of the work under this contract, whether or not changed as a result of the conditions, the Contractor shall file a claim in writing to the PHA within ten days after receipt of such instructions and, in any event, before proceeding with the work. An equitable adjustment in the contract price, the delivery schedule, or both shall be made under this clause and the contract modified in writing accordingly.

(c) No request by the Contractor for an equitable adjustment to the contract under this clause shall be allowed, unless the Contractor has given the written notice required; provided, that the time prescribed in (a) above for giving written notice may be extended by the Contracting Officer.

(d) No request by the Contractor for an equitable adjustment to the contract for differing site conditions shall be allowed if made after final payment under this contract.

## 9. Specifications and Drawings for Construction

(a) The Contractor shall keep on the work site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. In case of discrepancy in the figures, in the drawings, or in the specifications, the matter shall be promptly submitted to the Contracting Officer, who shall promptly make a determination in writing. Any adjustment by the Contractor without such a determination shall be at its own risk and expense. The Contracting Officer shall furnish from time to time such detailed drawings and other information as considered necessary, unless otherwise provided.

(b) Wherever in the specifications or upon the drawings the words "directed", "required", "ordered", "designated", "prescribed", or words of like import are used, it shall be understood that the "direction", "requirement", "order", "designation", or "prescription", of the Contracting Officer is intended and similarly the words "approved", "acceptable", "satisfactory", or words of like import shall mean "approved by", or "acceptable to", or "satisfactory to" the Contracting Officer, unless otherwise expressly stated.

(c) Where "as shown" "as indicated", "as detailed", or words of similar import are used, it shall be understood that the reference is made to the drawings accompanying this contract unless stated otherwise. The word "provided" as used herein shall be understood to mean "provide complete in place" that is "furnished and installed".

(d) "Shop drawings" means drawings, submitted to the PHA by the Contractor, subcontractor, or any lower tier subcontractor, showing in detail (1) the proposed fabrication and assembly of structural elements and (2) the installation (i.e., form, fit, and attachment details) of materials of equipment. It includes drawings, diagrams, layouts, schematics, descriptive literature, illustrations, schedules, performance and test data, and similar materials furnished by the Contractor to explain in detail specific portions of the work required by the contract. The PHA may duplicate, use, and disclose in any manner and for any purpose shop drawings delivered under this contract.

(e) If this contract requires shop drawings, the Contractor shall coordinate all such drawings, and review them for accuracy, completeness, and compliance with other contract requirements and shall indicate its approval thereon as evidence of such coordination and review. Shop drawings submitted to the Contracting Officer without evidence of the Contractor's approval may be returned for resubmission. The Contracting Officer will indicate an approval or disapproval of the shop drawings and if not approved as submitted shall indicate the PHA's reasons therefore. Any work done before such approval shall be at the Contractor's risk. Approval by the Contracting Officer shall not relieve the Contractor from responsibility for any errors or omissions in such drawings, nor from responsibility for complying with the requirements of this contract, except with respect to variations described and approved in accordance with (f) below.

(f) If shop drawings show variations from the contract requirements, the Contractor shall describe such variations in writing, separate from the drawings, at the time of submission. If the Architect approves any such variation and the Contracting Officer concurs, the Contracting Officer shall issue an appropriate modification to the contract, except that, if the variation is minor or does not involve a change in price or in time of performance, a modification need not be issued.

(g) It shall be the responsibility of the Contractor to make timely requests of the PHA for such large scale and full size drawings, color schemes, and other additional information, not already in his possession, which shall be

required in the planning and production of the work. Such requests may be submitted as the need arises, but each such request shall be filed in ample time to permit appropriate action to be taken by all parties involved so as to avoid delay.

(h) The Contractor shall submit to the Contracting Officer for approval four copies (unless otherwise indicated) of all shop drawings as called for under the various headings of these specifications. Three sets (unless otherwise indicated) of all shop drawings, will be retained by the PHA and one set will be returned to the Contractor. As required by the Contracting Officer, the Contractor, upon completing the work under this contract, shall furnish a complete set of all shop drawings as finally approved. These drawings shall show all changes and revisions made up to the time the work is completed and accepted.

(i) This clause shall be included in all subcontracts at any tier. It shall be the responsibility of the Contractor to ensure that all shop drawings prepared by subcontractors are submitted to the Contracting Officer.

10. As-Built Drawings

(a) "As-built drawings," as used in this clause, means drawings submitted by the Contractor or subcontractor at any tier to show the construction of a particular structure or work as actually completed under the contract. "As-built drawings" shall be synonymous with "Record drawings."

(b) As required by the Contracting Officer, the Contractor shall provide the Contracting Officer accurate information to be used in the preparation of permanent as-built drawings. For this purpose, the Contractor shall record on one set of contract drawings all changes from the installations originally indicated, and record final locations of underground lines by depth from finish grade and by accurate horizontal offset distances to permanent surface improvements such as buildings, curbs, or edges of walks.

(c) This clause shall be included in all subcontracts at any tier. It shall be the responsibility of the Contractor to ensure that all as-built drawings prepared by subcontractors are submitted to the Contracting Officer.

11. Material and Workmanship

(a) All equipment, material, and articles furnished under this contract shall be new and of the most suitable grade for the purpose intended, unless otherwise specifically provided in this contract. References in the contract to equipment, material, articles, or patented processes by trade name, make, or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition. The Contractor may, at its option, use any equipment, material, article, or process that, in the judgment of, and as approved by the Contracting Officer, is equal to that named in the specifications, unless otherwise specifically provided in this contract.

(b) Approval of equipment and materials.

(1) The Contractor shall obtain the Contracting Officer's approval of the machinery and mechanical and other equipment to be incorporated into the work. When requesting approval, the Contractor shall furnish to the Contracting Officer the name of the manufacturer, the model number, and other information concerning the performance, capacity, nature, and rating of the machinery and mechanical and other equipment. When required by this contract or by the Contracting Officer, the Contractor shall also obtain the Contracting Officer's approval of the material or articles which the Contractor contemplates incorporating into the work. When requesting approval, the Contractor shall provide full information concerning the material or articles. Machinery, equipment, material, and articles that do not have the required approval shall be installed or used at the risk of subsequent rejection.

(2) When required by the specifications or the Contracting Officer, the Contractor shall submit appropriately marked samples (and certificates related to them) for approval at the Contractor's expense, with all shipping charges prepaid. The Contractor shall label, or otherwise properly mark on the container, the material or product represented, its place of origin, the name of the producer, the Contractor's name, and the identification of the construction project for which the material or product is intended to be used.

(3) Certificates shall be submitted in triplicate, describing each sample submitted for approval and certifying that the material, equipment or accessory complies with contract requirements. The certificates shall include the name and brand of the product, name of manufacturer, and the location where produced.

(4) Approval of a sample shall not constitute a waiver of the PHA right to demand full compliance with contract requirements. Materials, equipment and accessories may be rejected for cause even though samples have been approved.

(5) Wherever materials are required to comply with recognized standards or specifications, such specifications shall be accepted as establishing the technical qualities and testing methods, but shall not govern the number of tests required to be made nor modify other contract requirements. The Contracting Officer may require laboratory test reports on items submitted for approval or may approve materials on the basis of data submitted in certificates with samples. Check tests will be made on materials delivered for use only as frequently as the Contracting Officer determines necessary to insure compliance of materials with the specifications. The Contractor will assume all costs of retesting materials which fail to meet contract requirements and/or testing materials offered in substitution for those found deficient.

(6) After approval, samples will be kept in the Project office until completion of work. They may be built into the work after a substantial quantity of the materials they represent has been built in and accepted.

(c) Requirements concerning lead-based paint. The Contractor shall comply with the requirements concerning lead-based paint contained in the Lead-Based Paint Poisoning Prevention Act (42 U.S.C. 4821-4846) as implemented by 24 CFR Part 35.

12. Permits and Codes

(a) The Contractor shall give all notices and comply with all applicable laws, ordinances, codes, rules and regulations. Notwithstanding the requirement of the Contractor to comply with the drawings and specifications in the contract, all work installed shall comply with all applicable codes and regulations as amended by any

waivers. Before installing the work, the Contractor shall examine the drawings and the specifications for compliance with applicable codes and regulations bearing on the work and shall immediately report any discrepancy it may discover to the Contracting Officer. Where the requirements of the drawings and specifications fail to comply with the applicable code or regulation, the Contracting Officer shall modify the contract by change order pursuant to the clause entitled Changes herein to conform to the code or regulation.

(b) The Contractor shall secure and pay for all permits, fees, and licenses necessary for the proper execution and completion of the work. Where the PHA can arrange for the issuance of all or part of these permits, fees and licenses, without cost to the Contractor, the contract amount shall be reduced accordingly.

13. Health, Safety, and Accident Prevention

(a) In performing this contract, the Contractor shall:

(1) Ensure that no laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his/her health and/or safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation;

(2) Protect the lives, health, and safety of other persons;

(3) Prevent damage to property, materials, supplies, and equipment; and,

(4) Avoid work interruptions.

(b) For these purposes, the Contractor shall:

(1) Comply with regulations and standards issued by the Secretary of Labor at 29 CFR Part 1926. Failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act (Public Law 91-54, 83 Stat. 96), 40 U.S.C. 3701 et seq.; and

(2) Include the terms of this clause in every subcontract so that such terms will be binding on each subcontractor.

(c) The Contractor shall maintain an accurate record of exposure data on all accidents incident to work performed under this contract resulting in death, traumatic injury, occupational disease, or damage to property, materials, supplies, or equipment, and shall report this data in the manner prescribed by 29 CFR Part 1904.

(d) The Contracting Officer shall notify the Contractor of any noncompliance with these requirements and of the corrective action required. This notice, when delivered to the Contractor or the Contractor's representative at the site of the work, shall be deemed sufficient notice of the noncompliance and corrective action required. After receiving the notice, the Contractor shall immediately take corrective action. If the Contractor fails or refuses to take corrective action promptly, the Contracting Officer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. The Contractor shall not base any claim or request for equitable adjustment for additional time or money on any stop order issued under these circumstances.

(e) The Contractor shall be responsible for its subcontractors' compliance with the provisions of this clause. The Contractor shall take such action with respect to any subcontract as the PHA, the Secretary of Housing and Urban Development, or the Secretary of Labor shall direct as a means of enforcing such provisions.

14. Temporary Heating

The Contractor shall provide and pay for temporary heating, covering, and enclosures necessary to properly protect all work and materials against damage by dampness and cold, to dry out the work, and to facilitate the completion of the work. Any permanent heating equipment used shall be turned over to the PHA in the condition and at the time required by the specifications.

15. Availability and Use of Utility Services

(a) The PHA shall make all reasonably required amounts of utilities available to the Contractor from existing outlets and supplies, as specified in the contract. Unless otherwise provided in the contract, the amount of each utility service consumed shall be charged to or paid for by the Contractor at prevailing rates charged to the PHA or, where the utility is produced by the PHA, at reasonable rates determined by the Contracting Officer. The Contractor shall carefully conserve any utilities furnished without charge.

(b) The Contractor, at its expense and in a manner satisfactory to the Contracting Officer, shall install and maintain all necessary temporary connections and distribution lines, and all meters required to measure the amount of each utility used for the purpose of determining charges. Before final acceptance of the work by the PHA, the Contractor shall remove all the temporary connections, distribution lines, meters, and associated paraphernalia.

16. Protection of Existing Vegetation, Structures, Equipment, Utilities, and Improvements

(a) The Contractor shall preserve and protect all structures, equipment, and vegetation (such as trees, shrubs, and grass) on or adjacent to the work site, which are not to be removed under this contract, and which do not unreasonably interfere with the work required under this contract.

(b) The Contractor shall only remove trees when specifically authorized to do so, and shall avoid damaging vegetation that will remain in place. If any limbs or branches of trees are broken during performance of this contract, or by the careless operation of equipment, or by workmen, the Contractor shall trim those limbs or branches with a clean cut and paint the cut with a tree-pruning compound as directed by the Contracting Officer.

(c) The Contractor shall protect from damage all existing improvements and utilities (1) at or near the work site and (2) on adjacent property of a third party, the locations of which are made known to or should be known by the Contractor. Prior to disturbing the ground at the construction site, the Contractor shall ensure that all underground utility lines are clearly marked.

(d) The Contractor shall shore up, brace, underpin, secure, and protect as necessary all foundations and other parts of existing structures adjacent to, adjoining, and in the vicinity of the site, which may be affected by the excavations or other operations connected with the construction of the project.

(e) Any equipment temporarily removed as a result of work under this contract shall be protected, cleaned, and replaced in the same condition as at the time of award of this contract.

(f) New work which connects to existing work shall correspond in all respects with that to which it connects and/or be similar to existing work unless otherwise required by the specifications.

(g) No structural members shall be altered or in any way weakened without the written authorization of the Contracting Officer, unless such work is clearly specified in the plans or specifications.

(h) If the removal of the existing work exposes discolored or unfinished surfaces, or work out of alignment, such surfaces shall be refinished, or the material replaced as necessary to make the continuous work uniform and harmonious. This, however, shall not be construed to require the refinishing or reconstruction of dissimilar finishes previously exposed, or finished surfaces in good condition, but in different planes or on different levels **Construction** when brought together by the removal of intervening work, unless such refinishing or reconstruction is specified in the plans or specifications.

(i) The Contractor shall give all required notices to any adjoining or adjacent property owner or other party before the commencement of any work.

(j) The Contractor shall indemnify and save harmless the PHA from any damages on account of settlement or the loss of lateral support of adjoining property, any damages from changes in topography affecting drainage, and from all loss or expense and all damages for which the PHA may become liable in consequence of such injury or damage to adjoining and adjacent structures and their premises.

(k) The Contractor shall repair any damage to vegetation, structures, equipment, utilities, or improvements, including those that are the property of a third party, resulting from failure to comply with the requirements of this contract or failure to exercise reasonable care in performing the work. If the Contractor fails or refuses to repair the damage promptly, the Contracting Officer may have the necessary work performed and charge the cost to the Contractor.

## 17. Temporary Buildings and Transportation of Materials

(a) Temporary buildings (e.g., storage sheds, shops, offices, sanitary facilities) and utilities may be erected by the Contractor only with the approval of the Contracting Officer and shall be built with labor and materials furnished by the Contractor without expense to the PHA. The temporary buildings and utilities shall remain the property of the Contractor and shall be removed by the Contractor at its expense upon completion of the work. With the written consent of the Contracting Officer, the buildings and utilities may be abandoned and need not be removed.

(b) The Contractor shall, as directed by the Contracting Officer, use only established roadways, or use temporary roadways constructed by the Contractor when and as authorized by the Contracting Officer. When materials are transported in prosecuting the work, vehicles shall not be loaded beyond the loading capacity recommended by the manufacturer of the vehicle or prescribed by any federal, state, or local law or regulation. When it is necessary to cross curbs or sidewalks, the Contractor shall protect them from damage. The Contractor shall repair or pay for the repair of any damaged curbs, sidewalks, or roads.

## 18. Clean Air and Water

The contactor shall comply with the Clean Air Act, as amended, 42 USC 7401 et seq., the Federal Water Pollution Control Water Act, as amended, 33 U.S.C. 1251 et seq., and standards issued pursuant thereto in the facilities in which this contract is to be performed.

## 19. Energy Efficiency

The Contractor shall comply with mandatory standards and policies relating to energy efficiency which are contained in the energy conservation plan issued in compliance with the Energy Policy and Conservation Act (Pub.L. 94-163) for the State in which the work under the contract is performed.

## 20. Inspection and Acceptance of

(a) Definitions. As used in this clause -
(1) “Acceptance” means the act of an authorized representative of the PHA by which the PHA approves and assumes ownership of the work performed under this contract. Acceptance may be partial or complete.
(2) “Inspection” means examining and testing the work performed under the contract (including, when appropriate, raw materials, equipment, components, and intermediate assemblies) to determine whether it conforms to contract requirements.
(3) “Testing” means that element of inspection that determines the properties or elements, including functional operation of materials, equipment, or their components, by the application of established scientific principles and procedures.

(b) The Contractor shall maintain an adequate inspection system and perform such inspections as will ensure that the work performed under the contract conforms to contract requirements. All work is subject to PHA inspection and test at all places and at all reasonable times before acceptance to ensure strict compliance with the terms of the contract.

(c) PHA inspections and tests are for the sole benefit of the PHA and do not: (1) relieve the Contractor of responsibility for providing adequate quality control measures; (2) relieve the Contractor of responsibility for loss or damage of the material before acceptance; (3) constitute or imply acceptance; or, (4) affect the continuing rights of the PHA after acceptance of the completed work under paragraph (j) below.

(d) The presence or absence of the PHA inspector does not relieve the Contractor from any contract requirement, nor is the inspector authorized to change any term or condition of the specifications without the Contracting Officer’s written authorization. All instructions and approvals with respect to the work shall be given to the Contractor by the Contracting Officer.

(e) The Contractor shall promptly furnish, without additional charge, all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by the Contracting Officer. The PHA may charge to the Contractor any additional cost of inspection or test when work is not ready at the time specified by the Contractor for inspection or test, or when prior rejection makes reinspection or retest necessary. The PHA shall perform all inspections and tests in a manner that will not unnecessarily delay the work. Special, full size, and performance tests shall be performed as described in the contract.

(f) The PHA may conduct routine inspections of the construction site on a daily basis.

(g) The Contractor shall, without charge, replace or correct work found by the PHA not to conform to contract requirements, unless the PHA decides that it is in its interest to accept the work with an appropriate adjustment in contract price. The Contractor shall promptly segregate and remove rejected material from the premises.

(h) If the Contractor does not promptly replace or correct rejected work, the PHA may (1) by contract or otherwise, replace or correct the work and charge the cost to the Contractor, or (2) terminate for default the Contractor's right to proceed.

(i) If any work requiring inspection is covered up without approval of the PHA, it must, if requested by the Contracting Officer, be uncovered at the expense of the Contractor. If at any time before final acceptance of the entire work, the **Construction** PHA considers it necessary or advisable, to examine work already completed by removing or tearing it out, the Contractor, shall on request, promptly furnish all necessary facilities, labor, and material. If such work is found to be defective or nonconforming in any material respect due to the fault of the Contractor or its subcontractors, the Contractor shall defray all the expenses of the examination and of satisfactory reconstruction. If, however, such work is found to meet the requirements of the contract, the Contracting Officer shall make an equitable adjustment to cover the cost of the examination and reconstruction, including, if completion of the work was thereby delayed, an extension of time.

(j) The Contractor shall notify the Contracting Officer, in writing, as to the date when in its opinion all or a designated portion of the work will be substantially completed and ready for inspection. If the Architect determines that the state of preparedness is as represented, the PHA will promptly arrange for the inspection. Unless otherwise specified in the contract, the PHA shall accept, as soon as practicable after completion and inspection, all work required by the contract or that portion of the work the Contracting Officer determines and designates can be accepted separately. Acceptance shall be final and conclusive except for latent defects, fraud, gross mistakes amounting to fraud, or the PHA's right under any warranty or guarantee.

## 21. Use and Possession Prior to Completion

(a) The PHA shall have the right to take possession of or use any completed or partially completed part of the work. Before taking possession of or using any work, the Contracting Officer shall furnish the Contractor a list of items of work remaining to be performed or corrected on those portions of the work that the PHA intends to take possession of or use. However, failure of the Contracting Officer to list any item of work shall not relieve the Contractor of responsibility for complying with the terms of the contract. The PHA's possession or use shall not be deemed an acceptance of any work under the contract.

(b) While the PHA has such possession or use, the Contractor shall be relieved of the responsibility for (1) the loss of or damage to the work resulting from the PHA's possession or use, notwithstanding the terms of the clause entitled Permits and Codes herein; (2) all maintenance costs on the areas occupied; and, (3) furnishing heat, light, power, and water used in the areas occupied without proper remuneration therefore. If prior possession or use by the PHA delays the progress of the work or causes additional expense to the Contractor, an equitable adjustment shall be made in the contract price or the time of completion, and the contract shall be modified in writing accordingly.

## 22. Warranty of Title

The Contractor warrants good title to all materials, supplies, and equipment incorporated in the work and agrees to deliver the premises together with all improvements thereon free from any claims, liens or charges, and agrees further that neither it nor any other person, firm or corporation shall have any right to a lien upon the premises or anything appurtenant thereto.

## 23. Warranty of

(a) In addition to any other warranties in this contract, the Contractor warrants, except as provided in paragraph (j) of this clause, that work performed under this contract conforms to the contract requirements and is free of any defect in equipment, material, or workmanship performed by the Contractor or any subcontractor or supplier at any tier. This warranty shall continue for a period of _____ (one year unless otherwise indicated) from the date of final acceptance of the work. If the PHA takes possession of any part of the work before final acceptance, this warranty shall continue for a period of (one year unless otherwise indicated) from the date that the PHA takes possession.

(b) The Contractor shall remedy, at the Contractor's expense, any failure to conform, or any defect. In addition, the Contractor shall remedy, at the Contractor's expense, any damage to PHA-owned or controlled real or personal property when the damage is the result of—

(1) The Contractor's failure to conform to contract requirements; or

(2) Any defects of equipment, material, workmanship or design furnished by the Contractor.

(c) The Contractor shall restore any work damaged in fulfilling the terms and conditions of this clause. The Contractor's warranty with respect to work repaired or replaced will run for (one year unless otherwise indicated) from the date of repair or replacement.

(d) The Contracting Officer shall notify the Contractor, in writing, within a reasonable time after the discovery of any failure, defect or damage.

(e) If the Contractor fails to remedy any failure, defect, or damage within a reasonable time after receipt of notice, the PHA shall have the right to replace, repair or otherwise remedy the failure, defect, or damage at the Contractor's expense.

(f) With respect to all warranties, express or implied, from subcontractors, manufacturers, or suppliers for work performed and materials furnished under this contract, the Contractor shall:

(1) Obtain all warranties that would be given in normal commercial practice;

(2) Require all warranties to be executed in writing, for the benefit of the PHA; and,

(3) Enforce all warranties for the benefit of the PHA.

(g) In the event the Contractor's warranty under paragraph (a) of this clause has expired, the PHA may bring suit at its own expense to enforce a subcontractor's, manufacturer's or supplier's warranty.

(h) Unless a defect is caused by the negligence of the Contractor or subcontractor or supplier at any tier, the Contractor shall not be liable for the repair of any defect of material or design furnished by the PHA nor for the repair of any damage that results from any defect in PHA furnished material or design.

(i) Notwithstanding any provisions herein to the contrary, the establishment of the time periods in paragraphs (a) and (c) above relate only to the specific obligation of the Contractor to correct the work, and have no relationship to the time within which its obligation to comply with the contract may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to its obligation other than specifically to correct the work.

(j) This warranty shall not limit the PHA's rights under the Inspection and Acceptance of Construction clause of this contract with respect to latent defects, gross mistakes or fraud.

24. Prohibition Against Liens

The Contractor is prohibited from placing a lien on the PHA's property. This prohibition shall apply to all subcontractors at any tier and all materials suppliers.

## Administrative Requirements

25. Contract Period

this contract within calendar days of the effective date of the contract, or within the time schedule established in the notice to proceed issued by the Contracting Officer.

26. Order of Provisions

accordance with the terms and conditions of the

In the event of a conflict between these General Conditions and the Specifications, the General Conditions shall prevail. In the event of a conflict between the contract and any applicable state or local law or regulation, the state or local law or regulation shall prevail; provided that such state or local law or regulation does not conflict with, or is less restrictive than applicable federal law, regulation, or Executive Order. In the event of such a conflict, applicable federal law, regulation, and Executive Order shall prevail.

27. Payments

retain ten (10) percent of the amount of progress

(a) The PHA shall pay the Contractor the price as provided in this contract.

(b) The PHA shall make progress payments approximately every 30 days as the work proceeds, on estimates of work accomplished which meets the standards of quality established under the contract, as approved by the Contracting Officer. The PHA may, subject to written determination and approval of the Contracting Officer, make more frequent payments to contractors which are qualified small businesses.

(c) Before the first progress payment under this contract, the Contractor shall furnish, in such detail as requested by the Contracting Officer, a breakdown of the total contract price showing the amount included therein for each principal category of the work, which shall substantiate the payment amount requested in order to provide a basis for determining progress payments. The breakdown shall be approved by the Contracting Officer and must be acceptable to HUD. If the contract covers more than one project, the Contractor shall furnish a separate breakdown for each. The values and quantities employed in making up this breakdown are for determining the amount of progress payments and shall not be construed as a basis for additions to or deductions from the contract price. The Contractor shall prorate its overhead and profit over the construction period of the contract.

(d) The Contractor shall submit, on forms provided by the PHA, periodic estimates showing the value of the work performed during each period based upon the approved

submitted not later than _____ days in advance of the date set for payment and are subject to correction and revision as required. The estimates must be approved by the Contracting Officer with the concurrence of the Architect prior to payment. If the contract covers more than one project, the Contractor shall furnish a separate progress payment estimate for each.

(e) Along with each request for progress payments and the required estimates, the Contractor shall furnish the following certification, or payment shall not be made: I hereby certify, to the best of my knowledge and belief, that:

(1) The amounts requested are only for performance in accordance with the specifications, terms, and conditions of the contract;

(2) Payments to subcontractors and suppliers have been made from previous payments received under the contract, and timely payments will be made from the proceeds of the payment covered by this certification, in accordance with subcontract agreements; and,

(3) This request for progress payments does not include any amounts which the prime contractor intends to withhold or retain from a subcontractor or supplier in

subcontract.

**Name:**

Title:

Date:

(f) Except as otherwise provided in State law, the PHA shall

payments until completion and acceptance of all work under the contract; except, that if upon completion of 50 percent of the work, the Contracting Officer, after consulting with the Architect, determines that the Contractor's performance and progress are satisfactory, the PHA may make the remaining payments in full for the work subsequently completed. If the Contracting Officer subsequently determines that the Contractor's performance and progress are unsatisfactory, the PHA shall reinstate the ten (10) percent (or other percentage as provided in State law) retainage until such time as the Contracting Officer determines that performance and progress are satisfactory.

(g) The Contracting Officer may authorize material delivered on the site and preparatory work done to be taken into consideration when computing progress payments.

Material delivered to the Contractor at locations other than the site may also be taken into consideration if the Contractor furnishes satisfactory evidence that (1) it has acquired title to such material; (2) the material is properly stored in a bonded warehouse, storage yard, or similar suitable place as may be approved by the Contracting Officer; (3) the material is insured to cover its full value; and (4) the material will be used to perform this contract. Before any progress payment which includes delivered material is made, the Contractor shall furnish such documentation as the Contracting Officer may require to assure the protection of the PHA's interest in such materials. The Contractor shall remain responsible for such stored material notwithstanding the transfer of title to the PHA.

(h) All material and work covered by progress payments made shall, at the time of payment become the sole property of the PHA, but this shall not be construed as (1) relieving the Contractor from the sole responsibility for all material and work upon which payments have been made or the restoration of any damaged work; or, (2) waiving the right of the PHA to require the fulfillment of all of the terms of the contract. In the event the work of the Contractor has been damaged by other contractors or persons other than employees of the PHA in the course of their employment, the Contractor shall restore such damaged work without cost to the PHA and to seek redress for its damage only from those who directly caused it.

(i) The PHA shall make the final payment due the Contractor under this contract after (1) completion and final acceptance of all work; and (2) presentation of release of all claims against the PHA arising by virtue of this contract, other than claims, in stated amounts, that the Contractor has specifically excepted from the operation of the release. Each such exception shall embrace no more than one claim, the basis and scope of which shall be clearly defined. The amounts for such excepted claims shall not be included in the request for final payment. A release may also be required of the assignee if the Contractor's claim to amounts payable under this contract has been assigned.

(j) Prior to making any payment, the Contracting Officer may require the Contractor to furnish receipts or other evidence of payment from all persons performing work and supplying material to the Contractor, if the Contracting Officer determines such evidence is necessary to substantiate claimed costs.

(k) The PHA shall not; (1) determine or adjust any claims for payment or disputes arising there under between the Contractor and its subcontractors or material suppliers; or, (2) withhold any moneys for the protection of the subcontractors or material suppliers. The failure or refusal of the PHA to withhold moneys from the Contractor shall in nowise impair the obligations of any surety or sureties under any bonds furnished under this contract.

## 28. Contract Modifications

(a) Only the Contracting Officer has authority to modify any term or condition of this contract. Any contract modification shall be authorized in writing.

(b) The Contracting Officer may modify the contract unilaterally (1) pursuant to a specific authorization stated in a contract clause (e.g., Changes); or (2) for administrative matters which do not change the rights or responsibilities of the parties (e.g., change in the PHA address). All other contract modifications shall be in the form of supplemental agreements signed by the Contractor and the Contracting Officer.

(c) When a proposed modification requires the approval of HUD prior to its issuance (e.g., a change order that exceeds the PHA's approved threshold), such modification shall not be effective until the required approval is received by the PHA.

## 29. Changes

(a) The Contracting Officer may, at any time, without notice to the sureties, by written order designated or indicated to be a change order, make changes in the work within the general scope of the contract including changes:
(1) In the specifications (including drawings and designs);
(2) In the method or manner of performance of the work;
(3) PHA-furnished facilities, equipment, materials, services, or site; or,
(4) Directing the acceleration in the performance of the work.

(b) Any other written order or oral order (which, as used in this paragraph (b), includes direction, instruction, interpretation, or determination) from the Contracting Officer that causes a change shall be treated as a change order under this clause; provided, that the Contractor gives the Contracting Officer written notice stating (1) the date, circumstances and source of the order and (2) that the Contractor regards the order as a change order.

(c) Except as provided in this clause, no order, statement or conduct of the Contracting Officer shall be treated as a change under this clause or entitle the Contractor to an equitable adjustment.

(d) If any change under this clause causes an increase or decrease in the Contractor's cost of, or the time required for the performance of any part of the work under this contract, whether or not changed by any such order, the Contracting Officer shall make an equitable adjustment and modify the contract in writing. However, except for a adjustment based on defective specifications, no proposal for any change under paragraph (b) above shall be allowed for any costs incurred more than 20 days (5 days for oral orders) before the Contractor gives written notice as required. In the case of defective specifications for which the PHA is responsible, the equitable adjustment shall include any increased cost reasonably incurred by the Contractor in attempting to comply with the defective specifications.

(e) The Contractor must assert its right to an adjustment under this clause within 30 days after (1) receipt of a written change order under paragraph (a) of this clause, or (2) the furnishing of a written notice under paragraph (b) of this clause, by submitting a written statement describing the general nature and the amount of the proposal. If the facts justify it, the Contracting Officer may extend the period for submission. The proposal may be included in the notice required under paragraph (b) above. No proposal by the Contractor for an equitable adjustment shall be allowed if asserted after final payment under this contract.

(f) The Contractor's written proposal for equitable adjustment shall be submitted in the form of a lump sum proposal supported with an itemized breakdown of all increases and decreases in the contract in at least the following details:

(1) Direct Costs. Materials (list individual items, the quantity and unit cost of each, and the aggregate cost); Transportation and delivery costs associated with materials; Labor breakdowns by hours or unit costs (identified with specific work to be performed); Construction equipment exclusively necessary for the change; Costs of preparation and/ or revision to shop drawings resulting from the change; Worker's Compensation and Public Liability Insurance; Employment taxes under FICA and FUTA; and, Bond Costs when size of change warrants revision.

(2) Indirect Costs. Indirect costs may include overhead, general and administrative expenses, and fringe benefits not normally treated as direct costs.

(3) Profit. The amount of profit shall be negotiated and may vary according to the nature, extent, and complexity of the work required by the change. The allowability of the direct and indirect costs shall be determined in accordance with the Contract Cost Principles and Procedures for Commercial Firms in Part 31 of the Federal Acquisition Regulation (48 CFR 1-31), as implemented by HUD Handbook 2210.18, in effect on the date of this contract. The Contractor shall not be allowed a profit on the profit received by any subcontractor. Equitable adjustments for deleted work shall include a credit for profit and may include a credit for indirect costs. On proposals covering both increases and decreases in the amount of the contract, the application of indirect costs and profit shall be on the net-change in direct costs for the Contractor or subcontractor performing the work.

(g) The Contractor shall include in the proposal its request for time extension (if any), and shall include sufficient information and dates to demonstrate whether and to what extent the change will delay the completion of the contract in its entirety.

(h) The Contracting Officer shall act on proposals within 30 days after their receipt, or notify the Contractor of the date when such action will be taken.

(i) Failure to reach an agreement on any proposal shall be a dispute under the clause entitled Disputes herein. Nothing in this clause, however, shall excuse the Contractor from proceeding with the contract as changed.

(j) Except in an emergency endangering life or property, no change shall be made by the Contractor without a prior order from the Contracting Officer.

## 30. Suspension of Work

(a) The Contracting Officer may order the Contractor in writing to suspend, delay, or interrupt all or any part of the work of this contract for the period of time that the Contracting Officer determines appropriate for the convenience of the PHA.

(b) If the performance of all or any part of the work is, for an unreasonable period of time, suspended, delayed, or interrupted (1) by an act of the Contracting Officer in the administration of this contract, or (2) by the Contracting Officer's failure to act within the time specified (or within a reasonable time if not specified) in this contract an adjustment shall be made for any increase in the cost of performance of the contract (excluding profit) necessarily caused by such unreasonable suspension, delay, or interruption and the contract modified in writing accordingly. However, no adjustment shall be made under this clause for any suspension, delay, or interruption to the extent that performance would have been so suspended, delayed, or interrupted by any other cause, including the fault or negligence of the Contractor or for which any equitable adjustment is provided for or excluded under any other provision of this contract.

(c) A claim under this clause shall not be allowed (1) for any costs incurred more than 20 days before the Contractor shall have notified the Contracting Officer in writing of the act or failure to act involved (but this requirement shall not apply as to a claim resulting from a suspension order); and, (2) unless the claim, in an amount stated, is asserted in writing as soon as practicable after the termination of the suspension, delay, or interruption, but not later than the date of final payment under the contract.

## 31. Disputes

(a) "Claim," as used in this clause, means a written demand or written assertion by one of the contracting parties seeking, as a matter of right, the payment of money in a sum certain, the adjustment or interpretation of contract terms, or other relief arising under or relating to the contract. A claim arising under the contract, unlike a claim relating to the contract, is a claim that can be resolved under a contract clause that provides for the relief sought by the claimant. A voucher, invoice, or other routine request for payment that is not in dispute when submitted is not a claim. The submission may be converted to a claim by complying with the requirements of this clause, if it is disputed either as to liability or amount or is not acted upon in a reasonable time.

(b) Except for disputes arising under the clauses entitled Labor Standards - Davis Bacon and Related Acts, herein, all disputes arising under or relating to this contract, including any claims for damages for the alleged breach thereof which are not disposed of by agreement, shall be resolved under this clause.

(c) All claims by the Contractor shall be made in writing and submitted to the Contracting Officer for a written decision. A claim by the PHA against the Contractor shall be subject to a written decision by the Contracting Officer.

(d) The Contracting Officer shall, within 60 (unless otherwise indicated) days after receipt of the request, decide the claim or notify the Contractor of the date by which the decision will be made.

(e) The Contracting Officer's decision shall be final unless the Contractor (1) appeals in writing to a higher level in the PHA in accordance with the PHA's policy and procedures, (2) refers the appeal to an independent mediator or arbitrator, or (3) files suit in a court of competent jurisdiction. Such appeal must be made within (30 unless otherwise indicated) days after receipt of the Contracting Officer's decision.

(f) The Contractor shall proceed diligently with performance of this contract, pending final resolution of any request for relief, claim, appeal, or action arising under or relating to the contract, and comply with any decision of the Contracting Officer.

## 32. Default

(a) If the Contractor refuses or fails to prosecute the work, or any separable part thereof, with the diligence that will insure its completion within the time specified in this contract, or any extension thereof, or fails to complete said work within this time, the Contracting Officer may, by written notice to the Contractor, terminate the right to

proceed with the work (or separable part of the work) that has been delayed. In this event, the PHA may take over the work and complete it, by contract or otherwise, and may take possession of and use any materials, equipment, and plant on the work site necessary for completing the work. The Contractor and its sureties shall be liable for any damage to the PHA resulting from the Contractor's refusal or failure to complete the work within the specified time, whether or not the Contractor's right to proceed with the work is terminated. This liability includes any increased costs incurred by the PHA in completing the work.

(b) The Contractor's right to proceed shall not be terminated or the Contractor charged with damages under this clause if—

(1) The delay in completing the work arises from unforeseeable causes beyond the control and without the fault or negligence of the Contractor. Examples of such causes include (i) acts of God, or of the public enemy, (ii) acts of the PHA or other governmental entity in either its sovereign or contractual capacity, (iii) acts of another contractor in the performance of a contract with the PHA, (iv) fires, (v) floods, (vi) epidemics, (vii) quarantine restrictions, (viii) strikes, (ix) freight embargoes, (x) unusually severe weather, or (xi) delays of subcontractors or suppliers at any tier arising from unforeseeable causes beyond the control and without the fault or negligence of both the Contractor and the subcontractors or suppliers; and

(2) The Contractor, within days (10 days unless otherwise indicated) from the beginning of such delay (unless extended by the Contracting Officer) notifies the Contracting Officer in writing of the causes of delay. The Contracting Officer shall ascertain the facts and the extent of the delay. If, in the judgment of the Contracting Officer, the findings of fact warrant such action, time for completing the work shall be extended by written modification to the contract. The findings of the Contracting Officer shall be reduced to a written decision which shall be subject to the provisions of the Disputes clause of this contract.

(c) If, after termination of the Contractor's right to proceed, it is determined that the Contractor was not in default, or that the delay was excusable, the rights and obligations of the parties will be the same as if the termination had been for convenience of the PHA.

## 33. Liquidated Damages

(a) If the Contractor fails to complete the work within the time specified in the contract, or any extension, as specified in the clause entitled Default of this contract, the Contractor shall pay to the PHA as liquidated damages, the sum of $ _____ Contracting Officer insert amount] for each day of delay. If different completion dates are specified in the contract for separate parts or stages of the work, the amount of liquidated damages shall be assessed on those parts or stages which are delayed. To the extent that the Contractor's delay or nonperformance is excused under another clause in this contract, liquidated damages shall not be due the PHA. The Contractor remains liable for damages caused other than by delay.

(b) If the PHA terminates the Contractor's right to proceed, the resulting damage will consist of liquidated damages until such reasonable time as may be required for final completion of the work together with any increased costs occasioned the PHA in completing the work.

(c) If the PHA does not terminate the Contractor's right to proceed, the resulting damage will consist of liquidated damages until the work is completed or accepted.

## 34. Termination for Convenience

(a) The Contracting Officer may terminate this contract in whole, or in part, whenever the Contracting Officer determines that such termination is in the best interest of the PHA. Any such termination shall be effected by delivery to the Contractor of a Notice of Termination specifying the extent to which the performance of the work under the contract is terminated, and the date upon which such termination becomes effective.

(b) If the performance of the work is terminated, either in whole or in part, the PHA shall be liable to the Contractor for reasonable and proper costs resulting from such termination upon the receipt by the PHA of a properly presented claim setting out in detail: (1) the total cost of the work performed to date of termination less the total amount of contract payments made to the Contractor; (2) the cost (including reasonable profit) of settling and paying claims under subcontracts and material orders for work performed and materials and supplies delivered to the site, payment for which has not been made by the PHA to the Contractor or by the Contractor to the subcontractor or supplier; (3) the cost of preserving and protecting the work already performed until the PHA or assignee takes possession thereof or assumes responsibility therefore; (4) the actual or estimated cost of legal and accounting services reasonably necessary to prepare and present the termination claim to the PHA; and (5) an amount constituting a reasonable profit on the value of the work performed by the Contractor.

(c) The Contracting Officer will act on the Contractor's claim within days (60 days unless otherwise indicated) of receipt of the Contractor's claim.

(d) Any disputes with regard to this clause are expressly made subject to the provisions of the Disputes clause of this contract.

## 35. Assignment of Contract

The Contractor shall not assign or transfer any interest in this contract; except that claims for monies due or to become due from the PHA under the contract may be assigned to a bank, trust company, or other financial institution. Such assignments of claims shall only be made with the written concurrence of the Contracting Officer. If the Contractor is a partnership, this contract shall inure to the benefit of the surviving or remaining member(s) of such partnership as approved by the Contracting Officer.

## 36. Insurance

(a) Before commencing work, the Contractor and each subcontractor shall furnish the PHA with certificates of insurance showing the following insurance is in force and will insure all operations under the Contract:

(1) Workers' Compensation, in accordance with state or Territorial Workers' Compensation laws.

(2) Commercial General Liability with a combined single limit for bodily injury and property damage of not less than $ _____ [Contracting Officer insert amount]

per occurrence to protect the Contractor and each subcontractor against claims for bodily injury or death and damage to the property of others. This shall cover the use of all equipment, hoists, and vehicles on the site(s) not covered by Automobile Liability under (3) below. If the Contractor has a "claims made" policy, then the following additional requirements apply: the policy must provide a "retroactive date" which must be on or before the execution date of the Contract; and the extended reporting period may not be less than five years following the completion date of the Contract.

(3) Automobile Liability on owned and non -owned motor vehicles used on the site(s) or in connection therewith for a combined single limit for bodily injury and property damage of not less than $ _____ [Contracting Officer insert amount] per occurrence.

(b) Before commencing work, the Contractor shall furnish the PHA with a certificate of insurance evidencing that Builder's Risk (fire and extended coverage) Insurance on all work in place and/or materials stored at the building site(s), including foundations and building equipment, is in force. The Builder's Risk Insurance shall be for the benefit of the Contractor and the PHA as their interests may appear and each shall be named in the policy or policies as an insured. The Contractor in installing equipment supplied by the PHA shall carry insurance on such equipment from the time the Contractor takes possession thereof until the Contract work is accepted by the PHA. The Builder's Risk Insurance need not be carried on excavations, piers, footings, or foundations until such time as work on the superstructure is started. It need not be carried on landscape work. Policies shall furnish coverage at all times for the full cash value of all completed construction, as well as materials in place and/or stored at the site(s), whether or not partial payment has been made by the PHA. The Contractor may terminate this insurance on buildings as of the date taken over for occupancy by the PHA. The Contractor is not required to carry Builder's Risk Insurance for modernization work which does not involve structural alterations or additions and where the PHA's existing fire and extended coverage policy can be endorsed to include such work.

(c) All insurance shall be carried with companies which are financially responsible and admitted to do business in the State in which the project is located. If any such insurance is due to expire during the construction period, the Contractor (including subcontractors, as applicable) shall not permit the coverage to lapse and shall furnish evidence of coverage to the Contracting Officer. All certificates of insurance, as evidence of coverage, shall provide that no coverage may be canceled or non-renewed by the insurance company until at least 30 days prior written notice has been given to the Contracting Officer.

## 37. Subcontracts

(a) Definitions. As used in this contract -

(1) "Subcontract" means any contract, purchase order, or other purchase agreement, including modifications and change orders to the foregoing, entered into by a subcontractor to furnish supplies, materials, equipment, and services for the performance of the prime contract or a subcontract.

(2) "Subcontractor" means any supplier, vendor, or firm that furnishes supplies, materials, equipment, or services to or for the Contractor or another subcontractor.

(b) The Contractor shall not enter into any subcontract with any subcontractor who has been temporarily denied participation in a HUD program or who has been suspended or debarred from participating in contracting programs by any agency of the United States Government or of the state in which the work under this contract is to be performed.

(c) The Contractor shall be as fully responsible for the acts or omissions of its subcontractors, and of persons either directly or indirectly employed by them as for the acts or omissions of persons directly employed by the Contractor.

(d) The Contractor shall insert appropriate clauses in all subcontracts to bind subcontractors to the terms and conditions of this contract insofar as they are applicable to the work of subcontractors.

(e) Nothing contained in this contract shall create any contractual relationship between any subcontractor and the PHA or between the subcontractor and HUD.

## 38. Subcontracting with Small and Minority Firms, Women's Business Enterprise, and Labor Surplus Area Firms

The Contractor shall take the following steps to ensure that, whenever possible, subcontracts are awarded to small business firms, minority firms, women's business enterprises, and labor surplus area firms:

(a) Placing qualified small and minority businesses and women's business enterprises on solicitation lists;

(b) Ensuring that small and minority businesses and women's business enterprises are solicited whenever they are potential sources;

(c) Dividing total requirements, when economically feasible, into smaller tasks or quantities to permit maximum participation by small and minority businesses and women's business enterprises;

(d) Establishing delivery schedules, where the requirements of the contract permit, which encourage participation by small and minority businesses and women's business enterprises; and

(e) Using the services and assistance of the U.S. Small Business Administration, the Minority Business Development Agency of the U.S. Department of Commerce, and State and local governmental small business agencies.

## 39. Equal Employment Opportunity

During the performance of this contract, the Contractor/ Seller agrees as follows:

(a) The Contractor/Seller shall not discriminate against any employee or applicant for employment because of of race color, religion, sex, sexual orientation, gender identity, disability, or national origin.

(b) The Contractor/Seller shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, disability, or national origin. Such action shall include, but not be limited to, (1) employment, (2) upgrading demotion, (4) transfer, (5) recruitment or recruitment advertising, (6) layoff or termination, (7) rates of pay or other forms of compensation, and (8) selection for training,including apprenticeship

(c) The Contractor/Seller agrees to post in conspicuous places available to employees and applicants for employment the notices to be provided by the Contracting Officer setting forth the provisions of this nondiscrimination clause.
(d) The Contractor/Seller shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor/Seller, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.
(e) The Contractor/Seller shall send, to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, the notice to be provided by the Contracting Officer advising the labor union or workers' representative of the Contractor's commitments under this clause, and post copies of the notice in conspicuous places available to employees and applicants for employment.
(f) The Contractor/Seller shall comply with Executive Order 11246, as amended, and the rules, regulations, and orders of the Secretary of Labor.
(g) The Contractor/Seller shall furnish all information and reports required by Executive Order 11246, as amended, Section 503 of the Rehabilitation Act of 1973, as amended, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto. The Contractor/Seller shall permit

access to its books, records, and accounts by the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

(h) In the event of a that the Contractor/Seller is in noncompliance with the nondiscrimination clauses of this contract or with any of such rules, regulations, or orders, this contract may be canceled, terminated or suspended in whole or in part and the contractor/seller may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

(i)The contractor/seller will include the provisions of paragraphs (a) through (h) in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each sub[contractor/seller] or vendor. The [contractor/seller] will take such action with respect to any subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions in cluding sanctions for noncompliance: Provided, however, that in the event the [contractor/seller] becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction, the [contractor/seller] may request the United States to enter into such litigation to protect the interests of the United States.

(j) Compliance with the requirements of this clause shall be to the maximum extent consistent with, but not in derogation of, compliance with section 7(b) of the Indian Self-Determination and Education Assistance Act and the Indian Preference clause of this contract.

**40. Employment, Training, and Contracting Opportunities for Low-Income Persons, Section 3 of the Housing and Urban Development Act of 1968.**

(a) The work to be performed under this contract is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u (section 3). The purpose of section 3 is to ensure that employment and other economic opportunities generated by HUD assistance or HUD-assisted projects covered by Section 3, shall, to the greatest extent feasible, be directed to low- and very low-income persons, particularly persons who are recipients of HUD assistance for housing.
(b) The parties to this contract agree to comply with HUD's regulations in 24 CFR Part 75, which implement Section 3. As evidenced by their execution of this contract, the parties to this contract certify that they are under no contractual or other impediment that would prevent them from complying with the Part 75 regulations.
(c) The contractor agrees to send to each labor organization or representative of workers with which the contractor has a collective bargaining agreement or other understanding, if any, a notice advising the labor organization or workers' representative of the contractor's commitments under this section 3 clause and will post copies of the notice in conspicuous places at the work site where both employees and applicants for training and employment positions can see the notice. The notice shall describe the Section 3 prioritization requirements and shall state the minimum percentages of labor hour requirements established in the Benchmark Notice (FR-6085-N-04).
(d) The contractor agrees to include this section 3 clause in every subcontract subject to compliance with regulations in 24 CFR Part 75, and agrees to take appropriate action, as provided in an applicable provision of the subcontract or in this section 3 clause, upon a finding that the subcontractor is in violation of the regulations in 24 CFR Part 75. The contractor will not subcontract with any subcontractor where the contractor has notice or knowledge that the subcontractor has been found in violation of the regulations in 24 CFR Part 75.
(e) Noncompliance with HUD's regulations in 24 CFR Part 75 may result in sanctions, termination of this contract for default, and debarment or suspension from future HUD assisted contracts.
(f) Contracts, subcontracts, grants, or subgrants subject to Section 7(b) of the Indian Self-Determination and Education Assistance Act (25 U.S.C. 5307(b)) or subject to tribal preference requirements as authorized under 101(k) of the Native American Housing Assistance and Self-Determination Act (25 U.S.C. 4111(k)) must provide preferences in employment, training, and business opportunities to Indians and Indian organizations, and are therefore not subject to the requirements of 24 CFR Part 75.

## 41. Interest of Members of Congress

No member of or delegate to the Congress of the United States of America shall be admitted to any share or part of this contract or to any benefit that may arise therefrom.

## 42. Interest of Members, Officers, or Employees and Former Members, Officers, or Employees

No member, officer, or employee of the PHA, no member of the governing body of the locality in which the project is situated, no member of the governing body of the locality in which the PHA was activated, and no other public official of such locality or localities who exercises any functions or responsibilities with respect to the project, shall, during his or her tenure, or for one year thereafter, have any interest, direct or indirect, in this contract or the proceeds thereof.

## 43. Limitations on Payments made to Influence Certain Federal Financial Transactions

(a) The Contractor agrees to comply with Section 1352 of Title 31, United States Code which prohibits the use of Acts Federal appropriated funds to pay any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, and officer or employee of Congress, or an employee of a Member of Congress in connection with any of the following covered Federal actions: the awarding of any Federal contract; the making of any Federal grant; the making of any Federal loan; the entering into of any cooperative agreement; or the modification of any Federal contract, grant, loan, or cooperative agreement.

(b) The Contractor further agrees to comply with the requirement of the Act to furnish a disclosure (OMB Standard Form LLL, Disclosure of Lobbying Activities) if any funds other than Federal appropriated funds (including profit or fee received under a covered Federal transaction) have been paid, or will be paid, to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with a Federal contract, grant, loan, or cooperative agreement.

## 44. Royalties and Patents

The Contractor shall pay all royalties and license fees. It shall defend all suits or claims for infringement of any patent rights and shall save the PHA harmless from loss on account thereof; except that the PHA shall be responsible for all such loss when a particular design, process or the product of a particular manufacturer or manufacturers is specified and the Contractor has no reason to believe that the specified design, process, or product is an infringement. If, however, the Contractor has reason to believe that any design, process or product specified is an infringement of a patent, the Contractor shall promptly notify the Contracting Officer. Failure to give such notice shall make the Contractor responsible for resultant loss.

## 45. Examination and Retention of Contractor's Records

(a) The PHA, HUD, or Comptroller General of the United States, or any of their duly authorized representatives shall, until 3 years after final payment under this contract, have access to and the right to examine any of the Contractor's directly pertinent books, documents, papers, or other records involving transactions related to this contract for the purpose of making audit, examination, excerpts, and transcriptions.

(b) The Contractor agrees to include in first-tier subcontracts under this contract a clause substantially the same as paragraph (a) above. "Subcontract," as used in this clause, excludes purchase orders not exceeding $10,000.

(c) The periods of access and examination in paragraphs (a) and (b) above for records relating to (1) appeals under the Disputes clause of this contract, (2) litigation or settlement of claims arising from the performance of this contract, or (3) costs and expenses of this contract to which the PHA, HUD, or Comptroller General or any of their duly authorized representatives has taken exception shall continue until disposition of such appeals, litigation, claims, or exceptions.

## 46. Labor Standards - Davis-Bacon and Related

If the total amount of this contract exceeds $2,000, the Federal labor standards set forth in the clause below shall apply to the development or construction work to be performed under the contract.

(a) Minimum Wages.

(1) All laborers and mechanics employed under this contract in the development or construction of the project(s) involved will be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1(b)(2) of the Davis-Bacon Act on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs which cover the regular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits in the wage determination for the classification of work actually performed, without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein; provided, that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR 5.5(a)(1)(ii) and the Davis-Bacon poster (WH-1321) shall

be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(2) (i) Any class of laborers or mechanics, including helpers, which is not listed in the wage determination and which is to be employed under the contract shall be classified in conformance with the wage determination. HUD shall approve an additional classification and wage rate and fringe benefits therefor only when all the following criteria have been met: (A) The work to be performed by the classification requested is not performed by a classification in the wage determination; and (B) The classification is utilized in the area by the construction industry; and (C) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(ii) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and HUD or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by HUD or its designee to the Administrator of the Wage and Hour Division, Employee Standards Administration, U.S. Department of Labor, Washington, DC 20210. The Administrator, or an authorized representative, will approve, modify, or disapprove every additional classification action within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary.

(iii) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives, and HUD or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), HUD or its designee shall refer the questions, including the views of all interested parties and the recommendation of HUD or its designee, to the Administrator of the Wage and Hour Division for determination. The Administrator, or an authorized representative, will issue a determination within 30 days of receipt and so advise HUD or its designee or will notify HUD or its designee within the 30-day period that additional time is necessary.

(iv) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs (a)(2)(ii) or (iii) of this clause shall be paid to all workers performing work in the classification under this contract from the first day on which work is performed in classification.

(3) Whenever the minimum wage rate prescribed in the contract for a class of laborers or mechanics includes a fringe benefit which is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(4) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program; provided, that the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside in a separate account assets for the meeting of obligations under the plan or program.

(b) Withholding of funds. HUD or its designee shall, upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from the Contractor under this contract or any other Federal contract with the same prime Contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime Contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees, and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee, or helper, employed or working in the construction or development of the project, all or part of the wages required by the contract, HUD or its designee may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased. HUD or its designee may, after written notice to the Contractor, disburse such amounts withheld for and on account of the Contractor or subcontractor to the respective employees to whom they are due.

(c) Payrolls and basic records.

(1) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working in the construction or development of the project. Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in section 1(b)(2)(B) of the Davis-Bacon Act), daily and weekly number of hours worked, deductions made, and actual wages paid. Whenever the Secretary of Labor has found, under 29 CFR 5.5(a)(1)(iv), that the wages of any laborer or mechanic include the amount of costs reasonably anticipated in providing benefits under a plan or program described in section 1(b)(2)(B) of the Davis-Bacon Act, the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs.

(2) (i) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to the Contracting Officer for transmission to HUD or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under subparagraph (c)(1) of this clause. This information may be submitted in any form desired. Optional Form WH-347 (Federal Stock Number 029-005-00014-1) is available for this purpose and may be purchased from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. The Contractor is responsible for the submission of copies of payrolls by all subcontractors. (Approved by the Office of Management and Budget under OMB Control Number 1214-0149.)

(ii) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the contract and shall certify the following:

(A) That the payroll for the payroll period contains the information required to be maintained under paragraph (c) (1) of this clause and that such information is correct and complete;

(B) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR Part 3; and

(C) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the contract.

(iii) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirements for submission of the "Statement of Compliance" required by subparagraph (c)(2)(ii) of this clause.

(iv) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Section 3729 of Title 31 of the United States Code.

(3) The Contractor or subcontractor shall make the records required under subparagraph (c)(1) available for inspection, copying, or transcription by authorized representatives of HUD or its designee, the Contracting Officer, or the Department of Labor and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, HUD or its designee may, after written notice to the Contractor, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

(d) (1) Apprentices. Apprentices will be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship and Training, Employer and Labor Services (OATELS), or with a State Apprenticeship Agency recognized by OATELS, or if a person is employed in his or her first 90 days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by OATELS or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated in this paragraph, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. Where a contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator of the Wage and Hour Division determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event OATELS, or a State Apprenticeship Agency recognized by OATELS, withdraws approval of an apprenticeship program, the Contractor will no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(2) Trainees. Except as provided in 29 CFR 5.16, trainees will not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under

the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed in the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate in the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate who is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate in the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate in the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor will no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(3) Equal employment opportunity. The utilization of apprentices, trainees, and journeymen under this clause shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

(e) Compliance with Copeland Act requirements. The Contractor shall comply with the requirements of 29 CFR Part 3, which are hereby incorporated by reference in this contract.

(f) Contract termination; debarment. A breach of this contract clause may be grounds for termination of the contract and for debarment as a Contractor and a subcontractor as provided in 29 CFR 5.12.

(g) Compliance with Davis-Bacon and related Act requirements. All rulings and interpretations of the Davis-Bacon and related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this contract.

(h) Disputes concerning labor standards. Disputes arising out of the labor standards provisions of this clause shall not be subject to the general disputes clause of this contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and the PHA, HUD, the U.S. Department of Labor, or the employees or their representatives.

(i) Certification of eligibility.

(1) By entering into this contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded contracts by the United States Government by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(2) No part of this contract shall be subcontracted to any person or firm ineligible for award of a United States Government contract by virtue of section 3(a) of the Davis-Bacon Act or 29 CFR 5.12(a)(1).

(3) The penalty for making false statements is prescribed in the U. S. Criminal Code, 18 U.S.C. 1001.

(j) Contract Work Hours and Safety Standards Act. As used in this paragraph, the terms "laborers" and "mechanics" include watchmen and guards.

(1) Overtime requirements. No contractor or subcontractor contracting for any part of the contract work which may require or involve the employment of laborers or mechanics, including watchmen and guards, shall require or permit any such laborer or mechanic in any workweek in which the individual is employed on such work to work in excess of 40 hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of 40 hours in such workweek.

(2) Violation; liability for unpaid wages; liquidated damages. In the event of any violation of the provisions set forth in subparagraph (j)(1) of this clause, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, such Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory), for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic (including watchmen and guards) employed in violation of the provisions set forth in subparagraph (j)(1) of this clause, in the sum of $27 for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of 40 hours without payment of the overtime wages required by provisions set forth in subparagraph (j)(1) of this clause. DOL posts current fines at: https://www.dol.gov/whd/govcontracts/cwhssa.htm#cmp

(3) Withholding for unpaid wages and liquidated damages. HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld, from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract or any Federal contract with the same prime Contractor, or any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act, which is held by the same prime Contractor, such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the provisions set forth in subparagraph (j)(2) of this clause.

(k) Subcontracts. The Contractor or subcontractor shall insert in any subcontracts all the provisions contained in this clause, and such other clauses as HUD or its designee may by appropriate instructions require, and also a clause requiring the subcontractors to include these provisions in any lower tier subcontracts. The prime Contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all these provisions.

47. Non-Federal Prevailing Wage Rates

(a) Any prevailing wage rate (including basic hourly rate and any fringe benefits), determined under State or tribal law to be prevailing, with respect to any employee in any trade or position employed under the contract, is inapplicable to the contract and shall not be enforced against the Contractor or any subcontractor, with respect to employees engaged under the contract whenever such non-Federal prevailing wage rate exceeds:

(1) The applicable wage rate determined by the Secretary of Labor pursuant to the Davis-Bacon Act (40 U.S.C. 3141 et seq.) to be prevailing in the locality with respect to such trade;

(b) An applicable apprentice wage rate based thereon specified in an apprenticeship program registered with the U.S. Department of Labor (DOL) or a DOL-recognized State Apprenticeship Agency; or

(c) An applicable trainee wage rate based thereon specified in a DOL-certified trainee program.

48. Procurement of Recovered Materials.

(a) In accordance with Section 6002 of the Solid Waste Disposal Act, as amended by the Resource Conservation and Recovery Act, the Contractor shall procure items designated in guidelines of the Environmental Protection Agency (EPA) at 40 CFR Part 247 that contain the highest percentage of recovered materials practicable, consistent with maintaining a satisfactory level of competition. The Contractor shall procure items designated in the EPA guidelines that contain the highest percentage of recovered materials practicable unless the Contractor determines that such items: (1) are not reasonably available in a reasonable period of time; (2) fail to meet reasonable performance standards, which shall be determined on the basis of the guidelines of the National Institute of Standards and Technology, if applicable to the item; or (3) are only available at an unreasonable price.

( ) Paragraph (a) of this clause shall apply to items purchased under this contract where: (1) the Contractor purchases in excess of $10,000 of the item under this contract; or (2) during the preceding Federal fiscal year, the Contractor: (i) purchased any amount of the items for use under a contract that was funded with Federal appropriations and was with a Federal agency or a State agency or agency of a political subdivision of a State; and (ii) purchased a total of in excess of $10,000 of the item both under and outside that contract.

DOCUMENT 00 0710

"EXHIBIT B"

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THE MINORITY BUSINESS ENTERPRISE PROGRAM
IN COMPLIANCE WITH EXECUTIVE ORDER 11625
(3 PAGES)

"EXHIBIT B"

THE MINORITY BUSINESS ENTERPRISE PROGRAM
IN COMPLIANCE WITH EXECUTIVE ORDER 11625

The Westmoreland County Housing Authority hereby adopts this Affirmative Action Program for the Utilization of Minority Businesses, in compliance with Executive Order 11625.

OBJECTIVE
To affirmatively provide opportunities for business participation by Minority Businesses.

POLICY:
It is the Policy of the Westmoreland County Housing Authority to implement Executive Order 11625 that, to the fullest extent feasible, opportunities for full participation by Minority Business Enterprises will be provided.

BOUNDARIES:
There are no boundaries to the area of coverage to the Minority Business Enterprise Program. However, priority of consideration will be afforded to those sub-areas of lesser geographical definition as they relate to specific projects and opportunities.

ANALYSIS:
In order to access realistically the potential for involvement relative to Minority Business Enterprise Participation, the Small Business Administration, Department of Labor, Minority Business Directory, Employment Security Office, the Department of Housing and Urban Development, and the Department of Labor will be consulted. The Westmoreland County Housing Authority will through contract conditions, require compliance by all Contractors and Subcontractors with the intent and purpose of this Minority Business Enterprise Program.

GOALS:
Minority Business Enterprise goals will be projected on an annual basis by the Westmoreland County Housing Authority. The Annual Goals may be realized by the Westmoreland County Housing Authority through the Annual Operating Budget and/or sub-goals on specified projects.

OUTREACH:
Bidding procedures will be in compliance with Federal, State, and Local Statutes. Advertising will be done in the local newspapers once a week for a period of two (2) weeks. Also, all Minority Contractors listed in the current Minority Business Directory will be sent a copy of the advertisement. In addition, copies of the Advertisement will send to the Minority Business Opportunity Committee and Dodge Reports. Special notice will be given to community organizations, both public and private, with interest in minority affairs. All advertisements and notices will contain the Executive Order 11625 requirements.

THE MINORITY BUSINESS ENTERPRISE PROGRAM – PAGE 2

MONITORING:
The Westmoreland County Housing Authority will be responsible for the implementation and monitoring of this Program. Contracts will be monitored weekly, with a monthly report listing the extent of the minority utilization. In the event that projected goals are not met, a concentrated effort will be made in order to meet stated goals.

SANCTIONS:
Any compliance or disputes which may arise in connection with the Minority Business Enterprise Program operation will be resolved by the Westmoreland County Housing Authority. If not resolved, the matter shall be referred to the Fair Housing and Equal Opportunity Division, Pittsburgh Area Office, U.S. Department of Housing and Urban Development, for advice and assistance.

EVALUATION:
The Westmoreland County Housing Authority will, on a timely basis, with the assistance of the U.S. Department of Housing and Urban Development, evaluate the success of this Program, and take the appropriate measure to improve the operation of the Minority Business Enterprise Program.

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"EXHIBIT C"

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THE MINORITY BUSINESS ENTERPRISE PROGRAM

(4 PAGES)

"EXHIBIT C"

PART OF GENERAL CONDITIONS
PROVISIONS AND PROCEDURES
Pertaining to
THE MINORITY BUSINESS ENTERPRISE PROGRAM
IN CONNECTION WITH FEDERAL ASSISTED PROJECTS
IN COMPLIANCE WITH EXECUTIVE ORDER 11625

OBJECTIVE

The procedures set forth in this Part contain the method approved by the Secretary of Housing and Urban Development for carrying out the responsibilities under Executive Order 11625.

DEFINITION

Executive Order 11625 covered projects means any project assisted by any program administered by the Secretary of Housing and Urban Development in which loans, grants, subsidies, or other financial assistance is provided.

Minority is defined racially, to include Negro/black, Spanish American, American Indian, Oriental, and others, not ethnically.

Work – is defined for purposes of Executive Order 11625 as construction or construction related activities including the purchase of goods, supplies and services.

ASSURANCE OF COMPLIANCE

Every contractor and subcontractor shall incorporate, or cause to be incorporated, in all contracts for work in connection with a Federally assisted project the following:

A. The work to be performed under this contract is on a project assisted under a program providing direct Federal financial assistance from the Department of Housing and Urban Development and is subject to the requirements of executive Order 11625.

B. The parties to this contract will comply with the intent and purposes of said Executive Order 11625, and all applicable procedures issued there under prior to the execution of this contract. The parties to this contract certify and agree that they are under no contractual or other disability, which would prevent them from complying with these requirements.

C. The contractor will send to appropriate minority organizations or representative(s) of minority(s) a notice advising the said minority organization or representative of his commitments under this Executive Order 11625 and shall retain copies of the notice in an appropriate file available for inspection by authorized party(s).

D. The contractor will include this Executive Order 11625 clause in every subcontract for work in connection with the project and will, at the directions of the applicant for or recipient of Federal financial assistance, take appropriate action pursuant to the subcontract upon a finding that the subcontractor is in non-compliance. The contractor will not subcontract with any subcontractor where it

has notice or knowledge that the latter will not participate and will not let any subcontract unless the subcontractor has first provided it with a preliminary statement of goals to comply with the intent and purpose of these procedures.

E. Compliance with the provisions of Executive Order 11625, the intent and purpose thereof, shall be a condition of the Federal financial assistance provided to the project, binding upon the applicant or recipient for such assistance, its successors, and assigns, to these sanctions specified by the grant or loan agreement or contract through which Federal assistance is provided.

PROCEDURES

Prior to the signing of the contract, the contractor shall provide a preliminary statement of minority business utilization where known; where not known, such information shall be supplied prior to the signing of any contract between the contractor and subcontractor.

UTILIZATION OF BUSINESSES

Each contractor and subcontractor undertaking work on an Executive Order 11625 covered object shall assure that to the greatest extent feasible, contracts for work to be performed connection with the projects are awarded to minority business concerns.

AFFIRMATIVE ACTION PLAN FOR UTILIZATION OF MINORITY BUSINESS

The contractor or subcontractor shall utilize minority business concerns in contracting for work to be performed in connection with the completion of the contract. To this end the contractor or subcontractor projects a utilization goal of $_____ or _____ _____% of total dollar amount, $_____.

GOAL ALLOCATIONS

| Category | Amount Available in Dollars | Amount Project in Dollars |
|---|---|---|
| Minority Business | $_____ | $_____ |
| Minority Contractors | $_____ | $_____ |

Set forth the dollar value of contracts to be awarded to eligible contractors and businesses within each category over the duration of this contract.

Analyze the minority potential for each category and set projected utilization goals for minority participation.

Ensure that the appropriate business concerns are timely notified of pending contractual opportunities either personally or through locally utilized media.

GOOD FAITH EFFORT

Each contractor and subcontractor seeking to establish that a good faith effort has been made shall, as a minimum, attempt to recruit from the appropriate areas the necessary eligible business concerns through:

A. Local advertising
B. Small Business Administration
C. Signs placed at the site.
D. U.S. Department of Commerce Funded Agency

E. Community Organizations
F. U.S. Department of Housing and Urban Development

CERTIFICATION OF COMPLIANCE

The contractor shall execute the Certificate of Compliance and shall cause all subcontractors undertaking work in connection with this contract to furnish the same.

MINORITY BUSINESS UTILIZATION CERTIFICATION

_____ Will abide by and initiate in all their subcontracts, to the greatest extent feasible, the requirements of Executive Order 11625.

_____ _____
DATE

_____
TITLE

DOCUMENT 00 0730

"EXHIBIT D"
(NOTE: EXHIBIT E – NOT USED)

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STANDARD FEDERAL EQUAL EMPLOYMENT OPPORTUNITY
CONSTRUCTION CONTRACT SPECIFICATIONS

(6 PAGES)

**“EXHIBIT D”**

**41 CFR 60 – 4.3** **GENERAL CONDITIONS**

Standard Federal Equal Employment Opportunity Construction Contract Specifications (Executive Order 11246)

1. As used in these specifications:
   a) ``Covered area'' means the geographical area described in the solicitation from which this contract resulted.
   b) ``Director'' means Director, Office of Federal Contract Compliance Programs, United States Department of Labor, or any person to whom the Director delegates authority.
   c) ``Employer identification number'' means the Federal Social Security number used on the Employer's Quarterly Federal Tax Return, U.S. Treasury Department Form 941.
   d) ``Minority'' includes:
      i. Black (all persons having origins in any of the Black African racial groups not of Hispanic origin);
      ii. Hispanic (all persons of Mexican, Puerto Rican, Cuban, Central or South American or other Spanish Culture or origin, regardless of race)
      iii. Asian and Pacific Islander (all persons having origins in any of the original peoples of the Far East, Southeast Asia, the Indian Subcontinent, or the Pacific Islands); and
      iv. American Indian or Alaskan Native (all persons having origins in any of the original peoples of North America and maintaining identifiable tribal affiliations through membership and participation or community identification).
2. Whenever the Contractor, or any Subcontractor at any tier, subcontracts a portion of the work involving any construction trade, it shall physically include in each subcontract in excess of $10,000 the provisions of these specifications and the Notice which contains the applicable goals for minority and female participation and which is set forth in the solicitations from which this contract resulted.
3. If the Contractor is participating (pursuant to 41 CFR 60-4.5) in a Hometown Plan approved by the U.S. Department of Labor in the covered area either individually or through an association, its affirmative action obligations on all work in the Plan area (including goals and timetables) shall be in accordance with that Plan for those trades which have unions participating in the Plan. Contractors must be able to demonstrate their participation in and compliance with the provisions of any such Hometown Plan. Each Contractor or Subcontractor participating in an approved Plan is individually required to comply with its obligations under the EEO clause, and to make a good faith effort to achieve each goal under the Plan in each trade in which it has employees. The overall good faith performance by other Contractors or Subcontractors toward a goal in an approved Plan does not excuse any covered Contractor's or Subcontractor's failure to take good faith efforts to achieve the Plan goals and timetables.
4. The Contractor shall implement the specific affirmative action standards provided in paragraphs 7 a through p of these specifications. The goals set forth in the solicitation from which this contract resulted are expressed as percentages of the total hours of employment and training of minority and female utilization the Contractor should reasonably be able to achieve in each construction trade in which it has employees in the covered area. Covered Construction contractors performing construction work in geographical areas where they do not have a Federal or federally assisted construction contract shall apply the minority and female goals established for the geographical area where the work is being performed. Goals are published periodically in the Federal Register in notice form, and such notices may be obtained from any Office of Federal Contract Compliance Programs office or from Federal procurement contracting officers. The Contractor is expected to make substantially uniform progress in meeting its goals in each craft during the period specified.
5. Neither the provisions of any collective bargaining agreement, nor the failure by a union with whom the Contractor has a collective bargaining agreement, to refer either minorities or women

shall excuse the Contractor's obligations under these specifications, Executive Order 11246, or the regulations promulgated pursuant thereto.

6. In order for the nonworking training hours of apprentices and trainees to be counted in meeting the goals, such apprentices and trainees must be employed by the Contractor during the training period, and the Contractor must have made a commitment to employ the apprentices and trainees at the completion of their training, subject to the availability of employment opportunities. Trainees must be trained pursuant to training programs approved by the U.S. Department of Labor.
7. The Contractor shall take specific affirmative actions to ensure equal employment opportunity. The evaluation of the Contractor's compliance with these specifications shall be based upon its effort to achieve maximum results from its actions. The Contractor shall document these efforts fully, and shall implement affirmative action steps at least as extensive as the following:
   a) Ensure and maintain a working environment free of harassment, intimidation, and coercion at all sites, and in all facilities at which the Contractor's employees are assigned to work. The Contractor, where possible, will assign two or more women to each construction project. The Contractor shall specifically ensure that all foremen, superintendents, and other on-site supervisory personnel are aware of and carry out the Contractor's obligation to maintain such a working environment, with specific attention to minority or female individuals working at such sites or in such facilities.
   b) Establish and maintain a current list of minority and female recruitment sources, provide written notification to minority and female recruitment sources and to community organizations when the Contractor or its unions have employment opportunities available, and maintain a record of the organizations' responses.
   c) Maintain a current file of the names, addresses and telephone numbers of each minority and female off-the-street applicant and minority or female referral from a union, a recruitment source or community organization and of what action was taken with respect to each such individual. If such individual was sent to the union hiring hall for referral and was not referred back to the Contractor by the union or, if referred, not employed by the Contractor, this shall be documented in the file with the reason therefore, along with whatever additional actions the Contractor may have taken.
   d) Provide immediate written notification to the Director when the union or unions with which the Contractor has a collective bargaining agreement has not referred to the Contractor a minority person or woman sent by the Contractor, or when the Contractor has other information that the union referral process has impeded the Contractor's efforts to meet its obligations.
   e) Develop on-the-job training opportunities and/or participate in training programs for the area which expressly include minorities and women, including upgrading programs and apprenticeship and trainee programs relevant to the Contractor's employment needs, especially those programs funded or approved by the Department of Labor. The Contractor shall provide notice of these programs to the sources compiled under 7b above.
   f) Disseminate the Contractor's EEO policy by providing notice of the policy to unions and training programs and requesting their cooperation in assisting the Contractor in meeting its EEO obligations; by including it in any policy manual and collective bargaining agreement; by publicizing it in the company newspaper, annual report, etc.; by specific review of the policy with all management personnel and with all minority and female employees at least once a year; and by posting the company EEO policy on bulletin boards accessible to all employees at each location where construction work is performed.
   g) Review, at least annually, the company's EEO policy and affirmative action obligations under these specifications with all employees having any responsibility for hiring, assignment, layoff, termination or other employment decisions including specific review of these items with onsite supervisory personnel such as Superintendents, General Foremen, etc., prior to the initiation of construction work at any job site. A written record shall be made and maintained identifying the time and place of these meetings, persons attending, subject matter discussed, and disposition of the subject matter.
   h) Disseminate the Contractor's EEO policy externally by including it in any advertising in the news media, specifically including minority and female news media, and providing written

notification to and discussing the Contractor's EEO policy with other Contractors and Subcontractors with whom the Contractor does or anticipates doing business.

i) Direct its recruitment efforts, both oral and written, to minority, female and community organizations, to schools with minority and female students and to minority and female recruitment and training organizations serving the Contractor's recruitment area and employment needs. Not later than one month prior to the date for the acceptance of applications for apprenticeship or other training by any recruitment source, the Contractor shall send written notification to organizations such as the above, describing the openings, screening procedures, and tests to be used in the selection process.

j) Encourage present minority and female employees to recruit other minority persons and women and, where reasonable, provide after school, summer and vacation employment to minority and female youth both on the site and in other areas of a Contractor's work force.

k) Validate all tests and other selection requirements where there is an obligation to do so under 41 CFR Part 60-3.

l) Conduct, at least annually, an inventory and evaluation at least of all minority and female personnel for promotional opportunities and encourage these employees to seek or to prepare for, through appropriate training, etc., such opportunities.

m) Ensure that seniority practices, job classifications, work assignments and other personnel practices, do not have a discriminatory effect by continually monitoring all personnel and employment related activities to ensure that the EEO policy and the Contractor's obligations under these specifications are being carried out.

n) Ensure that all facilities and company activities are non-segregated except that separate or single-user toilet and necessary changing facilities shall be provided to assure privacy between the sexes.

o) Document and maintain a record of all solicitations of offers or subcontracts from minority and female construction contractors and suppliers, including circulation of solicitations to minority and female contractor associations and other business associations.

p) Conduct a review, at least annually, of all supervisors' adherence to and performance under the Contractor's EEO policies and affirmative action obligations.

8. Contractors are encouraged to participate in voluntary associations which assist in fulfilling one or more of their affirmative action obligations (7a through p). The efforts of a contractor association, joint contractor-union, contractor-community, or other similar group of which the contractor is a member and participant, may be asserted as fulfilling any one or more of its obligations under 7a through p of these Specifications provided that the contractor actively participates in the group, makes every effort to assure that the group has a positive impact on the employment of minorities and women in the industry, ensures that the concrete benefits of the program are reflected in the Contractor's minority and female workforce participation, makes a good faith effort to meet its individual goals and timetables, and can provide access to documentation which demonstrates the effectiveness of actions taken on behalf of the Contractor. The obligation to comply, however, is the Contractor's and failure of such a group to fulfill an obligation shall not be a defense for the Contractor's noncompliance.

9. A single goal for minorities and a separate single goal for women have been established. The Contractor, however, is required to provide equal employment opportunity and to take affirmative action for all minority groups, both male and female, and all women, both minority and non-minority. Consequently, the Contractor may be in violation of the Executive Order if a particular group is employed in a substantially disparate manner (for example, even though the Contractor has achieved its goals for women generally, the Contractor may be in violation of the Executive Order if a specific minority group of women is underutilized).

10. The Contractor shall not use the goals and timetables or affirmative action standards to discriminate against any person because of race, color, religion, sex, or national origin.

11. The Contractor shall not enter into any Subcontract with any person or firm debarred from Government contracts pursuant to Executive Order 11246.

12. The Contractor shall carry out such sanctions and penalties for violation of these specifications and of the Equal Opportunity Clause, including suspension, termination and cancellation of existing subcontracts as may be imposed or ordered pursuant to Executive Order 11246, as

amended, and its implementing regulations, by the Office of Federal Contract Compliance Programs. Any Contractor who fails to carry out such sanctions and penalties shall be in violation of these specifications and Executive Order 11246, as amended.

13. The Contractor, in fulfilling its obligations under these specifications, shall implement specific affirmative action steps, at least as extensive as those standards prescribed in paragraph 7 of these specifications, so as to achieve maximum results from its efforts to ensure equal employment opportunity. If the Contractor fails to comply with the requirements of the Executive Order, the implementing regulations, or these specifications, the Director shall proceed in accordance with 41 CFR 60-4.8.
14. The Contractor shall designate a responsible official to monitor all employment related activity to ensure that the company EEO policy is being carried out, to submit reports relating to the provisions hereof as may be required by the Government and to keep records. Records shall at least include for each employee the name, address, telephone numbers, construction trade, union affiliation if any, employee identification number when assigned, social security number, race, sex, status (e.g., mechanic, apprentice trainee, helper, or laborer), dates of changes in status, hours worked per week in the indicated trade, rate of pay, and locations at which the work was performed. Records shall be maintained in an easily understandable and retrievable form; however, to the degree that existing records satisfy this requirement, contractors shall not be required to maintain separate records.
15. Nothing herein provided shall be construed as a limitation upon the application of other laws which establish different standards of compliance or upon the application of requirements for the hiring of local or other area residents (e.g., those under the Public Works Employment Act of 1977 and the Community Development Block Grant Program).

## EXECUTIVE ORDER 11246 CERTIFICATION

_____will abide by and initiate in all subcontracts, to the greatest extent feasible, the requirements of Executive Order 11246.

_____

_____
Title

_____
Date

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“EXHIBIT F”

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EXECUTIVE ORDER NO. 12138
(8 PAGES)

"EXHIBIT "F"

**EXECUTIVE ORDER NO. 12138**

**May 18, 1979, 44 F.R. 29637**

**CREATING A NATIONAL WOMEN'S BUSINESS ENTERPRISE POLICY**

**AND PRESCRIBING ARRANGEMENTS FOR DEVELOPING, COORDINATING**

**AND IMPLEMENTING A NATIONAL PROGRAM FOR WOMEN'S BUSINESS ENTERPRISE**

In response to the findings of the Interagency Task Force on Women Business Owners and congressional findings that recognize:

1. The significant role which small business and women entrepreneurs can play in promoting full employment and balanced growth in our economy.

2. The many obstacles facing women entrepreneurs; and

3. The need to aid and stimulate women's business enterprise.

**RESPONSIBILITIES OF THE FEDERAL DEPARTMENTS AND AGENCIES**

**Within the constraints of statutory authority and as otherwise permitted by law:**

(A) Each department and agency of the Executive Branch shall take appropriate action to facilitate, preserve and strengthen women's business enterprise and to ensure full participation by women in the free enterprise system.

(B) Each department and agency shall take affirmative action in support of women's business enterprise in appropriate programs and activities including but not limited to:

1. Management, technical, financial and procurement assistance.

2. Business-related education, training, counseling information dissemination, and

3. Procurement.

(C) Each department or agency empowered to extend Federal financial assistance to any program or activity shall issue regulations requiring the recipient of such assistance to take appropriate affirmative action in support of women's business enterprise and to prohibit actions or policies which discriminate against women's business enterprise on the ground of sex. For purposes of this subsection, Federal financial assistance means assistance extended by way of grant, cooperative agreement, loan or contract other than a contract of insurance or guaranty. These regulations shall prescribe sanctions for noncompliance. Unless otherwise specified by law, no agency sanctions shall be applied until the agency or department concerned has advised the appropriate person or persons of the failure to comply with its regulations and has determined that compliance cannot be secured by voluntary means.

For purposes of this Order, affirmative action may include, but is not limited to, creating or supporting new programs responsive to the special needs of women's business enterprise, establishing incentives to promote business or business-related opportunities for women's business enterprise, collecting and disseminating information in support of women's business enterprise, and insuring to women's business enterprise knowledge of and ready access to business-related services and resources. If, in implementing this Order, an agency undertakes to use or to require compliance with numerical set-asides, or similar measures, it shall state the purpose of such measure, and the measure shall be designed on the basis of

pertinent factual findings of discrimination against women's business enterprise and the need for such measure.

In carrying out their responsibilities under Section 1-1, the departments and agencies shall consult the Department of Justice, and the Department of Justice shall provide legal guidance concerning these responsibilities.

**ESTABLISHMENT OF THE INTERAGENCY COMMITTEE ON WOMEN'S BUSINESS ENTERPRISE**

To help insure that the actions ordered above are carried out in an effective manner, I hereby establish the Interagency Committee on Women's Business Enterprise (hereinafter called the Committee).

**EXECUTIVE ORDER NO. 12138**

Chairperson of the Committee (hereinafter called the Chairperson) shall be appointed by the President. The Chairperson shall be the presiding officer of the Committee and shall have such duties as prescribed in this Order or by the Committee in its rules of procedure. The Chairperson may also represent his or her department, agency or office on the Committee.

Committee shall be composed of the Chairperson and other members appointed by the heads of departments and agencies from among high level policy-making officials. In making these appointments, the recommendations of the Chairperson shall be taken into consideration. The following departments and agencies and such other departments and agencies as the Chairperson shall select shall be members of the Committee: the Departments of Agriculture; Commerce; Defense; Energy; Health and Human Services; Housing and Urban Development; Interior; Justice; Labor; Transportation; Treasury; the Federal Trade Commission; General Services Administration; National Science Foundation; Office of Federal Procurement Policy; and the Small Business Administration. These members shall have a vote. Nonvoting members shall include the Executive Director of the Committee and at least one but no more than three representatives from the Executive Office of the President appointed by the President.

Committee shall meet at least quarterly at the call of the Chairperson, and at such other times as may be determined to be useful according to the rules of procedure adopted by the Committee.

Administrator of the Small Business Administration shall provide an Executive Director and adequate staff and administrative support for the Committee. The staff shall be located in the Office of the Chief Counsel for Advocacy of the Small Business Administration, or in such other office as may be established specifically to further the policies expressed herein. Nothing in this Section prohibits the use of other properly available funds and resources in support of the Committee.

**FUNCTIONS OF THE COMMITTEE**

Promote, coordinate and monitor the plans, programs and operations of the departments and agencies of the Executive Branch which may contribute to the establishment, preservation and strengthening of women's business enterprise. It may, as appropriate, develop comprehensive interagency plans and specific program goals for women's business enterprise with the cooperation of the departments and agencies.

Establish such policies, definitions, procedures and guidelines to govern the implementation, interpretation and application of this order, and generally perform such functions and take such steps as the Committee may deem to be necessary or appropriate to achieve the purposes and carry out the provisions hereof.

Promote the mobilization of activities and resources of State and local governments, business and trade associations, private industry, colleges and universities, foundations, professional organizations, and

volunteer and other groups toward the growth of women's business enterprise, and facilitate the coordination of the efforts of these groups with those of the departments and agencies.

Make an annual assessment of the progress made in the Federal Government toward assisting women's business enterprise to enter the mainstream of business ownership and to provide recommendations for future actions to the President.

Convene and consult as necessary with persons inside and outside government to develop and promote new ideas concerning the development of women's business enterprise.

Consider the findings and recommendations of government and private sector investigations and studies of the problems of women entrepreneurs and promote further research into such problems.

Design a comprehensive and innovative plan for a joint Federal and private sector effort to develop increased numbers of new women-owned businesses and larger and more successful women-owned businesses. The plan should set specific reasonable targets which can be achieved at reasonable and identifiable costs and should provide for the measurement of progress towards these targets at the end of two and five years. Related outcomes such as income and tax revenues generated, jobs created, new products and services introduced, or new domestic or foreign markets created should also be projected and measured in relation to costs wherever possible. The Committee should submit the plan to the President for approval within six months of the effective date of this Order.

## EXECUTIVE ORDER NO. 12138

## OTHER RESPONSIBILITIES OF THE FEDERAL DEPARTMENTS AND AGENCIES

The head of each department and agency shall designate a high-level official to have the responsibility for the participation and cooperation of that department or agency in carrying out this Executive order. This person may be the same person who is the department or agency's representative to the Committee.

To the extent permitted by law, each department and agency upon request by the Chairperson shall furnish information, assistance and reports and otherwise cooperate with the Chairperson and the Committee in the performance of their functions hereunder. Each department or agency shall ensure that systematic data collection processes are capable of providing the Committee current data helpful in evaluating and promoting the efforts herein described.

The officials designated under Section 1-401, when so requested, shall review the policies and programs of the women's business enterprise program, and shall keep the Chairperson informed of proposed budget, plans and programs of their departments or agencies affecting women's business enterprise.

Each Federal department or agency, within constraints of law, shall continue current efforts to foster and promote women's business enterprise and to support the program herein set forth, and shall cooperate with the Chairperson and the Committee in increasing the total Federal effort.

## REPORTS

The Chairperson shall, promptly after the close of the fiscal year, submit to the President a full report of the activities of the Committee hereunder during the previous fiscal year. Further, the Chairperson shall, from time to time, submit to the President the Committee's recommendations for legislation or other action to promote the purposes of this Order.

Each Federal department and agency shall report to the Chairperson as hereinabove provided on a timely basis so that the Chairperson and the Committee can consider such reports for the Committee report to the President.

**DEFINITIONS**

For the purposes of this Order, the following definitions shall apply:

(1) "Women-owned business" means a business that is at least 51 percent owned by a woman or women who also control and operate it. "Control" in this context means exercising the power to make policy decisions. "Operate" in this context means being actively involved in the day-to-day management.

(2) "Women's business enterprise" means a woman-owned business or businesses or the efforts of a woman or women to establish, maintain or develop such a business or businesses.

Nothing in subsections 1-601 or 1-602 of this Section (1-6) should be construed to prohibit the use of other definitions of a woman-owned business or women's business enterprise by departments and agencies of the Executive Branch where other definitions are deemed reasonable and useful for any purpose not inconsistent with the purposes of this Order. Wherever feasible, departments and agencies should use the definition of a woman-owned business in subsection 1-601 above for monitoring performance with respect to women's business enterprise in order to assure comparability of data throughout the Federal Government.

**CONSTRUCTION**

Nothing in this Order shall be construed as limiting the meaning or effect of any existing Executive order.

**EXECUTIVE ORDER 12138**

**ASSURANCE OF COMPLIANCE**

Every Contractor and Subcontractor shall incorporate, or cause to be incorporated, in all contracts for work in connection with a Federally assisted project the following:

A. The work to be performed under this Contract is on a project assisted basis under a program providing direct Federal Financial Assistance from the Department of Housing and Urban Development and is subject to the requirements of Executive Order 12138.

B. The parties to this Contract will comply with the intent and purposes of said Executive Order 12138, and all applicable procedures issued thereunder prior to the execution of this Contract. The parties to this Contract certify and agree that they are under no contractual or other disability which would prevent them from complying with these requirements.

C. The Contractor will send to appropriate woman-owned business organizations a notice advising the organization of their commitment under this Executive Order 12138 and shall retain copies of the notice in an appropriate file available for inspection by authorized parties.

D. The Contractor will include this Executive Order 12138 Clause in every subcontract for work in connection with the project and will, at the direction of the applicant for or recipient of Federal Financial Assistance, take appropriate action pursuant to the sub-contract upon a finding that the subcontractor is in non-compliance. The Contractor will not subcontract with any subcontractor where it has notice or knowledge that the latter will not participate and will not let any subcontract unless the subcontractor has first provided the contractor with a preliminary statement of goals to comply with the intent and purpose of these procedures.

E. Compliance with the provisions of Executive Order 12138, the intent and purpose, thereof, shall be a condition of the Federal Financial Assistance provided to the project, binding upon the applicant or recipient for such assistance, its successors, and assigns, to these sanctions specified by the grant or loan agreement or contract through which Federal assistance is provided.

**BIDDING PROCEDURES**

Prior to signing of the Contract, the contractor shall provide a preliminary statement of woman-owned business enterprise utilization where known; where not known, such information shall be supplied prior to signing of any contract between the contractor and subcontractor.

**UTILIZATION OF BUSINESSES**

Each contractor and subcontractor undertaking work on an Executive Order 12138 covered project shall assure to the greatest extent feasible, contracts for work to be performed in connection with the projects are awarded to woman-owned business concerns.

**AFFIRMATIVE ACTION PLAN FOR UTILIZATION OF WOMAN-OWNED BUSINESS ENTERPRISE**

The contractor or subcontractor shall utilize woman-owned business concerns in contracting the work to be performed in connection with the completion of the Contract. To this end, the contractor or subcontractor projects a utilization goal of $_____ or _____%

**EXECUTIVE ORDER 12138**

**GOAL ALLOCATIONS**

| Category | Amount Available (Dollars) | Amount Projected (Dollars) |
|---|---|---|
| A. Woman-Owned Business | $_____ | $_____ |
| B. Woman-Owned Contractors | $_____ | $_____ |

Set forth the dollar value of contracts to be awarded to eligible contractors and businesses within each category over the duration of the Contract.

Analyze the woman-owned potential for each category and set projected utilization goals for women-owned business participation.

Ensure that the appropriate business concerns are timely notified of pending contractual opportunities either personally or through locally utilized media.

**GOOD FAITH EFFORT**

Each contractor and subcontractor seeking to establish that a good faith effort has been made shall, as a minimum, attempt to recruit from the appropriate areas the necessary eligible business concerns through:

A. Local Advertising
B. Small Business Administration
C. Signs placed at the site
D. U.S. Department of Commerce Funded Agency
E. Community Organizations
F. U.S. Department of Housing and Urban Development

**CERTIFICATE OF COMPLIANCE**

The contractor shall execute the Certificate of Compliance and shall cause all subcontractors undertaking work in connection with this Contract to furnish the same.

**WOMAN-OWNED BUSINESS ENTERPRISE UTILIZATION CERTIFICATION**

_____ will abide by and initiate in all their subcontracts, to the greatest extent feasible, the requirements of Executive Order 12138.

_____

**CONTRACTOR OR SUBCONTRACTOR**

**BY**_____

**TITLE**_____

**DATE**_____

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# PROVISIONS AND PROCEDURES PERTAINING TO EMPLOYMENT OPPORTUNITIES FOR BUSINESS AND LOWER INCOME PERSONS IN CONNECTION WITH FEDERAL ASSISTED PROJECTS IN COMPLIANCE WITH SECTION 3 OF THE HOUSING AND URBAN DEVELOPMENT ACT OF 1968

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(7 PAGES)

PART OF GENERAL CONDITIONS

PROVISIONS AND PROCEDURES

Pertaining to
EMPLOYMENT OPPORTUNITIES FOR BUSINESS AND LOWER INCOME PERSONS
IN CONNECTION WITH FEDERAL ASSISTED PROJECTS
Incompliance with
SECTION 3 OF THE HOUSING AND URBAN DEVELOPMENT ACT OF 1968

SEC. 4.1 – Purpose and Scope

The regulations set forth in this Part contain the procedures established by the Secretary of Housing and Urban Development for carrying out the responsibilities under Section 3 of the Housing and Urban Development Act of 1968, 12 U.S.C. 1701u.

Sec. 4.2 Definitions

"Section 3 covered project" means any nonexempt project assisted by any program administered by the Secretary in which loans, grants, subsidies, or other financial assistance are provided in aid of housing, urban planning, development, redevelopment or renewal, public or community facilities, and new community development, except as provided under Title 24, Part 135, Section 135.5, para. (M).

Sec. 4.3 Assurance of Compliance

Every contractor and subcontractor shall incorporate, or cause to be incorporated, in all contract for work in connection with a Section 3 covered project, the following clause:

A. The work to be performed under this contract is on a project assisted under a program providing direct Federal financial assistance from the Department of Housing and Urban Development and is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u. Section 3 requires that to the greatest extent feasible opportunities for training and employment be given lower income residents of the project area and contracts for work in connection with the project by awarded to business concerns which are located in, or owned in substantial part by persons residing in the area of the project.

B. The parties to this contract will comply with the provisions of said Section 3 and the regulations issued pursuant thereto by the Secretary of Housing and Urban

Development set forth in 24 CFR 135, and all applicable rules and orders of the Department issued there under prior to the execution of this contract. The parties to this contract certify and agree that they are under no contractual or other disability which would prevent them from complying with these requirements.

C. The contractor will send to each labor organization or representative of workers with which he has a collective bargaining agreement or other contract or understanding, if any, a notice advising the said labor organization or workers' representative of his commitments under this Section 3 clause and shall post copies of the notice in conspicuous places available to employees and applicants for employment or training.

The contractor will include this Section 3 clause in every subcontract for work in connection with the project and will, at the direction of the applicant for or recipient of Federal financial assistance, take appropriate action pursuant to the subcontract upon a finding that the subcontractor is in violation of regulations issued by the Secretary of Housing and Urban Development, 24 CFR 135. The contractor will

not subcontract with any subcontractor where it has notice or knowledge that the latter has been found in violation of regulations under 24 CFR 135 and will not let any subcontract unless the subcontractor has first provided it with a preliminary statement of ability to comply with the requirements of these regulations.

Compliance with the provisions of Section 3, the regulations set forth in 24 CFR 135, and all applicable rules and orders of the Department issued thereunder prior to the execution of the contract, shall be a condition of the Federal financial assistance provided to the project, binding upon the applicant or recipient for such assistance, its successors, and assigns. Failure to fulfill these requirements shall subject the applicant or recipient, its contractors and subcontractors, its successors, and assigns, to those sanctions specified by the grant or loan agreement or contract through which Federal assistance is provided, and to such sanctions as are specified by 24 CFR 135, 135.

Section 4.4 Bidding Procedures

Prior to the signing of the contract, the contractor shall provide a preliminary statement of work force needs (skilled, semi-skilled, unskilled labor and trainees by category) where known; where not known, such information shall be supplied prior to the signing of any contract between the contractor and subcontractors.

Section 4.A Trainees

The contractor or subcontractor shall fulfill his obligation to utilize lower income project areas residents as trainees to the greatest extent feasible by:

(1) Utilizing the maximum number of persons in the various training categories in all phases of the work to be performed under the Section 3 covered project, and

(2) Filling all vacant training positions with lower income project area residents except for those training positions which remain unfilled after a good faith effort has been made.

(3) “Manpower Utilization Training Table” - See Appendix #1.

Section 4.B Residents as Employees

Each contractor and subcontractor shall fulfill his obligation to utilize lower income project areas residents as employees to the greatest extent feasible by:

(1) Identifying the number of positions in the various occupational categories including skilled, semi-skilled, and unskilled labor needed to perform each phase of the Section 3 covered project.
(2) Identifying the number of positions currently occupied by regular, permanent employees.
(3) Identifying the positions not currently occupied by regular, permanent employees.
(4) Establishing the positions identified in paragraph (3) of this Part, a goal which is consistent with this subpart within each occupational category of the number of positions to be filled by lower residents of the Section 3 covered project areas.
(5) “Work Force Needs Table” – See Appendix #1.

Section 4.C Utilization of Businesses

Each contractor and subcontractor undertaking work on a Section 3 covered project shall assure that to the greatest extent feasible, contracts for work to be performed in connection with the project – are awarded to business concerns located within the Section 3 covered project areas or business concerns owned in substantial part by persons residing in the Section 3 covered area.

(1) “Business Utilization Table” – See Appendix #2.

Section 4.5 Good Faith Effort

Each contractor and subcontractor seeking to establish that a good faith effort, as required by Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C., 1701u, has been made to fill all training positions with lower income area
residents; and fill all employment positions identified in Section 4.4, paragraph B, subparagraphs (3) and (4) shall:

A. Attempt to recruit from the appropriate areas the necessary number of lower income residents through local advertising media, signs placed at the proposed site and community organizations and public and private institutions operating within or serving the project area, such as State Employment Office, Opportunities Industrialization Center (OIC) and WCHA

B. Maintain a list of all lower income area residents who have applied either on their own or on referral from any source, and employ such person if otherwise eligible and/or qualified and if a vacancy exists. If no vacancies exist, the listed for the first available opening.

Any contractor or subcontractor which fills vacant apprentice and trainee positions and/or employment positions, identified in subparagraph B above, but more specifically identified in Section 3 of the Housing and Urban Development Act of 1968, 12 U.S.C. 1701u, Part 135. Section 135.40 and Section 135.55, in his organization immediate prior to undertaking work pursuant to a Section 3 covered contract shall set forth evidence acceptable to the Secretary that its actions were not an attempt to circumvent these regulations.

Section 4.6 Affirmative Action Plan

A. An Affirmative Action Plan pursuant to a Section 3 covered contract shall:

(1) Set forth the approximate number and estimated dollar value of contracts to be awarded to eligible businesses and entrepreneurs within each category over the duration of this contract.
(2) Ensure that the appropriate business concerns are notified of pending contractual opportunities either personally or through locally utilized media.

B. Good Faith Effort

Each contractor and subcontractor seeking to establish that a good faith effort has been made shall, as a minimum, attempt to recruit from the appropriate areas the necessary eligible business concerns through:

(1) Local Advertising.
(2) Signs placed at the site.
(3) Community organizations, public and private institutions operating or serving within the project areas such as P.A.C., OIC, and WCHA, and any equivalent organization.

C. "Business Utilization Table."

See Appendix #2

D. "AAP Form."

See Appendix #2

Sec. 4.7 Certificate of Compliance

The contractor shall execute the Certificate of Compliance and cause all subcontractors undertaking work in connection with this contract to furnish the same.

## SECTION 3 CERTIFICATION

Will abide by and initiate in all their subcontracts to the greatest extent feasible the requirements of Section 3 of the Housing and Urban Development Act of 1968, 12 U.S.C. 1701 u.

APPENDIX NO. 1

1. MANPOWER UTILIZATION TABLE

| Occupation Category | Total Work Force | Skilled | Trainees | No. Project Area Resident to be Utilized |
|---|---|---|---|---|
| (Write List) | | | | Skilled Trainee |
| Total | | | | |

EMPLOYMENT CERTIFICATION

A. The Company hereby certifies that the above table ( ) represents the appropriate number of employee positions required in the execution of Contract No._____ and also represents the number of lower income project area residents that the Company proposes to employ.

B. The Company certifies that it will make a good faith effort to employ the number of lower income employees stated above utilizing such community-based organizations and service agencies as _____, Opportunities Industrialization Center (OIC); and on the site company employment posters.

C. The Company certifies that the employee goals listed in the above table approximates the ratio of lower income residents to the total population of the project area.

_____
COMPANY

BY_____
Authorized Signature

Title_____

Date_____

APPENDIX NO. 2

AFFIRMATIVE ACTION PLAN FOR UTILIZATION OF SECTION 3 PROJECT BUSINESSES

The Company shall utilize business concerns located in Project No. _____ in contracting for work to be performed in connection with the completion of the contract. To this end the Company shall require the services of companies in the project area engaged in the business of:_____.

| Subcontracts | Total Subcontract Dollar Amount | Proposed Section 3 Business Available For Use | Total Subcontract to Section 3 Businesses Dollar Amount |
|---|---|---|---|
| (Write List) | | | |

_____
COMPANY

By_____
Authorized Signature

Title_____

Date_____

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PREVIOUS PARTICIPATION CERTIFICATION

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HUD FORM 2530

(5 PAGES)

OMB Approval No. 2502-0118
(Exp. 01/31/2026 )

**US Department of Housing and Urban Development**
Office of Housing/Federal Housing Commissioner

**US Department of Agriculture**
Farmers Home Administration

| **Part I to be completed by Controlling Participant(s) of Covered Projects** *(See instructions)* Reason for submission: | | **For HUD HQ/FmHA use only** | |
|---|---|---|---|
| **1.** Agency name and City where the application is filed | | **2**. Project Name, Project Number, City and Zip Code | |
| **3**. Loan or Contract amount $ | **4**. Number of Units or Beds | **5**. Section of Act | **6**. Type of Project (check one) ☐ Existing ☐ Rehabilitation ☐ Proposed (New) |

**7. List all proposed Controlling Participants and attach complete organization chart for all organizations showing ownership %**

| Name and address ( Last, First, Middle Initial) of controlling participant(s) proposing to participate | **8 Role of Each Principal in Project** | **9. SSN or IRS Employer Number (TIN)** |
|---|---|---|
| | | |
| | | |
| | | |
| | | |

1. Schedule A contains a listing, for the last ten years, of every project assisted or insured by HUD, USDA FmHA and/or State and local government housing finance agencies in which the controlling participant(s) have participated or are now participating.
2. For the period beginning 10 years prior to the date of this certification, and except as shown on the certification:
a. No mortgage on a project listed has ever been in default, assigned to the Government or foreclosed, nor has it received mortgage relief from the mortgagee;
b. The controlling participants have no defaults or noncompliance under any Conventional Contract or Turnkey Contract of Sale in connection with a public housing project;
c. There are no known unresolved findings as a result of HUD audits, management reviews or other Governmental investigations concerning the controlling participants or their projects;
d. There has not been a suspension or termination of payments under any HUD assistance contract due to the controlling participant's fault or negligence;
e. The controlling participants have not been convicted of a felony and are not presently the subject of a complaint or indictment charging a felony. (A felony is defined as any offense punishable by imprisonment for a term exceeding one year, but does not include any offense classified as a misdemeanor under the laws of a State and punishable by imprisonment of two years or less);
f. The controlling participants have not been suspended, debarred or otherwise restricted by any Department or Agency of the Federal Government or of a State Government from doing business with such Department or Agency;
g. The controlling participants have not defaulted on an obligation covered by a surety or performance bond and have not been the subject of a claim under an employee fidelity bond;
3. All the names of the controlling participants who propose to participate in this project are listed above.
4. None of the controlling participants is a HUD/FmHA employee or a member of a HUD/FmHA employee's immediate household as defined in Standards of Ethical Conduct for Employees of the Executive Branch in 5 C.F.R. Part 2635 (57 FR 35006) and HUD's Standard of Conduct in 24 C.F.R. Part 0 and USDA's Standard of Conduct in 7 C.F.R. Part 0 Subpart B.
5. None of the controlling participants is a participant in an assisted or insured project as of this date on which construction has stopped for a period in excess of 20 days or which has been substantially completed for more than 90 days and documents for closing, including final cost certification, have not been filed with HUD or FmHA.
6.None of the controlling participants have been found by HUD or FmHA to be in noncompliance with any applicable fair housing and civil rights requirements in 24 CFR 5.105(a). (If any controlling participants have been found to be in noncompliance with any requirements, attach a signed statement explaining the relevant facts, circumstances, and resolution, if any).
7. None of the controlling participants is a Member of Congress or a Resident Commissioner nor otherwise prohibited or limited by law from contracting with the Government of the United States of America.
8.Statements above (if any) to which the controlling participant(s) cannot certify have been deleted by striking through the words with a pen, and the controlling participant(s) have initialed each deletion (if any) and have attached a true and accurate signed statement (if applicable) to explain the facts and circumstances.

I/We, the undersigned, certify under penalty of perjury that the information provided above is true and correct. WARNING: Anyone who knowingly submits a false claim or makes a false statement is subject to criminal and/or civil penalties, including confinement for up to 5 years, fines, and civil and administrative penalties. (18 U.S.C. §§ 287, 1001, 1010, 1012, 1014; 31 U.S.C. §3729, 3802).

| **Name of Controlling Participant** | **Signature of Controlling Participant** | **Certification Date (mm/dd/yyyy)** | **Area Code and Tel. No.** |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| **This form prepared by (print name)** | | **Area Code and Tel. No.** | |

**Schedule A: List of Previous Projects and Section 8 Contracts.** Below is a complete list of the controlling participants' previous participation projects and participation history in covered projects as per 24 CFR, part 200 §200.214 and multifamily Housing programs of FmHA, State and local Housing Finance Agencies, if applicable. **Note:** Read and follow the instruction sheet carefully. Make full disclosure. Add extra sheets if you need more space. Double check for accuracy. If no previous projects, write by your name, "**No previous participation, First Experience"**.

| 1. Controlling Participants' Name (Last, First) | 2. List of previous projects (Project name, project ID and, Govt. agency involved) | 3.List Participants' Role(s) (indicate dates participated, and if fee or identity of interest participant) | 4. Status of loan (current, defaulted, assigned, foreclosed) | 5.Was the Project ever in default during your participation **Yes** | **No** | **If yes, explain** | 6. Last MOR rating and Physical Insp. Score and date |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

## Part II- For HUD Internal Processing Only

Received and checked by me for accuracy and completeness; recommend approval or refer to Headquarters after checking appropriate box.

| Date (mm/dd/yyyy) | Tel No. and area code | ☐ A. No adverse information; form HUD-2530 approval recommended. | ☐ C. Disclosure or Certification problem |
|---|---|---|---|
| Staff | Processing and Control | ☐ B. Name match in system | ☐ D. Other (attach memorandum) |

| Signature of authorized reviewer | Signature of authorized reviewer | Approved ☐ Yes ☐ No | Date (mm/dd/yyyy) |
|---|---|---|---|
| | | | |

**Instructions for Completing the Previous Participation Certificate, form HUD-2530**

Carefully read these instructions and the applicable regulations. A copy of the regulations published at 24 C.F.R. part 200, subpart H, § 200.210-200.222 can be obtained on-line at www.gpo.gov and from the Account Executive at any HUD Office. Type or print neatly in ink when filling out this form. Incomplete form will be returned to the applicant.

Attach extra sheets as you need them. Be sure to indicate "Continued on Attachments" wherever appropriate. Sign each additional page that you attach if it refers to you or your record. **Carefully read the certification before you sign it.** Any questions regarding the form or how to complete it can be answered by your HUD Account Executive.

**Purpose:** This form provides HUD/USDA FmHA with a certified report of all previous participation in relevant HUD/USDA programs by those parties submitting the application. The information requested in this form is used by HUD/USDA to determine if you meet the standards established to ensure that all controlling participants in HUD/USDA projects will honor their legal, financial and contractual obligations and are of acceptable risks from the underwriting standpoint of an insurer, lender or governmental agency. HUD requires that you certify and submit your record of previous participation, in relevant projects, by completing and signing this form, before your participation can be approved.

***HUD approval of your certification is a necessary precondition for your participation in the project and in the capacity that you propose. If you do not file this certification, do not furnish the information requested accurately, or do not meet established standards, HUD will not approve your certification.***

***Note that approval of your certification does not obligate HUD to approve your project application, and it does not satisfy all other HUD program requirements relative to your qualifications.***

**Who Must Sign and File Form HUD-2530:** Form HUD-2530 must be completed and signed by all Controlling Participants of Covered Projects, as such terms are defined in 24 CFR part 200 §200.212, and as further clarified by the Processing Guide (HUD notice H 2016-15) referenced in 24 CFR §200.210(b) and available on the HUD website at: http://portal.hud.gov/hudportal/HUD?src=/program_offices/housing/mfh/prevparticipation.

**Where and When Form HUD-2530 Must Be Filed:** The original of this form must be submitted to the HUD Office where your project application will be processed at the same time you file your initial project application. This form must be filed with applications for projects listed in 24 CFR §200.214 and for the Triggering Events listed at 24 CFR §200.218.

**Review of Adverse Determination:** If approval of your participation in a HUD project is denied, withheld, or conditionally granted on the basis of your record of previous participation, you will be notified by the HUD Office. You may request reconsideration in accordance with 24 CFR §200.222 and further clarified by the Processing Guide. Request must be made in writing within 30 days from your receipt of the notice of determination.

The Department of Housing and Urban Development (HUD) is authorized to collect this information by law 42 U.S.C. 3535(d) and by regulation at 24 CFR 200.210. This information is needed so that principals applying to participate in multifamily programs can become HUD-approved controlling participants. The information you provide will enable HUD to evaluate your record with respect to established standards of performance, responsibility and eligibility. Without prior approval, a controlling participant may not participate in a proposed or existing multifamily or healthcare project. HUD uses this information to evaluate whether or not controlling participants pose an unsatisfactory underwriting risk. The information is used to evaluate the potential controlling participants and approve only individuals and organizations that will honor their legal, financial and contractual obligations.

**Privacy Act Statement:** The Housing and Community Development Act of 1987, 42 U.S.C. 3543 requires persons applying for a Federally-insured or guaranteed loan to furnish his/her Social Security Number (SSN). HUD must have your SSN for identification of your records. HUD may use your SSN for automated processing of your records and to make requests for information about you and your previous records with other public agencies and private sector sources. HUD may disclose certain information to Federal, State and local agencies when relevant to civil, criminal, or regulatory investigations and prosecutions. It will not be otherwise disclosed or released outside of HUD, except as required and permitted by law. You must provide all of the information requested in this application, including your SSN. Failure to provide any of the information will result in your disapproval of participation in this HUD program. APPS SORN could be accessed in Federal Register / Vol. 81, No. 146 / Friday, July 29, 2016 / Notices ([Docket No. FR–5921–N–10] Implementation of the Privacy Act of 1974, as Amended; Amended System of Records Notice, Active Partners Performance System).

**PRA Statement:** The public reporting burden is estimated at 3 hours per response, including the time for reviewing instructions, searching existing data sources, gathering, and maintaining the data needed, and completing and reviewing the collection of information.
Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions to reduce this burden, to the Reports Management Officer, Paperwork Reduction Project, to the Office of Information Technology, US. Department of Housing and Urban Development, Washington, DC 20410-3600. When providing comments, please refer to OMB Approval No. 2502-0118. HUD may not conduct and sponsor, and a person is not required to respond to, a collection of information unless the collection displays a valid control number.

The collection is authorized by 12 U.S.C 1702-1715z; 42 U.S.C. 3535(d). HUD form 2530 is created to collect information as mandated by 24 CFR Part 200. The HUD-2530 form is used to protect HUD's Multifamily Housing and Healthcare programs by comprehensively assessing industry participants' risk. It is the Department's policy that participants in its housing programs honor their legal, financial, and contractual obligations. Accordingly, uniform standards are established for approvals, disapprovals, or withholding actions on principals in projects, based upon their past performances as well as other relevant information. Respondents such as owners, management agents, master tenants, general contractors, and nursing home operators are subject to review. The information on this form needs to be collected by the Department to evaluate participants' previous performance and compliance with contracts, regulations, and directives.

DOCUMENT 00 0840

NON-COLLUSIVE AFFIDAVIT

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**Non-Collusive Affidavit**

STATE OF _____: CONTRACT/BID NO. _____

:s.s.

COUNTY OF _____:

I state that I am the _____ of _____,
(TITLE) (FIRM OR COMPANY)

and that I am authorized to make this Affidavit on behalf of my Firm or Company, and its owners, directors, and officers. I am the person responsible in my Firm or Company for the prices (s) and the amount of this Bid.

I state that:

(1) The price (s) and amount of this Bid have been arrived at independently and without consultation, communication or agreement with any other contractor, bidder, or potential bidder.

(2) Neither the price (s) nor the amount of this Bid, and neither the approximate price (s) nor the approximate amount of this Bid have been disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed to any other firm or person who is a bidder or potential bidder, and they will not be disclosed before bid opening.

(3) No attempt has been made or will be made to induce any firm or person to refrain from bidding on this Contract, or to submit a bid higher than this bid, or to submit any intentionally high or noncompetitive bid or other form of complementary bid.

(4) The bid of my Firm or Company is made in good faith and not pursuant to any agreement or discussion with, or inducement from, any firm or person to submit a complementary or other noncompetitive bid.

(5) _____, its affiliates, subsidiaries,
(FIRM OR COMPANY)
officers, directors and employees are not currently under investigation by any governmental agency and have not in the last four years been convicted or found liable of any act prohibited by State or Federal Law in any jurisdiction, involving conspiracy or collusion with respect to bidding on any public contract, except as follows:

I state that _____ understands and acknowledges
(FIRM OR COMPANY)

that the above representations are material and important, and will be relied on by the Westmoreland County Housing Authority in awarding the contract (s) for which this bid is submitted. I understand and my Firm Or Company understands that any misstatement in this Affidavit is and shall be treated as fraudulent concealment from the Westmoreland County Housing Authority of the true facts relating to the submission of bids for this contract.

_____
(NAME AND FIRM OR COMPANY POSITION)

SWORN TO AND SUBSCRIBED BEFORE ME

THIS _____ DAY OF

_____, 20_____

_____
NOTARY PUBLIC

My Commission Expires_____

DOCUMENT 00 0845

PUBLIC WORKS EMPLOYMENT VERIFICATION FORM

(2 PAGES)

COMMONWEALTH OF PENNSYLVANIA

# PUBLIC WORKS EMPLOYMENT VERIFICATION FORM

Date _____

Business or Organization Name (Employer)_____

Address _____

City _____ State_____ Zip Code _____

☐ Contractor ☐ {dzōŏ2yűNJI-ŏűzNJ óŏKŜŏʅ 2yŜú

Contracting Public Body _____

Contract/Project No _____

Project Description _____

Project Location _____

As a contractor/subcontractor for the above referenced public works contract, I hereby affirm that as of the above date, our company is in compliance with the Public Works Employment Verification Act ('the Act') through utilization of the federal E-Verify Program (EVP) operated by the United States Department of Homeland Security. To the best of my/our knowledge, all employees hired post January 1, 2013 are authorized to work in the United States.

It is also agreed to that all public works contractors/subcontractors will utilize the federal EVP to verify the employment eligibility of each new hire within five (5) business days of the employee start date throughout the duration of the public works contract. Documentation confirming the use of the federal EVP upon each new hire shall be maintained in the event of an investigation or audit.

I, _____, authorized representative of the company above, attest that the information contained in this verification form is true and correct and understand that the submission of false or misleading information in connection with the above verification shall be subject to sanctions provided by law.

_____

Authorized Representative Signature

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**Document 00 0850**

**Form of Bid Bond**

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**(3 Pages)**

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**BID BOND**

**KNOW ALL MEN BY THESE PRESENT**S, that we the undersigned,
_____, as PRINCIPAL, and
(Name of Principal)

_____, as SURETY are held and
(Name of Surety)

firmly bound unto **Westmoreland County Housing Authority,** herein after called the "LHA" in the penal sum of _____ DOLLARS, ($_____) lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators, successors, and assigns jointly and severally, firmly by these presents.

**THE CONDITION OF THIS OBLIGATION IS SUCH,** that whereas the Principal has submitted the accompanying bid dated _____, 20 ____, for _____
_____
_____
_____

**NOW, THEREFORE,** if the Principal shall not withdraw said bid within the period specified therein after the opening of the same, or, if no period be specified, within sixty (60) days after the said opening, and shall within the period specified therefore, or, if no period be specified therefore, or, if no period be specified within ten (10) days after the prescribed forms are presented to him for signature, enter into a written contract with the LHA in accordance with the bid as accepted, and give bond with good and sufficient surety or sureties, as may be required, for the faithful performance and proper fulfillment of such contract. In the event of the withdrawal of said bid within the period specified, or the failure to enter into such contract and give such bond within the time specified, if the Principal shall pay the LHA the difference between the amount specified in said bid and the amount for which the LHA may procure the required work or supplies or both, if the latter amount be in excess of the former, then the above obligation shall be void and of no effect, otherwise to remain in full force and virtue.

**IN WITNESSES WHEREOF,** the above-bounden parties have executed this instrument under their several seals this _____ day of _____, 20____, the name and corporate seal of each corporate party being hereto affixed and these presents duly signed by its undersigned representative, pursuant to authority of its governing body.

In presence of:

_____ _____(SEAL)
(Individual Principal)

_____ _____
(Business Address)

_____ _____(SEAL)
(Individual Principal)

_____ _____
(Business Address)

Attest:

_____ _____

(Corporate Principal)

_____
(Business Address)

Affix
By_____Corporate
Seal

_____ _____
Attest:

_____ _____
(Corporate Surety)

_____
(Business Address)

Affix
By_____Corporate
Seal

_____ _____

(Power-of-attorney for person signing for surety must be attached to bond.)

**CERTIFICATE AS TO CORPORATE PRINCIPAL**

I, _____, certify that I am _____Secretary of the corporation named as Principal in the within bond; that _____ who signed the said bond on behalf of the Principal was then _____ of said corporation; that I know the signature, and signature thereto is genuine; and that said bond was duly signed, sealed and attested to for and in behalf of said corporation by authority of its governing body.

_____ (Corporate Seal)

DOCUMENT 00 0860

PERFORMANCE AND LABOR AND MATERIALS BOND

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INSTRUCTIONS – 1 PAGE
PERFORMANCE BOND – 2 PAGES
LABOR AND MATERIALMEN'S BOND – 3 PAGES
(7 PAGES)

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**DIRECTIONS FOR PREPARATION OF PERFORMANCE AND LABOR AND MATERIALMEN'S BOND**

1. Individual sureties, partnerships, or corporations not in the surety business will not be acceptable.

2. The name of the Principal shall be shown exactly as it appears in the contract.

3. The penal sum shall be not less than that required by the specifications.

4. If the Principals are partners, or joint venturers, each member shall execute the bond as an individual, with his place of residence shown.

5. If the Principal is a corporation, the bond shall be executed under its corporate seal. If the corporation has no corporate seal the fact shall be stated, in which case a scroll or adhesive seal shall be affixed following the corporate name.

6. The official character and authority of the person(s) executing the bond for the Principal, if a corporation, shall be certified by the secretary or assistant secretary thereof under the corporate seal, OR there may be attached copies of so much of the records of the records of the corporation as will evidence the official character and authority of the officer signing, duly certified by the secretary or assistant secretary, under the corporate seal, to be true copies.

7. The current Power-of-Attorney of the person signing for the surety company must be attached to the bond.

8. The date of the bond must NOT be prior to the date of the surety company.

9. The Surety Company's Bond must include:
   a. The rate of premium in dollars per thousand; and
   b. The total dollar amount premium charged.

10. The signature of a witness shall appear in the appropriate place attesting to the signature of each party to the bond.

11. Type or print the name underneath EACH SIGNATURE appearing on the bond.

12. An executed copy of the bond must be attached to each copy of the Contract (Original Counterpart) intended for signing.

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**PERFORMANCE BOND**

**KNOW ALL MEN BY THESE PRESENTS**, that we
_____, as **Principal**, and
(Name of Principal)

_____, as **Surety,** are held and
(Name of Surety)

firmly bound unto the Westmoreland County Housing Authority**,** their certain attorney, successors or assigns (hereinafter called the **Obligee**), in the penal sum of _____ Dollars, ($_____), lawful money of the United States, for the payment of which sum will and truly to be made, we bind ourselves, our heirs, administrators, executors, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, said Principal has entered into a certain Contract with said Obligee (hereinafter called the Contract), dated _____, 20_____, for _____ _____which Contract and the Specifications for said work shall be deemed a part hereof as fully as if set out herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the Principal shall faithfully perform the Contract and his part at the time and in the manner therein provided and satisfy all claims and demands incurred in or for the same, or growing out of the same, or for injury or damage to persons or property in the performance thereof, and shall fully indemnify and save harmless the said Obligee from any and all cost and damage which the said Obligee may suffer by reason to do so, and shall fully reimburse and repay the said Obligee any and all outlay and expense which it may incur by reason of any such default, then this obligation shall be null and void, otherwise it shall remain in full force and virtue.

The said Surety, for the value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract or to the work to be performed or the Specifications accompanying the same shall in any way affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alteration or addition to the Terms of the contract or to the work or the Specifications.

**IN WITNESS WHEREOF,** the above bounded parties have executed this Instrument under their several seals this _____ day of _____, 20___, the name and corporate seal of each corporate party brings hereto affix, and these presents duly signed by its undersigned representative, pursuant to the authority of its governing body.

Individual Principals Sign Here
In the presence of:

_____ _____(SEAL)
(Individual Principal)

_____
(Business Address)

_____ _____(SEAL)
(Individual Principal)

_____
(Business Address)

Corporate Principals Sign Here
Attest:

_____ _____
(Corporate Principal)

_____(Title) _____
(Business Address)

Surety Sign Here
Attest:

_____ _____
(Corporate Surety)
Witness:

_____ _____
(Business Address)

By_____ AFFIX

CORPORATE

Title _____ SEAL

The rate of premium on this Bond is _____ per thousand.

Total amount of premium charged is $_____.

The above must be filled in by Corporate Surety. Power-of-Attorney of person signing for Surety company must be attached.

**CERTIFICATE AS TO CORPORATE PRINCIPAL**

I,_____, certify that I am the_____ Secretary of the corporation named as Principal in the within bond; that _____, who signed the said bond on behalf of the Principal was then _____ of said Corporation; that I know the signature and signature thereto is genuine; and that said Bond was duly signed, sealed and attested for and in behalf of said corporation by authority of its governing body.

_____ _____ (SEAL)
DATE

**LABOR AND MATERIALMEN'S BOND**

KNOW ALL MEN BE THESE PRESENTS, that we_____

_____

as principal, and _____

_____, as sureties are held and firmly bound unto the Westmoreland County Housing Authority, Pennsylvania, its certain attorneys, successors, or assigns (hereinafter called the Obligee) in the penal sum of _____

_____

_____

Dollars ($_____), lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, personal representatives, successors, and assigns, jointly and severally, firmly by the presents:

WHEREAS, said principal has entered into a certain contract with said Obligee, dated _____

_____, 20_____, (hereinafter called the Contract), for _____

_____

_____

_____

which Contract and the Specifications for said work shall be deemed a part thereof as fully as if set out herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH THAT if said principal and all subcontractors to whom any portion of the work provided for in said Contract is sublet and all assignees of said principal and of such subcontractors shall promptly make payment for all material furnished, labor supplied or performed, rental for equipment employed, and services rendered by public utilities or in connection with the prosecution of the work, whether or not the said material, labor, equipment, or services entered into and become component parts of the work or improvement contemplated in said contract, or in any amendment or extension of or addition to said Contract, then the above obligation shall be void; otherwise to remain in full force and effect. PROVIDED, However that this bond is subject to the following conditions and limitations.

(a) All persons who have performed labor, rendered services or furnished materials or machinery, shall have a direct right of action against the principal and surety on this Bond, which right of action shall be assorted in proceedings instituted in the state in which such labor performed, services rendered or materials furnished (or where labor has been performed, services rendered or materials furnished under said Contract in more than one State, then in any such State, insofar as permitted by the laws

of such State, such right of action shall be asserted in a proceeding instituted in the name of the Obligee to the use and benefit of the person instituting such action and any or all other persons having claims hereunder, and any other person having a claim hereunder shall have the right to be made a party to such proceeding (but not later than one year after the complete performance of said Contract and final settlement thereof) and to have such claim adjudicated in such action and judgment rendered thereon.

(b) The surety shall not be liable hereunder for any damages or compensation recoverable under any workmen's compensation or employer liability statute.

(c) In no event shall the surety be liable for a greater sum than the penalty of this bond, or subject to any suit, action or proceeding thereon that is instituted later than one year after the complete performance of said Contract and final settlement thereof.

(d) As used herein: The Term "person" refers to any individual, firm or corporation who have furnished materials or machinery or public utility services to be used on or incorporated in the work or the prosecution thereof provided for in said Contract or in any amendment or extension of or addition to said Contract, and/or to any person engaged in the prosecution of the work provided for in said Contract or in any amendment or extension of or addition to said Contract, who is an agent, servant or employee of the principal, or of any subcontractor, or of any assignee of said principal or of any subcontractor and also anyone so engaged who performs the work of a laborer or of a mechanic, regardless of any contractual relationship between the principal, or any subcontractor, or any assignee of said principal or of said subcontractor, and such laborer or mechanic, but shall not include office employees not regularly stationed at the site of the work.

The said Surety, for the value received, hereby stipulates and agrees that no change, extension of time, alteration or addition to the terms of the Contract, or to the work to be performed thereunder of the Specifications accompanying the same, shall in any wise affect its obligation on this Bond, and it does hereby waive notice of any such change, extension of time, alterations or addition to the terms of the Contract or to the work or the Specifications.

SIGNED, SEALED AND DELIVERED IN _____ORIGINAL COUNTERPARTS this _____day of _____, 20_____.

WITNESS:

_____

_____

_____

Individual Principals Sign Here.

_____

Title_____(Seal)

_____

Title_____(Seal)

_____

Title_____(Seal)

_____

Title _____(Seal)

ATTEST:

Corporate Principal Sign Here:

BY_____

TITLE_____

_____

BY_____

TITLE_____(Seal)

Surety Sign Here:

_____

BY_____

TITLE_____(Seal)

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SECTION 00 0865
MAINTENANCE BOND

CONTRACT NO. _CONTRACT

BOND NO. _____

KNOW ALL BY THESE PRESENTS THAT we, the undersigned _____ _____ _____as PRINCIPAL, and _____ _____, a corporation organized and existing under the laws of the state of _____, as SURETY, and just sum of _____ _____ DOLLARS_____($ _____),
lawful money of the United States of America, to pay to the said _____ to which payment well and truly be made and done, we bind ourselves, our heirs, executors, administrators, successors, and assigns, jointly and severally, firmly by these presents.

WHEREAS, the above bounded Principal, entered into a Contract with the said _____ _____ dated this the _____ day of 20____ , for the _____ _____ upon certain terms and conditions mentioned in the said Contract, a copy of which is hereto attached, and made apart of hereof; and

WHEREAS, IT IS ONE OF THE CONDITIONS of said Contract that these presents be executed on or before the final acceptance of the Principal work to be performed under said Contract.

NOW, THEREFORE, the conditions of this obligation is such that if the above bounded PRINCIPAL shall remedy without cost to the said _____ any defect which may develop during a period of one (1) year from the date of completion and acceptance of the work performed under said Contract, provided such defects, in the judgment of _____ _____ of its successor having jurisdiction in the premises, are caused by defective or inferior materials or workmanship, then this obligation shall be void, otherwise, it shall be and remain in full force and effect.

IN WITNESS WHEREOF, the said PRINCIPAL AND SURETY have duly executed this Bond under Seal the day and year first above written.

Signed and sealed this _____ day of _____ 20xx.

_____
(Principal Name) (Seal)

_____

_____
(Business Address)

_____
(Witness)

By:

_____ _____
(Principle Title)

_____
(Surety Name)

_____

_____
(Surety Business Address)

_____
(Witness)

By:
_____ (Attorney – In - Fact)

DOCUMENT 00 0870

FORM OF CONTRACT

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(3 PAGES)

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## FORM OF CONTRACT

THIS AGREEMENT made this_____ day of_____, in the year Two Thousand and _____

by and between _____ a corporation organized and existing under laws of the State of _____

_____, a partnership consisting of _____, or individual trading as _____

_____, hereinafter called the "Mitigation Company", and

THE WESTMORELAND COUNTY HOUSING AUTHORITY, hereinafter called the "WCHA",

WITNESSETH, That the Mitigation Company and the WCHA for the consideration stated herein mutually agree as follows:

ARTICLE 1. Statement of Work. The Mitigation Company shall furnish all labor, material, equipment and services, and perform and complete all work required for (the construction of) (description of work and project identification) in strict accordance with the Specifications for _____
(Identify the Specifications)

and Addenda thereto numbered _____and _____, dated _____and _____, and the Drawings referred to therein, all as prepared by _____, which said Specifications, Addenda and Drawings are incorporated herein by reference and made a part hereof.

ARTICLE 2. The Contract Price. The WCHA shall pay the Mitigation Company for the performance of the Contract, in current funds, subject to additions and deductions as provided in the Specifications, the sum of _____ _____Dollars ($_____).

ARTICLE 3. Contract Documents. The Contract shall consist of the following component parts:

a. This Instrument
b. General Conditions
c. Special Conditions
d. Technical Specifications
e. Drawings

This instrument, together with the other documents enumerated in this Article 3, which said other documents are as fully a part of the Contract as if hereto attached or herein repeated, form the Contract. In the event that any provision in any component part of this Contract conflicts with any provision of any other component part, the provision of the component part first enumerated in this Article 3 shall govern, except as otherwise specifically stated. The various provisions in Addenda shall be construed in the order of preference of the component part of Contract which each modifies.

FORM OF CONTRACT

IN WITNESS WHEREOF, the parties hereto have caused This Instrument to be executed in _____ original counterparts as of the day and year first above written.

_____
(Mitigation Company)

ATTEST:

_____ By_____

_____ Title_____

Business Address:

_____
(Street)

_____
(City) (Zip Code)

_____ _____
(WCHA)

_____ By_____

Title_____

Business Address:

_____
(Street)

_____
(City) (Zip Code)

(Print or type the names underneath all signatures).

DOCUMENT 00 0880

WAGE DETERMINATION SCHEDULE

"General Decision Number: PA20250105 07/18/2025

Superseded General Decision Number: PA20240105

State: Pennsylvania

Construction Type: Building

County: Westmoreland County in Pennsylvania.

BUILDING CONSTRUCTION PROJECTS (does not include single family homes or apartments up to and including 4 stories).

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

| | |
|---|---|
| If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022: | . Executive Order 14026 generally applies to the contract. . The contractor must pay all covered workers at least $17.75 per hour (or the applicable wage rate listed on this wage determination, if it is |

| | | higher) for all hours spent performing on the contract in 2025. |
|---|---|---|
| If the contract was awarded on or between January 1, 2015 and January 29, 2022, and the contract is not renewed or extended on or after January 30, 2022: | . Executive Order 13658 generally applies to the contract. . The contractor must pay all covered workers at least $13.30 per hour (or the applicable wage rate listed on this wage determination, if it is higher) for all hours spent performing on that contract in 2025. | |

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at http://www.dol.gov/whd/govcontracts.

| Modification Number | Publication Date |
|---|---|
| 0 | 01/03/2025 |
| 1 | 01/10/2025 |

| | |
|---|---|
| 2 | 01/24/2025 |
| 3 | 02/07/2025 |
| 4 | 03/07/2025 |
| 5 | 03/28/2025 |
| 6 | 07/18/2025 |

ASBE0002-005 08/01/2024

| | Rates | Fringes |
|---|---|---|
| ASBESTOS WORKER/HEAT & FROST INSULATOR MECHANICAL- Duct, Pipe & Mechanical System Insulation and Industrial Work (Including Duct and Pipe) | $ 46.50 | 29.43 |

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BOIL0154-007 01/01/2025

| | Rates | Fringes |
|---|---|---|
| BOILERMAKER | $ 48.28 | 33.17 |

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BRPA0009-011 12/01/2022

| | Rates | Fringes |
|---|---|---|
| TILE FINISHER | $ 28.76 | 17.16 |
| TILE SETTER | $ 35.64 | 21.63 |

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BRPA0009-051 12/01/2022

| | Rates | Fringes |
|---|---|---|
| BRICKLAYER (Including Pointing, Caulking, Cleaning and Brick Refractory Work) | $ 36.55 | 24.46 |
| MASON - STONE | $ 36.55 | 24.46 |

Additional $0.75 to the base wage for Brick Refractory work

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CARP0142-013 06/01/2023

| | Rates | Fringes |
|---|---|---|
| CARPENTER (Including Acoustical Ceiling Installation, Drywall Hanging, Metal Stud Installation, Floor Laying-Hardwood, Carpet and Vinyl; Form Work, and Scaffold Building) | $ 38.92 | 20.06 |

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CARP0274-003 01/01/2025

| | Rates | Fringes |
|---|---|---|
| PILEDRIVERMAN | $ 41.88 | 22.67 |

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CARP0443-004 06/01/2024

| | Rates | Fringes |
|---|---|---|

MILLWRIGHT.....$ 43.00 23.44

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ELEC0005-018 12/27/2024

| | Rates | Fringes |
|---|---|---|
| ELECTRICIAN (Alarm Installation, Installation of Sound and Communication System and Low Voltage Wiring, HVAC/Temperature Controls Installation Only)..... | $ 50.86 | 31.78 |

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* ENGI0066-040 06/01/2024

| | Rates | Fringes |
|---|---|---|
| POWER EQUIPMENT OPERATOR | | |
| Backhoe/Excavator/Trackhoe, Bobcat/Skid Steer/Skid Loader, Bulldozer, Compactor, Crane*, Drill Rig Caissons, Drill, Gradall, Grader/Blade, Man Lift/Outside Elevator, Mechanic, Paver (Asphalt, Aggregate, and Concrete), Scraper, Forklift (Lull).... | $ 41.69 | 24.05 |
| Broom/Sweeper, Compressor, Concrete Pump, Highlift, Hoist, Pump, | | |

Roller, Tugboat, Forklift
(ridden or self-propelled)..$ 35.62 24.05
Loader.....$ 41.69 24.05
Oiler.....$ 32.83 24.05

*Add to Crane rate:

Booms 101-150 jibs- Add $.75
Booms 151-200 jibs- Add $1.50
Booms 201-251 jibs- Add $2.25

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IRON0003-025 06/01/2023

| | Rates | Fringes |
|---|---|---|
| IRONWORKER (Ornamental, Reinforcing, Rigger and Structural; Metal Buildings: Metal Siding/Wall Panels Installation) | $ 38.89 | 34.54 |

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LABO0125-006 06/01/2022

| | Rates | Fringes |
|---|---|---|
| LABORER | | |
| Mason Tender - Cement/Concrete | $ 30.24 | 12.05 |

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LABO0373-001 01/01/2025

| | Rates | Fringes |
|---|---|---|
| LABORER (Asbestos Abatement (Removal from Floors, Walls, and Ceilings)) | $ 27.47 | 19.89 |

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LABO1451-001 01/01/2024

| | Rates | Fringes |
|---|---|---|
| LABORER | | |
| Mason Tender- Brick | $ 29.56 | 17.05 |
| Common or General | $ 26.31 | 17.05 |

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PAIN0057-033 06/01/2023

| | Rates | Fringes |
|---|---|---|
| PAINTER (Brush, Roller, and Spray, excluding work on Industrial sites) | $ 30.56 | 23.72 |
| PAINTER (Drywall Finishing/Taping) | $ 32.39 | 23.26 |

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PAIN0057-034 06/01/2023

| | Rates | Fringes |
|---|---|---|
| PAINTER (INDUSTRIAL: Brush and Roller Only) | $ 36.01 | 23.72 |
| PAINTER (INDUSTRIAL: Spray and Sandblaster Only) | $ 36.01 | 23.72 |

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PAIN0751-006 09/01/2023

| | Rates | Fringes |
|---|---|---|
| GLAZIER | $ 35.65 | 29.73 |

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PLAS0526-015 06/01/2021

| | Rates | Fringes |
|---|---|---|
| CEMENT MASON/CONCRETE FINISHER | $ 31.77 | 21.89 |

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PLAS0526-026 06/01/2021

| | Rates | Fringes |
|---|---|---|
| PLASTERER | $ 30.69 | 18.99 |

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PLUM0354-010 06/01/2024

| | Rates | Fringes |
|---|---|---|
| PIPEFITTER (Industrial) | $ 47.75 | 26.55 |

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PLUM0354-018 06/01/2024

| | Rates | Fringes |
|---|---|---|
| PLUMBER | $ 40.02 | 26.55 |

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PLUM0354-019 06/01/2024

| | Rates | Fringes |
|---|---|---|
| PIPEFITTER (Includes HVAC Pipe Installation, Excludes Work on Industrial Sites)..... | $ 40.02 | 26.55 |

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* ROOF0037-005 06/01/2025

| | Rates | Fringes |
|---|---|---|
| ROOFER (Excludes Metal Roof Installation and Waterproofing)..... | $ 39.91 | 20.76 |

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SHEE0012-011 07/01/2022

| | Rates | Fringes |
|---|---|---|
| SHEET METAL WORKER (Includes HVAC Duct and Metal Roof Installation)..... | $ 39.50 | 30.79 |

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* UAVG-PA-0032 01/01/2025

| | Rates | Fringes |
|---|---|---|
| SPRINKLER FITTER (Fire Sprinklers)..... | $ 45.15 | 27.08 |

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SUPA2011-063 08/20/2014

| | Rates | Fringes |
|---|---|---|
| LABORER: Asphalt Raker | $ 20.92 | 9.09 |
| LABORER: Landscape | $ 18.10 | 0.00 |
| LABORER: Luteman | $ 21.13 | 8.23 |
| ROOFER: Waterproofing Only | $ 23.13 | 2.51 |
| TRUCK DRIVER: Dump Truck | $ 23.36 | 7.60 |

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WELDERS - Receive rate prescribed for craft performing operation to which welding is incidental.

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Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic

violence, sexual assault, or stalking.  Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

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The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next

number, 005 in the example, is an internal number used in processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

The UAVG identifier indicates that no single rate prevailed for those classifications, but that 100% of the data reported for the classifications reflected union rates. EXAMPLE: UAVG-OH-0010 01/01/2024. UAVG indicates that the rate is a weighted union average rate. OH indicates the State of Ohio. The next number, 0010 in the example, is an internal number used in producing the wage determination. The date, 01/01/2024 in the example, indicates the date the wage determination was updated to reflect the most current union average rate.

A UAVG rate will be updated once a year, usually in January, to reflect a weighted average of the current rates in the collective bargaining agreements on which the rate is based.

Survey Rate Identifiers

The ""SU"" identifier indicates that either a single non-union rate prevailed (as defined in 29 CFR 1.2) for this classification in the survey or that the rate was derived by computing a weighted average rate based on all the rates

reported in the survey for that classification. As a weighted average rate includes all rates reported in the survey, it may include both union and non-union rates. Example: SUFL2022-007 6/27/2024. SU indicates the rate is a single non-union prevailing rate or a weighted average of survey data for that classification. FL indicates the State of Florida. 2022 is the year of the survey on which these classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 6/27/2024 in the example, indicates the survey completion date for the classifications and rates under that identifier.

?SU? wage rates typically remain in effect until a new survey is conducted. However, the Wage and Hour Division (WHD) has the discretion to update such rates under 29 CFR 1.6(c)(1).

State Adopted Rate Identifiers

The ""SA"" identifier indicates that the classifications and prevailing wage rates set by a state (or local) government were adopted under 29 C.F.R 1.3(g)-(h). Example: SAME2023-007 01/03/2024. SA reflects that the rates are state adopted. ME refers to the State of Maine. 2023 is the year during which the state completed the survey on which the listed classifications and rates are based. The next number, 007 in the example, is an internal number used in producing the wage determination. The date, 01/03/2024 in the example, reflects the date on which the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

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WAGE DETERMINATION APPEALS PROCESS

1) Has there been an initial decision in the matter? This can be:

a) a survey underlying a wage determination

b) an existing published wage determination

c) an initial WHD letter setting forth a position on a wage determination matter

d) an initial conformance (additional classification and rate) determination

On survey related matters, initial contact, including requests for summaries of surveys, should be directed to the WHD Branch of Wage Surveys. Requests can be submitted via email to davisbaconinfo@dol.gov or by mail to:

Branch of Wage Surveys
Wage and Hour Division
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

Regarding any other wage determination matter such as conformance decisions, requests for initial decisions should be directed to the WHD Branch of Construction Wage Determinations. Requests can be submitted via email to BCWD-Office@dol.gov or by mail to:

Branch of Construction Wage Determinations
Wage and Hour Division

U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

2) If an initial decision has been issued, then any interested party (those affected by the action) that disagrees with the decision can request review and reconsideration from the Wage and Hour Administrator (See 29 CFR Part 1.8 and 29 CFR Part 7). Requests for review and reconsideration can be submitted via email to dba.reconsideration@dol.gov or by mail to:

Wage and Hour Administrator
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210

The request should be accompanied by a full statement of the interested party's position and any information (wage payment data, project description, area practice material, etc.) that the requestor considers relevant to the issue.

3) If the decision of the Administrator is not favorable, an interested party may appeal directly to the Administrative Review Board (formerly the Wage Appeals Board). Write to:

Administrative Review Board
U.S. Department of Labor
200 Constitution Avenue, N.W.
Washington, DC 20210.

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END OF GENERAL DECISION"

"General Decision Number: PA20250042 01/10/2025

Superseded General Decision Number: PA20240042

State: Pennsylvania

Construction Type: Residential

County: Westmoreland County in Pennsylvania.

RESIDENTIAL CONSTRUCTION PROJECTS (consisting of single family homes and apartments up to and including 4 stories)

Note: Contracts subject to the Davis-Bacon Act are generally required to pay at least the applicable minimum wage rate required under Executive Order 14026 or Executive Order 13658. Please note that these Executive Orders apply to covered contracts entered into by the federal government that are subject to the Davis-Bacon Act itself, but do not apply to contracts subject only to the Davis-Bacon Related Acts, including those set forth at 29 CFR 5.1(a)(1).

| | |
|---|---|
| If the contract is entered into on or after January 30, 2022, or the contract is renewed or extended (e.g., an option is exercised) on or after January 30, 2022: | . Executive Order 14026 generally applies to the contract. The contractor must pay all covered workers at least $17.75 per hour (or |

| | the applicable wage rate |
|---|---|
| | listed on this wage |
| | determination, if it is |
| | higher) for all hours |
| | spent performing on the |
| | contract in 2025. |
| If the contract was awarded on | . Executive Order 13658 |
| or between January 1, 2015 and | generally applies to the |
| January 29, 2022, and the | contract. |
| contract is not renewed or | . The contractor must pay all |
| extended on or after January | covered workers at least |
| 30, 2022: | $13.30 per hour (or the |
| | applicable wage rate listed |
| | on this wage determination, |
| | if it is higher) for all |
| | hours spent performing on |
| | that contract in 2025. |

The applicable Executive Order minimum wage rate will be adjusted annually. If this contract is covered by one of the Executive Orders and a classification considered necessary for performance of work on the contract does not appear on this wage determination, the contractor must still submit a conformance request.

Additional information on contractor requirements and worker protections under the Executive Orders is available at

http://www.dol.gov/whd/govcontracts.

Modification Number Publication Date

0 01/03/2025

1 01/10/2025

BRPA0009-043 12/01/2022

Rates Fringes

BRICKLAYER

Except. Rostraver Twp.....$ 36.55 24.46

Rostraver Twp.....$ 37.00 23.82

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CARP0142-005 06/01/2023

Rates Fringes

CARPENTER.....$ 32.29 15.27

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* ELEC0005-013 12/27/2024

Rates Fringes

ELECTRICIAN.....$ 30.20 19.14

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ENGI0066-025 06/01/2011

Rates Fringes

POWER EQUIPMENT OPERATOR:

(Backhoe).....$ 31.045 15.75

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* PAIN0057-030 06/01/2014

Rates Fringes

PAINTER: Brush and Roller.....$ 17.67 ** 11.48

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PLAS0526-007 06/01/2021

Rates Fringes

CEMENT MASON/CONCRETE FINISHER...$ 31.77 21.89

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* SUPA2007-002 03/30/2007

Rates Fringes

Laborer, Unskilled.....$ 14.00 ** 2.10

SHEET METAL WORKER.....$ 16.00 ** 3.08

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WELDERS - Receive rate prescribed for craft performing

operation to which welding is incidental.

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** Workers in this classification may be entitled to a higher minimum wage under Executive Order 14026 ($17.75) or 13658 ($13.30). Please see the Note at the top of the wage determination for more information. Please also note that the minimum wage requirements of Executive Order 14026 are not currently being enforced as to any contract or subcontract to which the states of Texas, Louisiana, or Mississippi, including their agencies, are a party.

Note: Executive Order (EO) 13706, Establishing Paid Sick Leave for Federal Contractors applies to all contracts subject to the Davis-Bacon Act for which the contract is awarded (and any solicitation was issued) on or after January 1, 2017. If this contract is covered by the EO, the contractor must provide employees with 1 hour of paid sick leave for every 30 hours they work, up to 56 hours of paid sick leave each year. Employees must be permitted to use paid sick leave for their own illness, injury or other health-related needs, including preventive care; to assist a family member (or person who is like family to the employee) who is ill, injured, or has other health-related needs, including preventive care; or for reasons resulting from, or to assist a family member (or person who is like family to the employee) who is a victim of, domestic violence, sexual assault, or stalking. Additional information on contractor requirements and worker protections under the EO is available at https://www.dol.gov/agencies/whd/government-contracts.

Unlisted classifications needed for work not included within the scope of the classifications listed may be added after award only as provided in the labor standards contract clauses (29CFR 5.5 (a) (1) (iii)).

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The body of each wage determination lists the classifications and wage rates that have been found to be prevailing for the type(s) of construction and geographic area covered by the wage determination. The classifications are listed in alphabetical order under rate identifiers indicating whether the particular rate is a union rate (current union negotiated rate), a survey rate, a weighted union average rate, a state adopted rate, or a supplemental classification rate.

Union Rate Identifiers

A four-letter identifier beginning with characters other than ""SU"", ""UAVG"", ?SA?, or ?SC? denotes that a union rate was prevailing for that classification in the survey. Example: PLUM0198-005 07/01/2024. PLUM is an identifier of the union whose collectively bargained rate prevailed in the survey for this classification, which in this example would be Plumbers. 0198 indicates the local union number or district council number where applicable, i.e., Plumbers Local 0198. The next number, 005 in the example, is an internal number used in

processing the wage determination. The date, 07/01/2024 in the example, is the effective date of the most current negotiated rate.

Union prevailing wage rates are updated to reflect all changes over time that are reported to WHD in the rates in the collective bargaining agreement (CBA) governing the classification.

Union Average Rate Identifiers

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the classifications and rates under the ?SA? identifier took effect under state law in the state from which the rates were adopted.

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WAGE DETERMINATION APPEALS PROCESS

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Wage and Hour Division

U.S. Department of Labor

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Washington, DC 20210

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Washington, DC 20210

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Washington, DC 20210

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Administrative Review Board

U.S. Department of Labor

200 Constitution Avenue, N.W.

Washington, DC 20210.

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END OF GENERAL DECISION"

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DOCUMENT 00 0884

MINIMUM WAGE NOTICE

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(3 PAGES)

# EMPLOYEE RIGHTS

## UNDER THE DAVIS-BACON ACT

# FOR LABORERS AND MECHANICS EMPLOYED ON FEDERAL OR FEDERALLY ASSISTED CONSTRUCTION PROJECTS

**PREVAILING WAGES**

You must be paid not less than the wage rate listed in the Davis-Bacon Wage Decision posted with this Notice for the work you perform.

**OVERTIME**

You must be paid not less than one and one-half times your basic rate of pay for all hours worked over 40 in a work week. There are few exceptions.

**ENFORCEMENT**

Contract payments can be withheld to ensure workers receive wages and overtime pay due, and liquidated damages may apply if overtime pay requirements are not met. Davis-Bacon contract clauses allow contract termination and debarment of contractors from future federal contracts for up to three years. A contractor who falsifies certified payroll records or induces wage kickbacks may be subject to civil or criminal prosecution, fines and/or imprisonment.

**APPRENTICES**

Apprentice rates apply only to apprentices properly registered under approved Federal or State apprenticeship programs.

**PROPER PAY**

If you do not receive proper pay, or require further information on the applicable wages, contact the Contracting Officer listed below:

Westmoreland County Housing Authority
154 South Greengate Road
Greensburg, PA 15601
Michael L. Washowich

or contact the U.S. Department of Labor's Wage and Hour Division.

**WAGE AND HOUR DIVISION**
UNITED STATES DEPARTMENT OF LABOR

**1-866-487-9243**
TTY: 1-877-889-5627
**www.dol.gov/whd**

WH1321 REV 10/17

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DOCUMENT 00 0886

SUPPLEMENTARY CONDITIONS OF THE CONTRACT
FOR CONSTRUCTION (form HUD-2554)

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(5 PAGES)

**Supplementary Conditions of the Contract for Construction**
Section 232

**U.S. Department of Housing and Urban Development**
Office of Residential Care Facilities

OMB Approval No. 2502-0605
(exp. 06/30/2022)

**Public reporting** burden for this collection of information is estimated to average 0.5 hours. This includes the time for collecting, reviewing, and reporting the data. The information is being collected to obtain the supportive documentation which must be submitted to HUD for approval, and is necessary to ensure that viable projects are developed and maintained. The Department will use this information to determine if properties meet HUD requirements with respect to development, operation and/or asset management, as well as ensuring the continued marketability of the properties. This agency may not collect this information, and you are not required to complete this form, unless it displays a currently valid OMB control number.

**Warning:** Any person who knowingly presents a false, fictitious, or fraudulent statement or claim in a matter within the jurisdiction of the U.S. Department of Housing and Urban Development is subject to criminal penalties, civil liability, and administrative sanctions.

## Article 1: Labor Standards

A. **Applicability.** The Project or program to which the construction work covered by this Contract pertains is being assisted or insured by the United States of America, and the following Federal Labor Standards Provisions are included in this Contract or related instrument pursuant to the provisions applicable to such Federal assistance or insurance. Any statute or regulation contained herein shall also include any subsequent amendment or successor statute or regulation.

B. **Minimum Wages.** Pursuant to Section 212 of the National Housing Act, as amended, 12 U.S.C. 1715c, the minimum wage provisions contained in this paragraph B do not apply to those projects with Security Instruments insured under Section 221(h)(1) designed for less than 9 families and they do not apply to those projects with Security Instruments insured under either Section 220 or 233 designed for less than 12 families.

1. (i) All laborers and mechanics employed or working upon the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the Project) shall be paid unconditionally and not less often than once a week, and without subsequent deduction or rebate on any account (except such payroll deductions as are permitted by regulations issued by the Secretary of Labor under the Copeland Act (29 CFR Part 3)), the full amount of wages and bona fide fringe benefits (or cash equivalents thereof) due at time of payment computed at rates not less than those contained in the wage determination of the Secretary of Labor which is attached hereto and made a part hereof, regardless of any contractual relationship which may be alleged to exist between the Contractor and such laborers and mechanics. Contributions made or costs reasonably anticipated for bona fide fringe benefits under Section 1 (b)(2) of the Davis-Bacon Act (40 U.S.C. 3141(2)(B)(ii)) on behalf of laborers or mechanics are considered wages paid to such laborers or mechanics, subject to the provisions of 29 CFR 5.5(a)(1)(iv); also, regular contributions made or costs incurred for more than a weekly period (but not less often than quarterly) under plans, funds, or programs, which cover the particular weekly period, are deemed to be constructively made or incurred during such weekly period. Such laborers and mechanics shall be paid the appropriate wage rate and fringe benefits on the wage determination for the classification of work actually performed,

without regard to skill, except as provided in 29 CFR 5.5(a)(4). Laborers or mechanics performing work in more than one classification may be compensated at the rate specified for each classification for the time actually worked therein: *Provided,* that the employer's payroll records accurately set forth the time spent in each classification in which work is performed. The wage determination (including any additional classification and wage rates conformed under 29 CFR 5.5(a)(1)(v)) and the Davis-Bacon poster (WH-1321) shall be posted at all times by the Contractor and its subcontractors at the site of the work in a prominent and accessible place where it can be easily seen by the workers.

(ii) (a) Any class of laborers or mechanics that is not listed in the wage determination and that is to be employed under this Contract shall be classified in conformance with the wage determination. HUD shall approve an additional classification and wage rate and fringe benefits only when the following criteria have been met:

(1) The work to be performed by the classification requested is not performed by a classification in the wage determination; and

(2) The classification is utilized in the area by the construction industry; and

(3) The proposed wage rate, including any bona fide fringe benefits, bears a reasonable relationship to the wage rates contained in the wage determination.

(b) If the Contractor and the laborers and mechanics to be employed in the classification (if known), or their representatives, and HUD or its designee agree on the classification and wage rate (including the amount designated for fringe benefits where appropriate), a report of the action taken shall be sent by HUD or its designee to the Administrator of the Wage and Hour Division, U.S. Department of Labor, Washington, D.C. 20210 (**"Administrator"**). The Administrator, or an authorized representative, shall approve, modify, or disapprove every additional classification action within thirty (30) days of receipt and so advise HUD or its designee or shall notify HUD or its designee within the thirty (30) day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB control number 1215-0140.)

(c) In the event the Contractor, the laborers or mechanics to be employed in the classification or their representatives and HUD or its designee do not agree on the proposed classification and wage rate (including the amount designated for fringe benefits, where appropriate), HUD or its designee shall refer the questions, including the views of all interested parties and the recommendation of HUD or its designee, to the Administrator for determination. The Administrator, or an authorized representative, shall issue a determination within thirty (30) days of receipt and so advise HUD or its designee or shall notify HUD or its designee within the thirty (30) day period that additional time is necessary. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

(d) The wage rate (including fringe benefits where appropriate) determined pursuant to subparagraphs B.1.(ii)(b) or (c) of this Article, shall be paid to all workers performing work in the classification under this Contract from the first day on which work is performed in the classification.

(iii) Whenever the minimum wage rate prescribed in the Contract for a class of laborers or mechanics includes a fringe benefit that is not expressed as an hourly rate, the Contractor shall either pay the benefit as stated in the wage determination or shall pay another bona fide fringe benefit or an hourly cash equivalent thereof.

(iv) If the Contractor does not make payments to a trustee or other third person, the Contractor may consider as part of the wages of any laborer or mechanic the amount of any costs reasonably anticipated in providing bona fide fringe benefits under a plan or program, *Provided*, That the Secretary of Labor has found, upon the written request of the Contractor, that the applicable standards of the Davis-Bacon Act have been met. The Secretary of Labor may require the Contractor to set aside, in a separate account, assets for the meeting of obligations under the plan or program. (Approved by the Office of Management and Budget under OMB Control Number 1215-0140.)

2. **Withholding.** HUD or its designee shall upon its own action or upon written request of an authorized representative of the Department of Labor withhold or cause to be withheld from the Contractor under this Contract or any other Federal contract with the same prime contractor, or any other Federally-assisted contract subject to Davis-Bacon prevailing wage requirements, which is held by the same prime contractor, so much of the accrued payments or advances as may be considered necessary to pay laborers and mechanics, including apprentices, trainees and helpers, employed by the Contractor or any subcontractor the full amount of wages required by the Contract. In the event of failure to pay any laborer or mechanic, including any apprentice, trainee or helper, employed or working on the site of the work (or under the United States Housing Act of 1937 or under the Housing Act of 1949 in the construction or development of the Project), all or part of the wages required by the Contract, HUD or its designee may, after written notice to the Contractor, sponsor, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds until such violations have ceased. HUD or its designee may, after written notice to the Contractor, disburse such amounts withheld for and on account of the Contractor or subcontractor to the respective employees to whom they are due.

3. **Payrolls, records, and certifications.**

(i) Payrolls and basic records relating thereto shall be maintained by the Contractor during the course of the work and preserved for a period of three years thereafter for all laborers and mechanics working at the site of the work (or under the United States Housing Act of 1937, or under the Housing Act of 1949, in the construction or development of the Project). Such records shall contain the name, address, and social security number of each such worker, his or her correct classification, hourly rates of wages paid (including rates of contributions or costs anticipated for bona fide fringe benefits or cash equivalents thereof of the types described in Section 1 (b)(2)(B) of the Davis-Bacon Act (40 U.S.C. 3141(2)(B)(ii))), daily and weekly number of hours worked, deductions made and actual wages paid. Whenever the Secretary of

Labor has found under 29 CFR 5.5(a)(1)(iv) that the wages of any laborer or mechanic include the amount of any costs reasonably anticipated in providing benefits under a plan or program described in Section 1 (b)(2)(B) of the Davis-Bacon Act (40 U.S.C. 3141(2)(B)(ii)), the Contractor shall maintain records which show that the commitment to provide such benefits is enforceable, that the plan or program is financially responsible, and that the plan or program has been communicated in writing to the laborers or mechanics affected, and records which show the costs anticipated or the actual cost incurred in providing such benefits. Contractors employing apprentices or trainees under approved programs shall maintain written evidence of the registration of apprenticeship programs and certification of trainee programs, the registration of the apprentices and trainees, and the ratios and wage rates prescribed in the applicable programs. (Approved by the Office of Management and Budget under OMB Control Numbers 1215-0140 and 1215-0017.)

(ii)(a) The Contractor shall submit weekly for each week in which any contract work is performed a copy of all payrolls to HUD or its designee if the agency is a party to the Contract, but if the agency is not such a party, the Contractor shall submit the payrolls to the applicant, sponsor, or Owner, as the case may be, for transmission to HUD or its designee. The payrolls submitted shall set out accurately and completely all of the information required to be maintained under 29 CFR 5.5(a)(3)(i), except that full social security numbers and home addresses shall not be included on weekly transmittals. Instead the payrolls shall only need to include an individually identifying number for each employee (e.g., the last four digits of the employee's social security number). The required weekly payroll information must be submitted electronically. The prime contractor is responsible for the submission of copies of payrolls by all subcontractors. Contractors and subcontractors shall maintain the full social security number and current address of each covered worker, and shall provide them upon request to HUD or its designee if the agency is a party to the Contract, but if the agency is not such a party, the Contractor will submit the payrolls to the applicant sponsor, or Owner, as the case may be, for transmission to HUD or its designee, the Contractor, or the Wage and Hour Division of the Department of Labor for purposes of an investigation or audit of compliance with prevailing wage requirements. It is not a violation of this subparagraph for a prime contractor to require a subcontractor to provide addresses and social security numbers to the prime contractor for its own records, without weekly submission to HUD or its designee. (Approved by the Office of Management and Budget under OMB Control Number 1215-0149.)

(b) Each payroll submitted shall be accompanied by a "Statement of Compliance," signed by the Contractor or subcontractor or his or her agent who pays or supervises the payment of the persons employed under the Contract and shall certify the following:

(1) That the payroll for the payroll period contains the information required to be provided under 29 CFR 5.5(a)(3)(ii), the appropriate information is being maintained under 29 CFR 5.5(a)(3)(i), and that such information is correct and complete.

(2) That each laborer or mechanic (including each helper, apprentice, and trainee) employed on the Contract during the payroll period has been paid the full weekly wages earned, without rebate, either directly or indirectly, and that no deductions have been made either directly or indirectly from the full wages earned, other than permissible deductions as set forth in 29 CFR Part 3;

(3) That each laborer or mechanic has been paid not less than the applicable wage rates and fringe benefits or cash equivalents for the classification of work performed, as specified in the applicable wage determination incorporated into the Contract.

(c) The weekly submission of a properly executed certification set forth on the reverse side of Optional Form WH-347 shall satisfy the requirement for submission of the "Statement of Compliance" required by subparagraph B.3.(ii)(b) of this Article.

(d) The falsification of any of the above certifications may subject the Contractor or subcontractor to civil or criminal prosecution under Section 1001 of Title 18 and Sections 3801 *et seq*. of Title 31 of the United States Code.

(iii) The Contractor or subcontractor shall make the records required under subparagraph B.3.(i) of this Article available for inspection, copying, or transcription by authorized representatives of HUD or its designee or the Department of Labor, and shall permit such representatives to interview employees during working hours on the job. If the Contractor or subcontractor fails to submit the required records or to make them available, HUD or its designee may, after written notice to the Contractor, sponsor, applicant, or Owner, take such action as may be necessary to cause the suspension of any further payment, advance, or guarantee of funds. Furthermore, failure to submit the required records upon request or to make such records available may be grounds for debarment action pursuant to 29 CFR 5.12.

4. **Apprentices and Trainees.**

(i) **Apprentices.** Apprentices shall be permitted to work at less than the predetermined rate for the work they performed when they are employed pursuant to and individually registered in a bona fide apprenticeship program registered with the U.S. Department of Labor, Employment and Training Administration, Office of Apprenticeship, or with a State Apprenticeship Agency recognized by such Office, or if a person is employed in his or her first ninety (90) days of probationary employment as an apprentice in such an apprenticeship program, who is not individually registered in the program, but who has been certified by the Office of Apprenticeship, or a State Apprenticeship Agency (where appropriate) to be eligible for probationary employment as an apprentice. The allowable ratio of apprentices to journeymen on the job site in any craft classification shall not be greater than the ratio permitted to the Contractor as to the entire work force under the registered program. Any worker listed on a payroll at an apprentice wage rate, who is not registered or otherwise employed as stated above, shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any apprentice performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than

the applicable wage rate on the wage determination for the work actually performed. Where the Contractor is performing construction on a project in a locality other than that in which its program is registered, the ratios and wage rates (expressed in percentages of the journeyman's hourly rate) specified in the Contractor's or subcontractor's registered program shall be observed. Every apprentice must be paid at not less than the rate specified in the registered program for the apprentice's level of progress, expressed as a percentage of the journeymen hourly rate specified in the applicable wage determination. Apprentices shall be paid fringe benefits in accordance with the provisions of the apprenticeship program. If the apprenticeship program does not specify fringe benefits, apprentices must be paid the full amount of fringe benefits listed on the wage determination for the applicable classification. If the Administrator determines that a different practice prevails for the applicable apprentice classification, fringes shall be paid in accordance with that determination. In the event the Office of Apprenticeship, or a State Apprenticeship Agency recognized by such Office, withdraws approval of an apprenticeship program, the Contractor shall no longer be permitted to utilize apprentices at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(ii) **Trainees.** Except as provided in 29 CFR 5.16, trainees shall not be permitted to work at less than the predetermined rate for the work performed unless they are employed pursuant to and individually registered in a program which has received prior approval, evidenced by formal certification by the U.S. Department of Labor, Employment and Training Administration. The ratio of trainees to journeymen on the job site shall not be greater than permitted under the plan approved by the Employment and Training Administration. Every trainee must be paid at not less than the rate specified in the approved program for the trainee's level of progress, expressed as a percentage of the journeyman's hourly rate specified in the applicable wage determination. Trainees shall be paid fringe benefits in accordance with the provisions of the trainee program. If the trainee program does not mention fringe benefits, trainees shall be paid the full amount of fringe benefits listed on the wage determination unless the Administrator of the Wage and Hour Division determines that there is an apprenticeship program associated with the corresponding journeyman wage rate on the wage determination which provides for less than full fringe benefits for apprentices. Any employee listed on the payroll at a trainee rate that is not registered and participating in a training plan approved by the Employment and Training Administration shall be paid not less than the applicable wage rate on the wage determination for the classification of work actually performed. In addition, any trainee performing work on the job site in excess of the ratio permitted under the registered program shall be paid not less than the applicable wage rate on the wage determination for the work actually performed. In the event the Employment and Training Administration withdraws approval of a training program, the Contractor shall no longer be permitted to utilize trainees at less than the applicable predetermined rate for the work performed until an acceptable program is approved.

(iii) **Equal employment opportunity.** The utilization of apprentices, trainees and journeymen under 29 CFR Part 5 shall be in conformity with the equal employment opportunity requirements of Executive Order 11246, as amended, and 29 CFR Part 30.

5. **Compliance with Copeland Act Requirements.** The Contractor shall comply with the requirements of 29 CFR Part 3, which are incorporated by reference in this Contract.

6. **Subcontracts.** The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraphs 1 through 10 of this paragraph B and such other clauses as HUD or its designee may by appropriate instructions require, and a copy of the applicable prevailing wage determination, and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for the compliance by any subcontractor or lower tier subcontractor with all Contract clauses referenced in this subparagraph.

7. **Contract termination and debarment.** A breach of the Contract clauses in 29 CFR 5.5 may be grounds for termination of the Contract, and for debarment as a contractor or a subcontractor as provided in 29 CFR 5.12.

8. **Compliance with Davis-Bacon and Related Act Requirements.** All rulings and interpretations of the Davis-Bacon and Related Acts contained in 29 CFR Parts 1, 3, and 5 are herein incorporated by reference in this Contract.

9. **Disputes concerning labor standards.** Disputes arising out of the labor standards provisions of this Contract shall not be subject to the general disputes clause of this Contract. Such disputes shall be resolved in accordance with the procedures of the Department of Labor set forth in 29 CFR Parts 5, 6, and 7. Disputes within the meaning of this clause include disputes between the Contractor (or any of its subcontractors) and HUD or its designee, the U.S. Department of Labor, or the employees or their representatives.

10. **Certification of Eligibility.**

(i) By entering into this Contract, the Contractor certifies that neither it (nor he or she) nor any person or firm who has an interest in the Contractor's firm is a person or firm ineligible to be awarded Government contracts by virtue of Section 3(a) of the Davis-Bacon Act (40 U.S.C. 3144(b)(2)) or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 24 CFR Part 24.

(ii) No part of this Contract shall be subcontracted to any person or firm ineligible for award of a Government contract by virtue of Section 3(a) of the Davis-Bacon Act (40 U.S.C. 3144(b)(2)) or 29 CFR 5.12(a)(1) or to be awarded HUD contracts or participate in HUD programs pursuant to 2 CFR Part 2424.

(iii) The penalty for making false statements is prescribed in the U.S. Criminal Code, 18 U.S.C. 1001. Additionally, U.S. Criminal Code, 18 U.S.C. 1010, "Department of Housing and Urban Development and Federal Housing Administration transactions" provides in part: "Whoever, for the purpose of . . . influencing in any way the action of such Department . . . makes, passes, utters or publishes any statement, knowing the same to be false . . . shall be fined under this title or imprisoned not more than two years, or both."

C. **Contract Work Hours and Safety Standards Act.**

1. **Applicability and Definitions.** This paragraph C of Article 1 is applicable only if a direct form of federal assistance is involved, such as Section 8, Section 202/811 Capital

Advance, grants etc., and is applicable only where the prime contract is in an amount greater than $100,000. As used in this paragraph C, the terms "laborers" and "mechanics" include watchmen and guards.

2. **Overtime requirements.** No contractor or subcontractor contracting for any part of the Contract work that may require or involve the employment of laborers or mechanics shall require or permit any such laborer or mechanic in any workweek in which he or she is employed on such work to work in excess of forty (40) hours in such workweek unless such laborer or mechanic receives compensation at a rate not less than one and one-half times the basic rate of pay for all hours worked in excess of forty (40) hours in such workweek.

3. **Violation; liability for unpaid wages; liquidated damages.** In the event of any violation of the immediately preceding subparagraph C.2, the Contractor and any subcontractor responsible therefor shall be liable for the unpaid wages. In addition, the Contractor and subcontractor shall be liable to the United States (in the case of work done under contract for the District of Columbia or a territory, to such District or to such territory) for liquidated damages. Such liquidated damages shall be computed with respect to each individual laborer or mechanic, including watchmen and guards, employed in violation of such subparagraph, for each calendar day on which such individual was required or permitted to work in excess of the standard workweek of forty (40) hours without payment of the overtime wages required by the clause set forth in such subparagraph.

4. **Withholding for unpaid wages and liquidated damages.** HUD or its designee shall, upon its own action or upon written request of an authorized representative of the Department of Labor, withhold or cause to be withheld from any moneys payable on account of work performed by the Contractor or subcontractor under any such contract, or under any other Federal contract with the same prime contractor, or under any other Federally-assisted contract subject to the Contract Work Hours and Safety Standards Act which is held by the same prime contractor such sums as may be determined to be necessary to satisfy any liabilities of such Contractor or subcontractor for unpaid wages and liquidated damages as provided in the clause set forth in subparagraph 3 of this paragraph C.

5. **Subcontracts.** The Contractor or subcontractor shall insert in any subcontracts the clauses set forth in subparagraphs 1 through 5 of this paragraph C and also a clause requiring the subcontractors to include these clauses in any lower tier subcontracts. The prime contractor shall be responsible for compliance by any subcontractor or lower tier subcontractor with the clauses set forth in such subparagraphs 1 through 5.

D. **Certification.**

For projects with Security Instruments insured under the National Housing Act, as amended, that are subject to paragraph B of this Article 1, the Contractor is required to execute the Contractor's Prevailing Wage Certificate within HUD-92448 as a condition precedent to insurance by HUD of the Loan, or an advance thereof, made or to be made by the Lender in connection with the construction of the Project.

**Article 2: Equal Employment Opportunity**

A. **Applicability.** This Article 2 applies to any contract for construction work, or modification thereof, as defined in the regulations of the Secretary of Labor at 41 CFR Chapter 60, which is paid for in whole or in part with funds obtained from the Federal Government or borrowed on the credit of the Federal Government pursuant to a grant, contract, loan, insurance, or guarantee, or undertaken pursuant to any Federal program involving such grant, contract, loan, insurance, or guarantee.

B. The Contractor shall not discriminate against any employee or applicant for employment because of race, color, religion, sex, sexual orientation, gender identity, disability, or national origin. The Contractor shall take affirmative action to ensure that applicants are employed, and that employees are treated during employment without regard to their race, color, religion, sex, sexual orientation, gender identity, disability or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training including apprenticeship. The Contractor agrees to post in conspicuous places available to employees and applicants for employment notices to be provided setting forth the provisions of this nondiscrimination clause.

C. The Contractor shall, in all solicitations or advertisements for employees placed by or on behalf of the Contractor state that all qualified applicants shall receive consideration for employment without regard to race, color, religion, sex, sexual orientation, gender identity, disability, or national origin. The contractor will not discharge or in any other manner discriminate against any employee or applicant for employment because such employee or applicant has inquired about, discussed, or disclosed the compensation of the employee or applicant or another employee or applicant. This provision shall not apply to instances in which an employee who has access to the compensation information of other employees or applicants as a part of such employee's essential job functions discloses the compensation of such other employees or applicants to individuals who do not otherwise have access to such information, unless such disclosure is in response to a formal complaint or charge, in furtherance of an investigation, proceeding, hearing, or action, including an investigation conducted by the employer, or is consistent with the contractor's legal duty to furnish information.

D. The Contractor shall send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding a notice to be provided advising the said labor union or workers representatives of the Contractor's commitments hereunder, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

E. The Contractor shall comply with all provisions of Executive Order 11246 of September 24, 1965, as amended, and of the rules, regulations, and relevant orders of the Secretary of Labor.

F. The Contractor shall furnish all information and reports required by Executive Order 11246, and by rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and

shall permit access to its books, records, and accounts by the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

G. In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of the said rules, regulations, or orders, this Contract may be canceled, terminated, or suspended in whole or in part and Contractor may be declared ineligible for further government contracts or federally assisted construction contracts in accordance with procedures authorized in Executive Order 11246 and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246, or by rule, regulations or order of the Secretary of Labor, or as otherwise provided by law.

H. The Contractor shall include the provisions of paragraphs A through H of this Article 2 in every subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to Section 204 of Executive Order 11246, as amended, so that such provisions shall be binding upon each subcontractor or vendor. The Contractor shall take such action with respect to any subcontract or purchase order as HUD or the Secretary of Labor may direct as a means of enforcing such provisions, including sanctions for noncompliance. *Provided, however,* that in the event the Contractor becomes involved in, or is threatened with, litigation with a subcontractor or vendor as a result of such direction by HUD or the Secretary of Labor, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

**Article 3: Equal Opportunity for Businesses and Lower Income Persons Located Within the Project Area**

A. This Article 3 is applicable to projects covered by Section 3, as defined in 24 CFR Part 135.

B. The work to be performed under this Contract is on a project assisted under a program providing direct Federal financial assistance from HUD and is subject to the requirements of Section 3 of the Housing and Urban Development Act of 1968, as amended, 12 U.S.C. 1701u. Section 3 requires that to the greatest extent feasible opportunities for training and employment be given to low- and very low-income persons who are (1) residents of the housing developments for which the assistance is expended, (2) residents of other developments managed by the public or Indian housing agency that is expending the assistance, (3) participants in YouthBuild programs, and (4) other low- and very low-income persons residing within the metropolitan area (or nonmetropolitan county) as determined by HUD in which the Project is located and contracts for work in connection with the Project be awarded to business concerns that provide economic opportunities for low- and very low-income persons.

**Article 4: Health and Safety**

A. This Article 4 is applicable only where the prime contract is in an amount greater than $100,000.

B. No laborer or mechanic shall be required to work in surroundings or under working conditions which are unsanitary, hazardous, or dangerous to his or her health and safety as determined under construction safety and health standards promulgated by the Secretary of Labor by regulation.

C. The Contractor shall comply with all regulations issued by the Secretary of Labor pursuant to 29 CFR Part 1926, and failure to comply may result in imposition of sanctions pursuant to the Contract Work Hours and Safety Standards Act, 40 U.S.C 3701 *et seq.*

D. The Contractor shall include the provisions of this Article 4 in every subcontract so that such provisions shall be binding on each subcontractor. The Contractor shall take such action with respect to any subcontract as HUD or the Secretary of Labor shall direct as a means of enforcing such provisions.

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DOCUMENT 00 9100

ADDENDA
(Sample)

PROJECT NO. _____

Project Name: _____

ADDENDUM NO._____ DATE OF ISSUE: _____

PAGE NO. 1

Notice to All Bidders:

This addendum is hereby made a part of the contract and is to be included therein. The purpose of this addendum is to amend, modify and clarify the contract documents, as follows:

CHANGES TO PREVIOUS ADDENDUM:

CHANGES TO SPECIFICATIONS:

CHANGES TO DRAWINGS:

All bidders on this contract shall give due consideration to the contents of this addendum in the preparation of their Bid and shall so indicate on the Bid Form in the spaces provided. Failure of a bidder to acknowledge receipt of this addendum on his Bid form may be considered sufficient cause for rejection of his bid. It shall be the responsibility of each bidder to assure that all his suppliers and subcontractors are made aware of the contents of this addendum.

Architect:
Sleighter Design
1060 Eberly Way
Lemont Furnace, PA 15456

Owner:
Westmoreland County Housing Authority
167 South Greengate Road,
Greensburg, PA 15601

END OF ADDENDUM NO. _____

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SECTION 01 1000

SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Radon Testing & Mitigation for Multi-Family Housing & Hi-Rise Buildings

B. Owner's Name: Westmoreland County Housing Authority.

C. Architect's Name: Sleighter Design.

Summary of work:

The primary objective of this project is to provide radon mitigation throughout multiple areas and building types where radon threshold limits exceeded (4.0 pCi/L). The work will be completed following American National Standards Institute/American Association of Radon Scientists and Technologists (ANSI/AARST) radon testing standards for multi-family, and high-rise buildings.

1.02 CONTRACT DESCRIPTION

A. Contract Type: One prime contract, based on a Stipulated Base Bid Cost.

B. Contracts will be awarded for these trades:

1. Mitigation Company

C. The work of each trade is identified in the contract documents.

1.03 WORK BY OTHERS

A. Items noted NIC (Not in Contract) are not a part of the Prime Contracts.

1.04 OWNER OCCUPANCY

A. Owner intends to continue to occupy all of the spaces of the existing building during the entire construction period.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.05 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Arrange use of site and premises to allow:

1. Owner occupancy.

2. Use of site and premises by the public.

C. Provide access to and from site as required by law and by Owner:

1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.

2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Time Restrictions:

1. Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.

E. Utility Outages and Shutdown:

1. Limit disruption of utility services to hours the building is unoccupied.

2. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7-days notice to Owner and authorities having jurisdiction.

3. Prevent accidental disruption of utility services to other facilities.

1.06 WORK SEQUENCE

A. Coordinate construction schedule and operations with Owner and Architect.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

**Westmoreland County Housing Authority**

**Radon Testing & Mitigation**

SLEIGHTER ENGINEERING + ARCHITECTURE + SURVEYING DESIGN

**Public Housing Units**

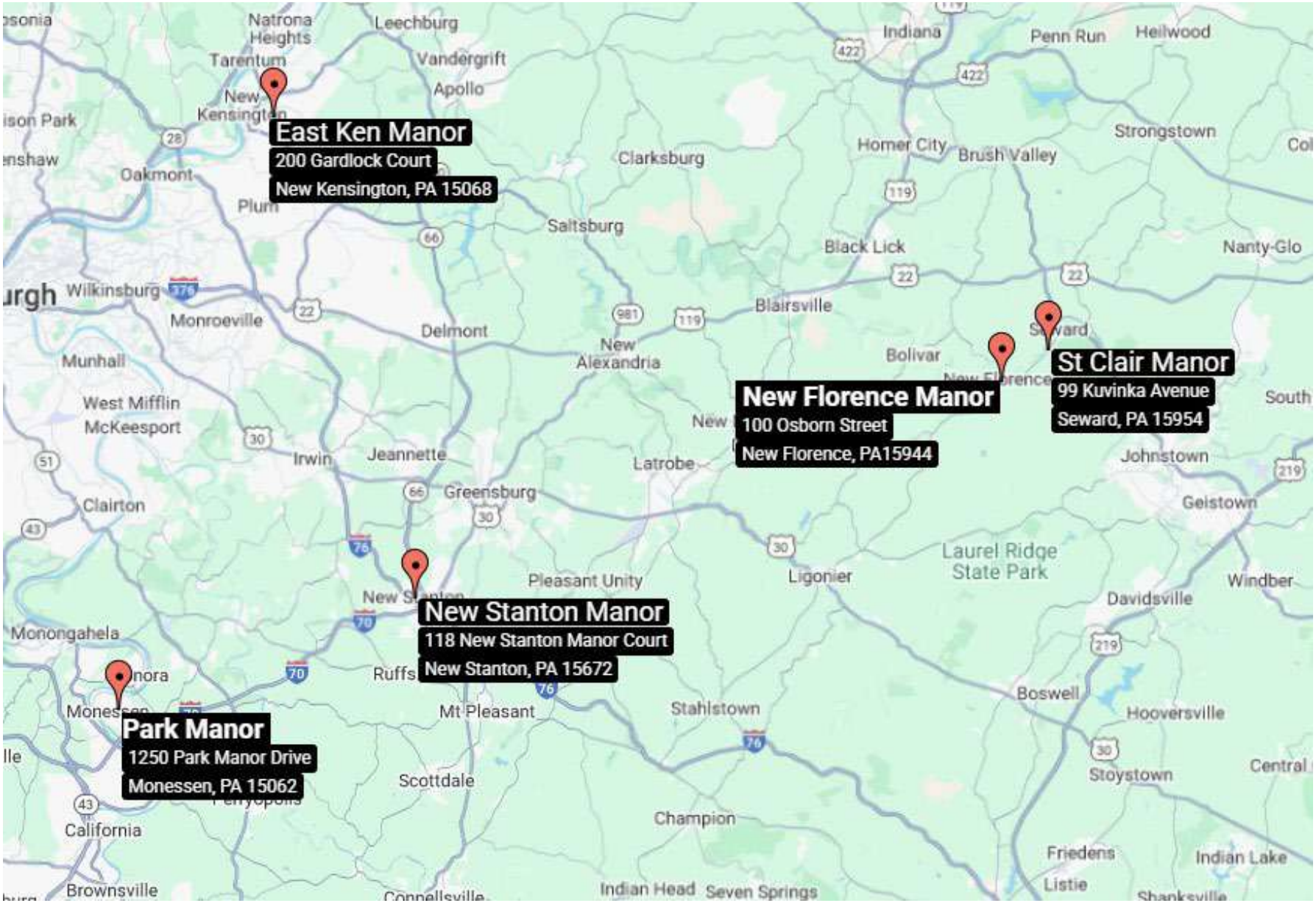
| East Ken Manor - 200 Gardlock Ct. New Kensignton, Pa 15068 | | | |
|---|---|---|---|
| **Unit** | **Foundation** | **Stories** | **Previous Test Result** |
| Unit 57 | Crawl Space | 2 | 6.2 pCi/L |
| Unit 59 | Crawl Space | 2 | 33.7 pCi/L |
| Unit 83 | Crawl Space | 1 | 9.9 pCi/L |
| Unit 101 | Crawl Space | 1 | 5.0 pCi/L |
| Unit 144 | Crawl Space | 2 | 12.5 pCi/L |
| Unit 146 | Crawl Space | 2 | 5.8 pCi/L |
| Unit 169 | Crawl Space | 1 | 14.8 pCi/L |
| Unit 252 | Crawl Space | 1 | 19.2 pCi/L |
| | | | |

| New Stanton Manor - 118 New Stanton Manor Court, New Stanton, Pa 15672 | | | |
|---|---|---|---|
| **Unit** | **Foundation** | **Stories** | **Previous Test Result** |
| Unit 25 | Basement | 3 | 15.7 pCi/L |
| Unit 26 | Basement | 3 | 6.9 pCi/L |
| Unit 28 | Basement | 3 | 6.5 pCi/L |
| Unit 49 | Basement | 3 | 5.4 pCi/L |
| Unit 50 | Basement | 3 | 4.9 pCi/L |
| Unit 52 | Basement | 3 | 4.5 pCi/L |
| Unit 62 | Basement | 3 | 7.9 pCi/L |
| | | | |

| Park Manor - 1250 Park Manor Dr. Monessen, Pa 15062 | | | |
|---|---|---|---|
| **Unit** | **Foundation** | **Stories** | **Previous Test Result** |
| Unit 301 | Basement | 3 | 13.3 pCi/L |
| Unit 405 | | | 9.4 pCi/L |
| | | | |

| St. Clair Manor - 99 Kuvinka Ave. Seward, Pa 15954 | | | |
|---|---|---|---|
| **Unit** | **Foundation** | **Stories** | **Previous Test Result** |
| Unit 167 | Slab On Grade | 1 | 5.8 pCi/L |

| | | | |
|---|---|---|---|
| **New Florence Manor - 100 Osborn St. New Florence, Pa 15944** | | | |
| **Unit** | **Foundation** | **Stories** | **Previous Test Result** |
| Unit 103 | Slab On Grade | 1 | 5.2 pCi/L |
| NOTES: | | | |
| 1. Owner is requesting that all Units be tested one final time before the mitigation occurs. | | | |
| 2. Field verify all existing conditions, including foundation type, number of stories, etc. | | | |


East Ken Manor
200 Gardlock Court
New Kensington, PA 15068
New Florence Manor
100 Osborn Street
New Florence, PA15944
St Clair Manor
99 Kuvinka Avenue
Seward, PA 15954
New Stanton Manor
118 New Stanton Manor Court
New Stanton, PA 15672
Park Manor
1250 Park Manor Drive
Monessen, PA 15062
Natrona Heights
Leechburg
Tarentum
Vandergrift
Apollo
Indiana
Penn Run
Heilwood
Strongstown
Homer City
Brush Valley
Clarksburg
Oakmont
Plum
Saltsburg
Black Lick
Nanty-Glo
Wilkinsburg
Monroeville
Delmont
Blairsville
Bolivar
Munhall
West Mifflin
McKeesport
Irwin
Jeannette
Latrobe
Johnstown
Greensburg
Clairton
Geistown
Laurel Ridge State Park
Ligonier
Pleasant Unity
Windber
Davidsville
Monongahela
Ruffs
Mt Pleasant
Stahlstown
Boswell
Hooversville
Stoystown
Scottdale
Champion
California
Brownsville
Friedens
Listie
Indian Lake
Indian Head
Seven Springs

**Westmoreland County Housing Authority**

**Radon Testing & Mitigation**

SLEIGHTER ENGINEERING + ARCHITECTURE + SURVEYING DESIGN

**CTSS Sites**

**Greenburg Townhomes - 320 Fox Hill Street, Greensburg, Pa 15601**

| Unit | Foundation | Stories | Previous Test Result |
|---|---|---|---|
| Bldg. 3 - Unit 332 | Slab On Grade | 2 | Missing |
| | | | |

**Jeannette Townhomes - 1020 Whiteman Street, Jeannette, Pa 15644**

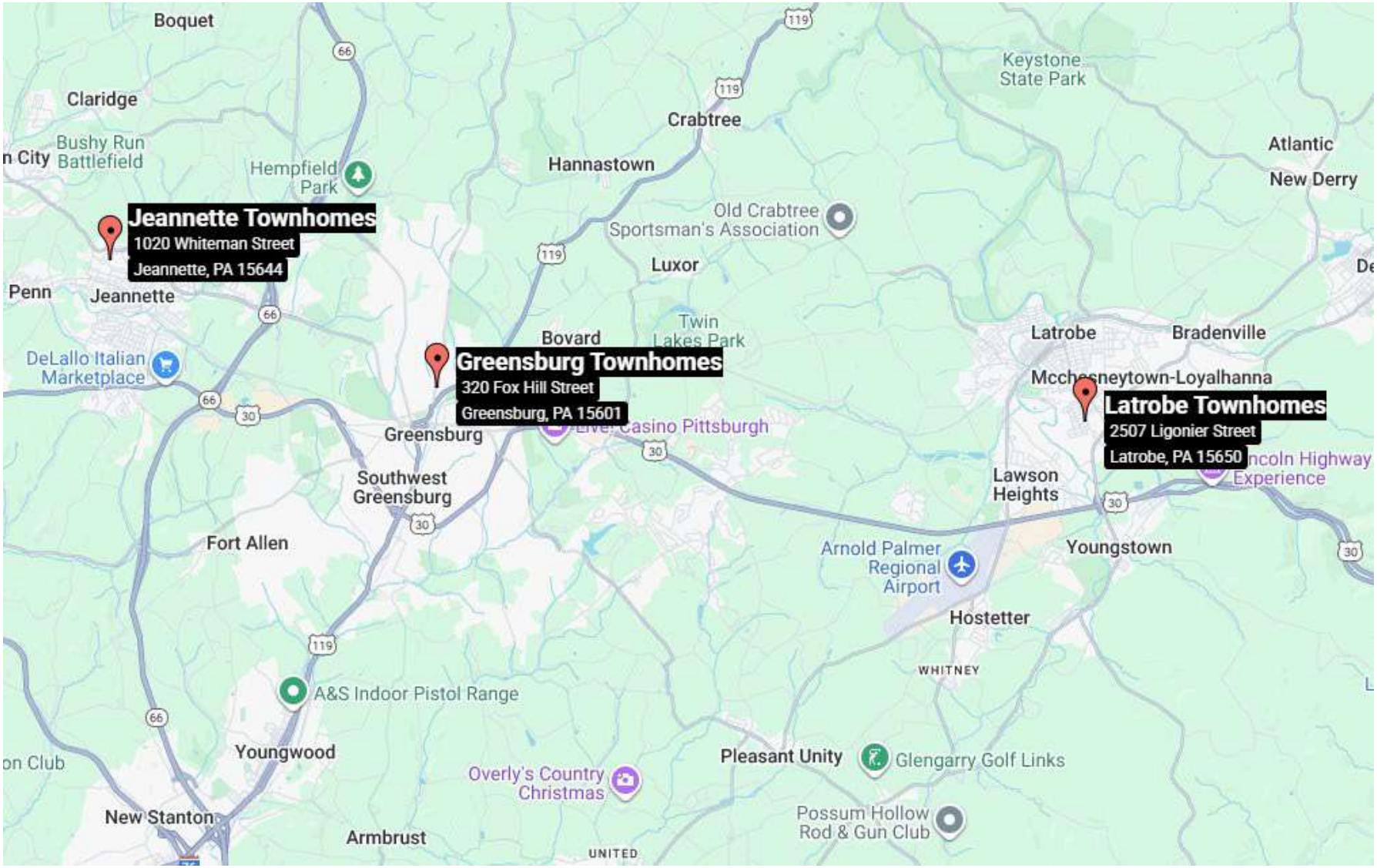
| Unit | Foundation | Stories | Previous Test Result |
|---|---|---|---|
| Unit 1 | Slab On Grade | 2 | 4.5 pCi/L |
| Unit 7 | Slab On Grade | 2 | 5.7 pCi/L |
| | | | |

**Latrobe Townhomes - 2507 South Ligonier Street, Latrobe, Pa 15650**

| Unit | Foundation | Stories | Previous Test Result |
|---|---|---|---|
| 2507 S Ligonier St | Slab On Grade | 1 | 4.4 pCi/L |

NOTES:

1. Owner is requesting that all Units be tested one final time before the mitigation occurs.
2. Field verify all existing conditions, including foundation type, number of stories, etc.


Jeannette Townhomes
1020 Whiteman Street
Jeannette, PA 15644
Greensburg Townhomes
320 Fox Hill Street
Greensburg, PA 15601
Latrobe Townhomes
2507 Ligonier Street
Latrobe, PA 15650
Boquet
Claridge
Bushy Run Battlefield
Hempfield Park
Crabtree
Hannastown
Keystone State Park
Atlantic
New Derry
Old Crabtree Sportsman's Association
Luxor
Penn
Jeannette
DeLallo Italian Marketplace
Bovard
Twin Lakes Park
Latrobe
Bradenville
Greensburg
Southwest Greensburg
Fort Allen
Lawson Heights
Youngstown
Arnold Palmer Regional Airport
Hostetter
WHITNEY
A&S Indoor Pistol Range
Youngwood
Pleasant Unity
Glengarry Golf Links
Overly's Country Christmas
New Stanton
Armbrust
Possum Hollow Rod & Gun Club
UNITED

**Westmoreland County Housing Authority**

**Radon Testing & Mitigation**

SLEIGHTER ENGINEERING + ARCHITECTURE + SURVEYING DESIGN

**NTSS Sites**

| Arnold Townhomes - 401 16th Street, Arnold, Pa 15068 | | | |
|---|---|---|---|
| **Unit** | **Foundation** | **Stories** | **Previous Test Result** |
| 422 15th St. | Slab On Grade | 2 | Missing |
| | | | |

| Lower Burrell Townhomes - 212 MacBeth Drive, Lower Burrell, Pa 15068 | | | |
|---|---|---|---|
| **Unit** | **Foundation** | **Stories** | **Previous Test Result** |
| 214 MacBeth Dr. | Slab On Grade | 2 | 4.3 pCi/L |
| 215 MacBeth Dr. | Slab On Grade | 2 | Missing |
| 220 MacBeth Dr. | Slab On Grade | 2 | 5.4 pCi/L |
| 222 MacBeth Dr. | Slab On Grade | 2 | 5.2 pCi/L |
| | | | |

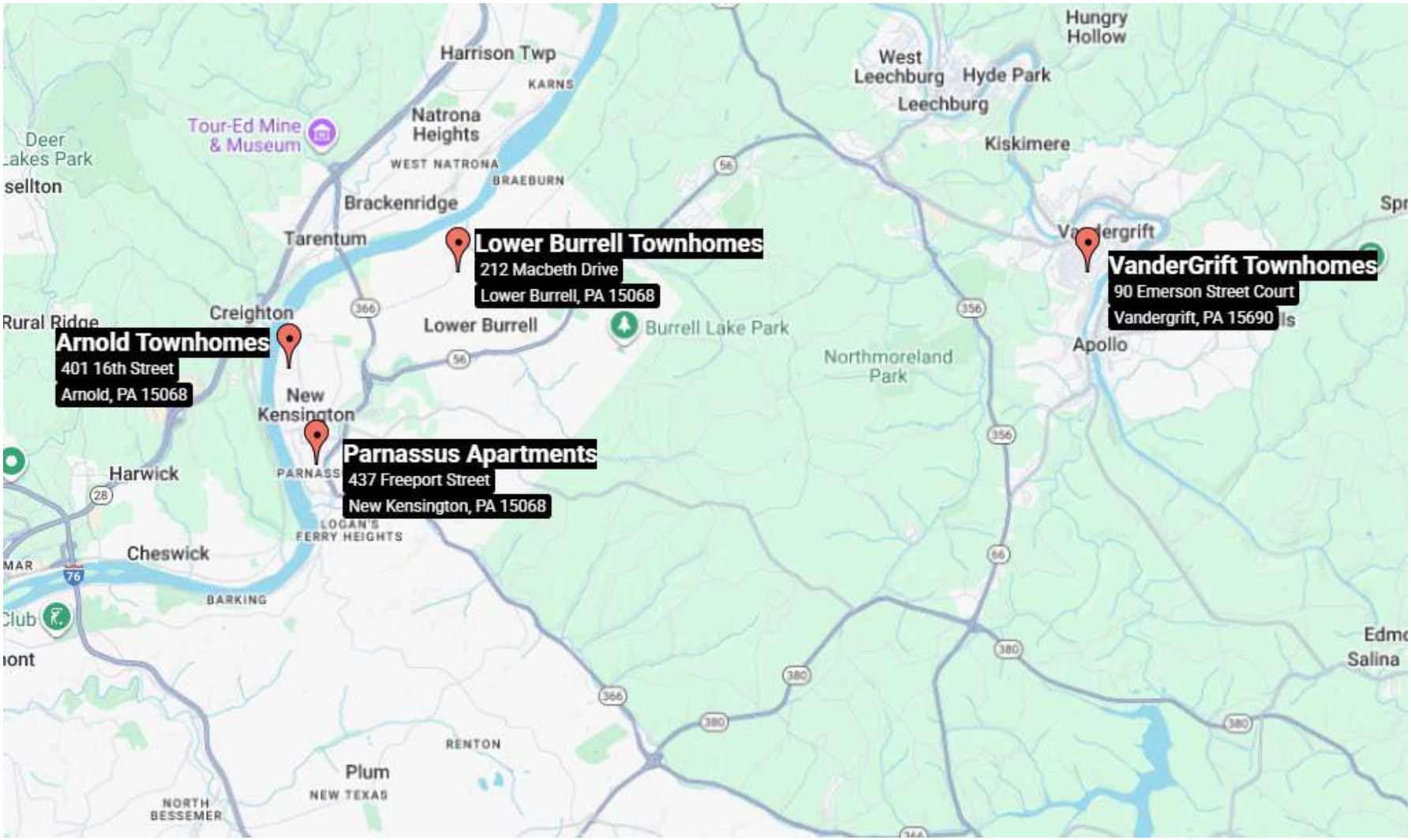
| Parnassus Apartments - 431 & 437 Freeport Street, New Kensington, Pa 15068 | | | |
|---|---|---|---|
| **Unit** | **Foundation** | **Stories** | **Previous Test Result** |
| 437 Freeport St. | | 2 | Missing |
| | | | |

| Vandergrift Townhomes - 90 Emerson Court, Vandergrift, Pa 15690 | | | |
|---|---|---|---|
| **Unit** | **Foundation** | **Stories** | **Previous Test Result** |
| 94B Emerson St | Slab On Grade | 2 | 5.0 pCi/L |
| 91B Emerson St | Slab On Grade | 2 | 10.8 pCi/L |
| 300B Poplar St | Slab On Grade | 2 | 4.2 pCi/L |

NOTES:

1. Owner is requesting that all Units be tested one final time before the mitigation occurs.

2. Field verify all existing conditions, including foundation type, number of stories, etc.




WESTMORELAND COUNTY HOUSING AUTHORITY NTSS UNITS - MAP

SECTION 01 1045

CUTTING AND PATCHING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Requirements and limitations for cutting and patching of Work.

B. Chases and Openings.

1.02 SUBMITTALS

A. Submit written request in advance of cutting or alteration which affects:

1. Structural integrity of any element of Project.
2. Integrity of weather exposed or moisture resistant element.
3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner

B. Include in request:

1. Identification of Project.
2. Location and description of affected Work.
3. Necessity for cutting or alteration.
4. Description of proposed Work and Products to be used.
5. Alternatives to cutting and patching.
6. Effect on work of Owner
8. Date and time work will be executed.

1.03 CHASES AND OPENINGS

A. Contractor is responsible for the size and location of all openings required for the proper installation of their work.

B. Openings in new work: The Contractor will construct or have built into any new work all such openings as are necessary.

C. Openings In Existing Structure: Contractor is responsible for cutting of openings required for the proper installation of work in their Contract.

PART 2 PRODUCTS

2.01 MATERIALS

A. Primary Products: Those required for original installation.

B. Product Substitution: For any proposed change in materials, submit request for substitution.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine existing conditions prior to commencing Work, including elements subject to damage or movement during cutting and patching.

B. After uncovering existing Work, assess conditions affecting performance of work.

C. Beginning of cutting or patching means acceptance of existing conditions.

3.02 PREPARATION

A. Provide temporary supports to ensure structural integrity of the Work. Provide devices and methods to protect other portions of Project from damage.

B. Provide protection from elements for areas which may be exposed by uncovering work.

3.03 CUTTING

A. Execute cutting and fitting to complete the Work.

B. Uncover work to install improperly sequenced work.

C. Remove and replace defective or non-conforming work.

D. Remove samples of installed work for testing when requested.

E. Provide openings in the Work for penetration of mechanical and electrical work.

F. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight-exposed surfaces.

G. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

3.04 PATCHING

A. Execute patching to complement adjacent Work.

B. Fit Products together to integrate with other Work.

C. Execute work by methods to avoid damage to other Work, and which will provide appropriate surfaces to receive patching and finishing.

D. Employ original installer to perform patching for weather exposed and moisture resistant elements, and sight-exposed surfaces.

E. Restore work with new Products in accordance with requirements of Contract Documents.

F. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

G. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material to full thickness of the penetrated element.

H. Refinish all exposed surfaces to match adjacent finish. For continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit. When patching masonry, tooth in all patches unless directed otherwise by the owner/engineer.

END OF SECTION 01 1045

# Schedule of Amounts for Contract Payments

**U.S. Department of Housing and Urban Development**
Office of Public and Indian Housing

OMB Approval No. 2577-0157
(Exp. 11/30/2023)

No progress payments shall be made to the contractor unless a schedule of amounts for contract payments in accordance with the construction contract is received.

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. HUD may not conduct or sponsor, and an applicant is not required to respond to a collection of information unless it displays a currently valid OMB control number. Construction practices and HUD administrative requirements establish the need that HAs maintain certain records or submit certain documents in conjunction with the oversight of the award of construction contracts for the construction of new low-income housing developments or modernization of existing developments. These forms are used by HAs to provide information on the construction progress schedule and schedule of amounts for contract payments. Responses to the collection of information are required to obtain a benefit or to retain a benefit. The information requested does not lend itself to confidentiality.

| Project Name and Location | Project Number |
|---|---|
| | |

Name, Address, and Zip Code of Contractor

| Nature of Contract | Contract Number |
|---|---|
| | |

| Approved for Contractor by | Title | Date (mm/dd/yyyy) |
|---|---|---|
| | | |

| Approved for Architect by | Title | Date (mm/dd/yyyy) |
|---|---|---|
| | | |

| Approved for Owner by | Title | Date (mm/dd/yyyy) |
|---|---|---|
| | | |

| Item No. (1) | Description of Item (2) | Quantity (3) | Unit of Measure (4) | Unit Price in Place (5) | Amount of Sub-Item (6) | Amount of Principal Item (7) |
|---|---|---|---|---|---|---|
| | | | D | | | |
| **Total Amount of Contract or Carried Forward** | | | | | | $ |

To the best of my knowledge, all the information stated herein, as well as any information provided in the accompaniment herewith, is true and accurate.
**Warning:** HUD will prosecute false claims and statements. Conviction may result in criminal and/or civil penalties. (18 U.S.C. 1001, 1010, 1012; 31 U.S.C. 3729, 3802)

| Signature of authorized represenative | Date signed (mm/dd/yyyy) |
|---|---|
| | |

**Instructions for Preparation of form HUD-51000**

1. A separate breakdown is required for each project and prime contract instructions for preparation are given below.
   a. **Heading.** Enter all identifying information required for both forms.
   b. **Columns 1 and 2.** In column 1, enter the item numbers starting with No. 1, and in column 2 enter each principal division of work incorporated in the contract work.
      (1) **Master List.** The Master list contains the basic items into which any construction contract may be subdivided for the purpose of preparing the Construction Progress Schedule and the Periodical Estimates for Partial Payments. Only those items shall be selected which apply to the particular contract. To ensure uniformity, no change shall be made in the item numbers. Generally, about 25 to 40 major items appear in a contract.
      (2) **Items Subdivided.** In the Contractor's breakdown, against which all periodical estimates will be checked prior to payment, each major item must be subdivided into sub-items pertinent to the project involved and in agreement with the Contractor's intended basis for requesting monthly payments.
   c. **Column 3.** Enter the total quantity for each sub-item of each principal division of work listed in the breakdown.
   d. **Column 4.** Enter the appropriate unit of measure for each sub-item of work opposite the quantities described in column 3, such as “sq. ft.,” “cu. yd.,” “tons,” “lb.,” “lumber per M/BM,” “brickwork per M,” etc., applicable to the particular sub-item. Items shown on “lump sum” or equivalent basis will be paid for only on completion of the whole item and not on a percentage of completion basis.
   e. **Column 5.** Enter the unit price, in place, of each sub-item of work.
   f. **Column 6.** Enter the amount of each sub-item obtained by multiplying the quantities in column 3 by the corresponding unit prices in column 5.
   g. **Column 7.** Enter the amount of principal item only, obtained by adding the amounts of all sub-items of each principal division of work listed in column 6. Continue with the breakdown on form HUD-51000.
   h. The “Schedule of Amounts for Contract Payments” shall be signed and dated in the space provided at the bottom of each sheet of the form by the individual who prepared the breakdown for the Contractor.

2. The minimum number of copies required for each submission for approval is an original and two copies. When approved, one fully approved copy will be returned to the Contractor.

**Master List of Items**

| Item No. | Division of Work | Item No. | Division of Work | Item No. | Division of Work |
|---|---|---|---|---|---|
| 1 | Bond | 20 | Rough Carpentry | | **Site Improvements** |
| 2 | General Conditions | 21 | Metal Bucks | 44 | Retaining Walls |
| 3 | Demolition & Clearing | 22 | Caulking | 45 | Storm Sewers |
| | | 23 | Weatherstripping | 46 | Sanitary Sewers |
| | **Structures** | 24 | Lath & Plastering-Drywall | 47 | Water Distribution System |
| 4 | General Excavation | 25 | Stucco | 48 | Gas Distribution System |
| 5 | Footing Excavation | 26 | Finish Carpentry | 49 | Electrical Distribution System |
| 6 | Backfill | 27 | Finish Hardware | 50 | Street & Yard Lighting |
| 7 | Foundation Piles & Caissons | 28 | Glass & Glazing | 51 | Fire & Police Alarm System |
| 8 | Concrete Foundations | 29 | Metal Doors | 52 | Fire Protection System |
| 9 | Concrete Superstructures | 30 | Metal Base & Trim | 53 | Street Work |
| 10 | Reinforcing Steel | 31 | Toilet Partitions | 54 | Yard Work |
| 11 | Waterproofing & Dampproofing | 32 | Floors | 55 | (Other) |
| 12 | Spandrel Waterproofing | 33 | Painting & Decorating | 56 | (Other) |
| 13 | Structural Steel | 34 | Screens | | |
| 14 | Masonry | 35 | Plumbing | | **Equipment** |
| 15 | Stonework | 36 | Heating | 57 | Shades & Drapery Rods |
| 16 | Miscellaneous & Ornamental Metal | 37 | Ventilating System | 58 | Ranges |
| 17 | Metal Windows | 38 | Electrical | 59 | Refrigerators |
| 18 | Roofing | 39 | Elevators | 60 | Kitchen Cabinets & Work Tables |
| 19 | Sheet Metal | 40 | Elevator Enclosures—Metal | 61 | Laundry Equipment |
| | | 41 | Incinerators—Masonry & Parts | 62 | (Other) |
| | | 42 | (Other) | | |
| | | 43 | (Other) | 63 | **Punch List** \2 |
| | | | | 64 | Lawns & Planting |

1 General Conditions should be 3% to 5% of contract amount.
2 Punch List should be approximately 1/2 of 1% or $30 per dwelling unit, whichever is greater.

# Periodic Estimate for Partial Payment

**U.S. Department of Housing and Urban Development**
Office of Public and Indian Housing

OMB Approval No. 2577-0157
(exp. 11/30/2023)

Submit original and one copy to the Public Housing Agency.
Complete instructions are on the back of this form.

Public reporting burden for this collection of information is estimated to average 3.5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. HUD may not conduct or sponsor , and an applicant is not required to respond to a collection of information unless it displays a currently valid OMB control number. This information is collected under the authority of Section 6(c) of the U.S Housing Act of l937 and HUD regulations. HAs are responsible for contract administration to ensure that the work for project development is done in accordance with State laws and HUD requirements. The contractor/subcontractor reports provide details and summaries on payments, change orders, and schedule of materials stored for the project The information will be used to ensure that the total development cost s, identified in the ACC, are kept as low as possible and consistent with HUD construction requirements. Responses to the collection are necessary to obtain a benefit. The information requested does not lend itself to confidentiality.

| Name of Public Housing Agency | Periodic Estimate Number | Period<br>From (mm/dd/yyyy) To (mm/dd/yyyy) |
|---|---|---|
| | | |

| Location of Project | Project Number |
|---|---|
| | |

| Name of Contractor | Contract Number |
|---|---|
| | |

| Item Number<br>(1) | Description of Item<br>(2) | Completed to Date<br>(3) |
|---|---|---|
| | | $ |

| **Value of Contract Work Completed to Date (Transfer this total to line 5 on back of this sheet)** | **$** |
|---|---|

## Instructions

**Headings.** Enter all identifying data required. Periodic estimates must be numbered in sequence beginning with the number 1.

**Columns 1 and 2.** The"Item Number"and "Description of Item" must correspond to the number and descriptive title assigned to each principal division of work in the "Schedule of Amounts for Contract Payments", form HUD-51000.

**Column 3.** Enter the accumulated value of each principal division of work completed as of the closing date of the periodic estimate. Enter the total in the space provided.

**Certifications.** The certification of the contractor includes the analysis of amounts used to determine the net balance due. In the first paragraph, enter the name of the Public Housing Agency, the contractor, and the date of the contract. Enter the calculations used in arriving at the "Balance Due This Payment" on lines 1 through 16.

Enter the contractor's name and signature in the certification following line 16.

The latter portion of this certification relating to payment of legal rates of wages, is required by the contract before any payment may be made. However, if the contractor does not choose to certify on behalf of his/her subcontractors to wage payments made by them, he/she may modify the language to cover only himself /herself and attach a list of all subcontractors who employed labor on the site during the period covered by the Periodic Estimate, together with the individual certifications of each.

### Certification of the Contractor or Duly Authorized Representative

According to the best of my knowledge and belief, I certify that all items and amounts shown on the other side of this form are correct; that all work has been performed and material supplied in full accordance with the items and conditions of the contract between the (name of owner) _____ and (contractor) _____ dated (mm/dd/yyyy) _____, and duly authorized deviations, substitutions, alterations, and additions; that the following is a true and correct statement of the Contract Account up to and including the last day of the period covered by this estimate, and that no part of the "Balance Due This Payment" has been received.

| | | | |
|---|---|---|---|
| 1. Original Contract Amount | | | $ |
| **Approved Change Orders:** | | | |
| 2. Additions (Total from Col. 3, form HUD-51002) | $ | | |
| 3. Deductions (Total from Col. 5, form HUD-51002) | $ | (net) $ | |
| 4. Current Adjusted Contract Amount (line 1 plus or minus net) | | | $ |
| **Computation of Balance Due this Payment** | | | |
| 5. Value of Original Contract work completed to date (from other side of this form) | | | $ |
| **Completed Under Approved Change Orders** | | | |
| 6. Additions (from Col. 4, form HUD-51002) | $ | | |
| 7. Deductions (from Col.5, form HUD-51002) | $ | (net) $ | |
| 8. Total Value of Work in Place (line 5 plus or minus net line 7) | | | $ |
| 9. **Less:** Retainage, _____ % | $ | | |
| 10. Net amount earned to date (line 8 less line 9) | | $ | |
| **11. Less:** Previously earned (line 10, last Periodic Estimate) | | $ | |
| 12. Net amount due, work in place (line 10 less line 11) | | | $ |
| **Value of Materials Properly Stored** | | | |
| 13. At close of this period (from form HUD-51004) | $ | | |
| 14. **Less:** Allowed last period | $ | | |
| 15. Increase (decrease) from amount allowed last period | $ | | |
| **16. Balance Due This Payment** | | | **$** |

I further certify that all just and lawful bills against the undersigned and his/her subcontractors for labor, material, and equipment employed in the performance of this contract have been paid in full in accordance with the terms and conditions of this contract, and that the undersigned and his/her subcontractors have complied with, or that there is an honest dispute with respect to, the labor provisions of this contract.

| Name of Contractor | Signature of Authorized Representative | Title | Date (mm/dd/yyyy) |
|---|---|---|---|
| | | | |

### Certificate of Authorized Project Representative and of Contracting Officer

Each of us certifies that he/she has checked and verified this Periodic Estimate No. _____ ; that to the best of his/her knowledge and belief it is a true statement of the value of work performed and material supplied by the contractor; that all work and material included in this estimate has been inspected by him/her or by his/her authorized assistants; and that such work has been performed or supplied in full accordance with the drawings and specifications, all applicable accessibility requirements (including Section 504 and Title II of the Americans with Disabilities Act; and the Fair Housing Act and Title III of the Americans with Disa bilities Act, if applicable),the terms and conditions of the contract, and duly authorized deviations, substitutions, alterations, and additions, all of which have been duly approved.

We, therefore, approve as the "Balance Due this Payment" the amount of $ _____

| Authorized Project Representative | Date (mm/dd/yyyy) | Contracting Officer | Date (mm/dd/yyyy) |
|---|---|---|---|
| | | | |

I certify the information on this form and in any accompanying documentation is true and accurate. I acknowledge making, presenting, or submitting a false, fictitious, or fraudulent statement, representation, or certification may result in criminal, civil, and/or administrative sanctions, including fines, penalties, and confinement for up to 5 years, (18 U.S.C. §§ 287, 1001 and 31 U.S.C. §3729)

# Schedule of Change Orders

**U.S. Department of Housing and Urban Development**
Office of Public and Indian Housing

OMB Approval No. 2577-0157
(exp. 11/30/2023)

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. HUD may not conduct or sponsor, and an applicant is not required to respond to a collection of information unless it displays a currently valid OMB control number.

This information is collected under the authority of Section 6(c) of the U.S Housing Act of l937 and HUD regulations. HAs are responsible for contract administration to ensure that the work for project development is done in accordance with State laws and HUD requirements. The contractor/subcontractor reports provide details and summaries on payments, change orders, and schedule of materials stored for the project The information will be used to ensure that the total development costs, identified in the ACC, are kept as low as possible and consistent with HUD construction requirements. Responses to the collection are necessary to obtain a benefit. The information requested does not lend itself to confidentiality.

**Instructions:** Contractors use this form for reporting the details of approved Change Orders. Attach an original (or a opy) to each copy of the Periodic Estimate for Partial Payment (form HUD-51001) submission, and send to the Public Housing Agency. Complete all entries. Only Change Orders which bear the signatures required by the contract are to be recorded.

| Name of Public Housing Agency | Supporting Periodic Estimate for Partial Payment Number | Period From (mm/dd/yyyy) to (mm/dd/yyyy) |
|---|---|---|
| | | |

| Location of Project | Project Number |
|---|---|
| | |

| Name of Contractor | Contract Number |
|---|---|
| | |

| Approved Change Orders | | Additions | | Deductions |
|---|---|---|---|---|
| Change Order Number (1) | Dated (mm/dd/yyyy) (2) | Total Amount of Change Order (3) | Value of Work Completed to Date (4) | Total Amount of Change Order (5) |
| | | $ | $ | $ |
| **Totals** | | $ | $ | $ |

| **Authorized Project Representative** | **Date (mm/dd/yyyy)** |
|---|---|
| | |

I certify that the information provided on this form and in any accompanying documentation is true and accurate. I acknowledge that making, presenting, or submitting a false, fictitious, or fraudulent statement, representation, or certification may result in criminal, civil, and/or administrative sanctions, including fines, civil penalties, and confinement for up to 5 years, (18 U.S.C. §§ 287, 1001 and 31 U.S.C. §3729)

# Schedule of Materials Stored

**U.S. Department of Housing and Urban Development**
Office of Public and Indian Housing

OMB Approval No. 2577-0157
(exp. 11/30/2023)

Public reporting burden for this collection of information is estimated to average 1.5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. HUD may not conduct or sponsor, and an applicant is not required to respond to a collection of information unless it displays a currently valid OMB control number. This information is collected under the authority of Section 6(c) of the U.S Housing Act of l937 and HUD regulations. HAs are responsible for contract administration to ensure that the work for project development is done in accordance with State laws and HUD requirements. The contractor/subcontractor reports provide details and summaries on payments, change orders, and schedule of materials stored for the project The information will be used to ensure that the total development costs, identified in the ACC, are kept as low as possible and consistent with HUD construction requirements. Responses to the collection are necessary to obtain a benefit. The information requested does not lend itself to confidentiality.

**Instructions:** This form is to be used to support the Periodic Estimate for Partial Payment (form HUD-51001). The contractor must prepare a separate schedule for his/her materials and for those of his/her subcontractors. Attach an original (or a copy ) to each copy of the Summary of Materials Stored (form HUD-51004). Enter all identifying data and list materials stored. The listing of materials stored must correspond to the arrangement established on the Schedule of Contract Payments (form HUD-51000) and each item will be keyed by corresponding item number. This form must be signed as noted.

| Name of Public Housing Agency | Supporting Periodic Estimate for Partial Payment Number | Period From (mm/dd/yyyy) To (mm/dd/yyyy) |
|---|---|---|
| | | |

| Name and Location of Project | Project Number |
|---|---|
| | |
| **Name of General Contractor** | **Contract Number** |
| | |
| **Name of Subcontractor** | **Subcontract Number** |
| | |

| Item Number* | Description and Quality | Quantity | Unit of Measure | Unit Price at Site | Total Price |
|---|---|---|---|---|---|
| **Amount Carried Forward** | | | | | **$** |
| | | | | | |

**Total Amount or Amount Carried Forward** **$**

| **Prepared by** (Contractor's Representative) | **Date (mm/dd/yyyy)** | **Checked by** (Owner's Representative) | **Date (mm/dd/yyyy)** |
|---|---|---|---|
| | | | |

I certify that the information provided on this form and in any accompanying documentation is true and accurate. I acknowledge that making, presenting, or submitting a false, fictitious, or fraudulent statement, representation, or certification may result in criminal, civil, and/or administrative sanctions, including fines, penalties, and imprisonment.

As identified in Schedule of Amounts for Contract Payments, form HUD-51000.

**Previous Editions are Obsolete**

# Summary of Materials Stored

**U.S. Department of Housing and Urban Development**
Office of Public and Indian Housing

OMB Approval No. 2577-0157
(exp. 11/30/2023)

Public reporting burden for this collection of information is estimated to average 2.5 hours per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. HUD may not conduct or sponsor, and an applicant is not required to respond to a collection of information unless it displays a currently valid OMB control number. This information is collected under the authority of Section 6(c) of the U.S Housing Act of I937 and HUD regulations. HAs are responsible for contract administration to ensure that the work for project development is done in accordance with State laws and HUD requirements. The contractor/subcontractor reports provide details and summaries on payments, change orders, and schedule of materials stored for the project The information will be used to ensure that the total development costs, identified in the ACC, are kept as low as possible and consistent with HUD construction requirements. Responses to the collection are necessary to obtain a benefit. The information requested does not lend itself to confidentiality.

**Instructions:** This form is for the Contractor to summarize the value of materials stored at the site (as shown on the schedule, form HUD-51003). Use a separate line for the contractor and each of his/her subcontractors. Prepare an original and one copy, attach form HUD-51003, and send to the Public Housing Agency with the Periodic Estimate for Partial Payment, form HUD-51001. **Payment Value.** No more than 90 percent of the estimated value of the stored materials will be allowed, and only the net amount will be carried to line 13 on the back of the Periodic Estimate for Partial Payment, form HUD-51001. **Signatures.** This form must be signed by those employees of the contractor and of the Public Housing Agency who prepare and check the Schedule of Materials Stored, form HUD-51003.

| Name of Public Housing Agency | Supporting Periodic Estimate for Partial Payment Number | Period From (mm/dd/yyyy) | To (mm/dd/yyyy) |
|---|---|---|---|
| | | | |

| Location of Project | Project Number |
|---|---|
| | |

| Name of General Contractor | Contract Number |
|---|---|
| | |

| **Name of General Contractor or Subcontractor** | **Amounts** |
|---|---|
| General Contractor | $ |
| Subcontractors | $ |
| **Total** | **$** |
| **Less 10%** | **$** |
| **Net** | **$** |

| **Prepared by** | **Date (mm/dd/yyyy)** | **Checked by** | **Date (mm/dd/yyyy)** |
|---|---|---|---|
| | | | |

I certify that I or my authorized representatives have examined and checked in detail the invoices representing the cost of materials set forth in appended "Schedule of Materials Stored", form HUD-51003, dated (mm/dd/yyyy) __---------- submitted by __ ---------- _____ consisting of _____ sheets with an indicated cost of $ _____ , and find that the net unit prices set forth in the schedule are the same or less than the invoices examined, and that such materials were suitably stored at the site of the development as of (date)(mm/dd/yyyy) _____ .

| **Name of Owner** | **By** (Authorized Representative) | **Title** | **Date (mm/dd/yyyy)** |
|---|---|---|---|
| | | | |

**Warning:** HUD will prosecute false claims and statements. Conviction may result in criminal and/or civil penalties. (18 U.S.C. 1001, 1010, 1012; 31 U.S.C. 3729, 3802)

# Construction Progress Schedule

**U.S. Department of Housing and Urban Development**
Office of Public and Indian Housing

OMB Approval No. 2577-0157 (Exp. 11/30/2023)

Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching exi sting data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. HUD may not conduct or sponsor, a nd an applicant is not required to respond to a collection of information unless it displays a currently valid OMB control number.

Construction practices and HUD administrative requirements establish the need that HAs maintain certain records or submit certain documents in conjunction with the oversight of the award of construction contracts for the construction of new low-income housing developments or modernization of existing developments. These forms are used by HAs to provide information on the construction progress schedule and schedule of amounts for contract payments. Responses to the collection of information are required to obtain a benefit or to retain a benefit. The information requested does not lend itself to confidentiality.

| 1. Name of Public Housing Agency/Indian Housing Authority (PHA/IHA) | | |
|---|---|---|
| 2. City | 3. State | 5. Project Name |
| 4. Location | | 6. Project Number |
| 7. Contract For | | 8. Contract Time (Days) |
| 9. From (mm/dd/yyyy) To (mm/dd/yyyy) | | 10. Contract Price $ |
| 11. Number of Buildings | 12. Number of Dwelling Units | 13. Number of Rooms |

| (Submit as many pages as necessary to cover the construction period.) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Year (yyyy) | | | | | | | |
| | Month | | | | | | | |
| Actual Monthly Value, Work in Place | ($) | | | | | | | |
| Actual Accumulated Progress | (%) | | | | | | | |
| Anticipated Monthly Value | ($) | | | | | | | |
| Accumulated Scheduled Progress | (%) | | | | | | | |

| | | | |
|---|---|---|---|
| Submitted by | Contractor's Name | | |
| | Title | Signature | Date (mm/dd/yyyy) |
| Approved by | PHA/IHA | | |
| | Title | | Date (mm/dd/yyyy) |
| Approved by | Architect | | Date (mm/dd/yyyy) |

## Instructions for Preparation of Construction Progress Schedule
## Form HUD-5372

**General.** The information required for items 1 through 6 can be obtained from the contract documents. (7.) Enter the type of work awarded by the PHA/IHA. This may be "general construction," "plumbing," "heating," "electrical," etc., depending upon prime contract awards. (8.) Enter the contract time in calendar days (unless otherwise stated). (9.) Enter the starting and completion dates as established by the Notice to Proceed.

**Year and Month.** At the top of the Schedule, space is provided for inserting the "Year" and "Month" to identify the times during which the work is to be performed.

**Year.** Enter the year when the Notice to Proceed was issued. If the starting date of the contract is such that the time assigned for completion will be carried into a succeeding year, two yearly designations will be shown, each centered over the applicable spread of time for each year.

**Month.** The body of the Schedule is divided into Columns, each representing a period of one month. Starting in the Column with the month stated in the Notice to Proceed, enter at the top of each column the successive months corresponding to the entire spread of the total contract time. The Schedule must contain monthly columns to cover the entire active period of contract, with extra columns for possible overruns in contract time.

**Computation of Anticipated Monthly Value of Work in Place**

Before presenting the form for approval, enter in each monthly column the dollar value (omit cents) of the increment of work anticipated to be put in place during that interval of time. This shall be the Contractor's best estimate of the rate of progress for each month. This section contains a suggested guide for the elapsed contract time vs. progress percentages.

The horizontal total of the monthly dollars shown for "Anticipated Monthly Value" must equal the contract price shown in the heading.

**Accumulated Scheduled Progress – %**

Entries on this line shall show in percentage of total completion the cumulative stage of progress that is scheduled to be reached at the end of each monthly interval. It is generally sufficient to state this anticipated progress to the nearest tenth of one percent, but for very large contracts it may be advisable to extend computations to the nearest hundredth.

The entry for the first month's column should be the % obtained by the anticipated monthly dollar value of work in place at the close of the first month being divided by the contract price.

The entry for the second month's column is obtained by the sum of the anticipated monthly dollar values of work in place for Columns 1 and 2 being divided by the contract price.

Enter in the third month's column the percentage computed similarly, using the sum of dollar values of work in place for Columns 1, 2, and 3. Continue in this manner for the succeeding monthly columns until "100" is reached in the final column.

**Charting Actual Progress.** The horizontal space extending through the monthly columns is divided into "Actual Monthly Value of Work in Place – $" and Actual Accumulated Progress – %." In each monthly column show the actual accumulated % of progress and the actual value of work in place for that month, as the work progresses. An anticipated complete shutdown at some stage in the work because of adverse seasonal weather or otherwise, as may occur in road work, excavation (grading), etc., is readily shown by a gap.

The Contractor's name shall be placed in the lower left-hand corner of the form, together with the signature and title of the employee who prepared the Schedule and the date. The form then shall be sent to the Architect for review. If the Architect considers that changes are necessary to make the Schedule more realistic, it will withhold approval and so advise the Contractor. When the form is acceptable and approved by the Architect, and the PHA/ IHA, it will be returned to the Contractor, who shall reproduce and submit the number and style of prints required by the PHA/ IHA.

Normal building construction experience has proved that the rate of overall progress (as measured by work in place) accelerates slowly at the start, reaches its peak in the middle third of the construction period, and tapers down at the close. The data following illustrate the general average expectancy of a well-balanced operation and may be used as a guide. If the proposed progress lies within reasonable range of these check points, the Schedule may be considered satisfactory insofar as the time-performance feature is involved.

| % of Contract Time | % of Accumulated Progress |
|---|---|
| 0 | 0 |
| 10 | 2 |
| 20 | 8 |
| 30 | 20 |
| 40 | 37 |
| 50 | 57 |
| 60 | 75 |
| 70 | 89 |
| 80 | 96 |
| 90 | 99 |
| 100 | 100 |

The foregoing percentages must be tempered by consideration of seasonal weather conditions and other known conditions which may affect the progress of the work. These percentages are offered for information only.

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DOCUMENT 01 1999.1

CHAPTER 9 HUD MAP GUIDELINES

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# 9.6.3 Radon (Supersedes ML 2013-07)

## 9.6.3.1 Background

**A.** One common constituent of soil and rock is the unstable element uranium. One of the decay products of uranium is radon, a colorless, odorless gas. Under certain natural conditions, the radon gas can enter surface soils and become part of the "soil gas" environment, which then can enter the air, including air inside of buildings. When soil gas that contains radon enters a building, radon and its decay products are either directly inhaled, or attached to dust on walls, floors and in the air, which then can be inhaled. These decay products then undergo further decay, resulting in the release of subatomic alpha particles. This alpha particle radiation can cause mutations in lung tissue which can lead to lung cancer. The risk of contracting lung cancer from radon increases with an increase in the concentration of radon in the air that is breathed by building occupants. EPA recommends mitigation for residences with radon concentrations at or above 4 picocuries per liter of air (pCi/L).

## 9.6.3.2 General Requirements

**A. Radon Report**:

1. A radon report is required unless an exception listed in Section 9.6.3.2.C applies.
2. The radon report shall be included in the pre-application, or application, as applicable. For new construction, or substantial rehabilitations or conversions where early testing is not feasible, the radon report must be submitted to HUD at the final completion inspection[40]. Applications (including those for which early testing is not feasible) must include the radon mitigation system in the architectural plans, as HUD relies on the Project Architect to design and incorporate any required radon mitigation system consistent with the relevant standard. HUD encourages the Architect to seek

[40] For phased new construction projects, HUD will require the radon report at the 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 a radon report.

technical advice from a radon professional should the Architect believe it to be necessary in their professional judgment or if it is required by the relevant mitigation standard.

3. The radon report shall include the results of any testing performed, the sampling strategy as applicable, the details of any mitigation deemed necessary, and the timing of any such mitigation. The radon report must be signed and certified as to its compliance with the requirements of this section by a Radon Professional and include copies of appropriate certifications and/or licenses.

**B. Radon Professionals**:

1. All 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, in accordance with the protocols referenced in this section.
2. Radon Certification/License of the Radon Professional is required as follows:
   a. Certification from either the American Association of Radon Scientists and Technologists (AARST) National Radon Proficiency Program (NRPP) or the National Radon Safety Board (NRSB); and
   b. Certification/License from the state in which the testing or mitigation work is being conducted if the state has this requirement.

**C. Exceptions to a Radon Report**:

1. A Radon Professional may conclude that testing or mitigation is not necessary based on exemptions laid out in the relevant state or ANSI-AARST radon standard. Any such justifications as to why testing or mitigation is not necessary must be provided in the Environmental Report in the form of a signed letter from the radon professional that references the appropriate standard. Housing staff will determine whether to grant the exception.
2. A radon report is not required for applications that are categorically excluded not subject to the laws and authorities at 50.4 (CENST) as per 24 CFR 50.19(b)(21) (see Section 9.1.3.C.1 and Section 9.1.3.C.2).

   However, applicants are encouraged to test for radon even at the CENST level of review. Any such testing must follow the testing protocols and resident notification protocols below and must then be incorporated within a radon report as described within this section. If the results of such testing indicate levels of radon at or above the threshold for unacceptability, mitigation as described in this section is required, following Section 9.6.3.2.F.

**D. Testing Protocols**:

1. Radon testing must follow the protocols set by the American Association of Radon Scientists and Technologists, Protocol for Conducting Radon and Radon Decay Product Measurements in Multifamily Buildings (ANSI-AARST MAMF-2017) (available at www.standards.aarst.org). This includes testing 100% of ground floor units and 10% of upper floor units in all buildings included in the project.
2. As an alternative to a full testing assessment, all ground level units/rooms in all buildings included in the project must be mitigated following the appropriate mitigation standard listed at Section 9.6.3.2.F.
3. The threshold for unacceptability is 4.0 picocuries per liter (4.0 pCi/L) based on initial and any confirmatory testing, if performed.

**E. Occupant Notification**:

1. Occupants of all new applications for Multifamily MAP mortgage insurance programs shall be informed of forthcoming testing in the manner described in AARST MAMF-2017, Section II.B and Section III. 2.2.1.
2. Occupants shall be informed both prior to and after mitigation activities. In the case of new construction, incoming occupants shall be informed of radon mitigation activities.

**F. Mitigation Standards**:

1. Radon resistant construction is required for all new construction, and radon mitigation is required for existing construction where testing has revealed that radon levels exceed the threshold for unacceptability. The radon resistant construction or radon mitigation, when required, must conform to the following standards, which include post-mitigation testing requirements. All standards listed below are available at www.standards.aarst.org.
    a. For existing buildings:
        1) Multifamily structures reference ANSI-AARST RMS-MF 2018, Radon Mitigation Standards for Multifamily Buildings.
        2) Single Family structures reference ANSI/AARST Standard SGM-SF-2017, Soil Gas Mitigation Standards for Existing Homes.
    b. For new construction:
        1) Multifamily structures reference ANSI-AARST CC-1000-2018, Soil Gas Control Systems in New Construction of Buildings or ANSI-ASHRAE 189.1-2017, Standard for the Design of High-Performance Green Buildings except Low Rise Residential Buildings, Sections 801.3.4, 1001.3.1.9, and 1001.3.2.1.4.5.d.
        2) Single Family structures reference ANSI-AARST CCAH-2020, Reducing Radon in New Construction of 1 & 2 Family Dwellings and Townhouses.

**G. Mitigation Timing**:

1. For new construction and substantial rehabilitation properties, all mitigation, including follow-up testing, must be complete and all reports submitted to HUD staff prior to final endorsement.
2. Radon mitigation included as part of a Section 223(f) project's repairs must be completed as quickly as practicable, and in any event, no later than 12 months after Closing. The scope of work and related costs identified in the Firm application must include all repairs related to radon.

**H. Certificate of completion**:

1. A certificate of completion from the Radon Professional must be submitted and appended to the radon report once radon testing and/or mitigation is completed. HUD staff must upload this to HEROS.

**I. Operation and Maintenance Plans**:

1. An operation and maintenance plan (called an operation, maintenance and monitoring (OM+M) plan under the ANSI-AARST standards) must be administered in accordance with the applicable mitigation standard for any mitigation project. A condition shall be attached to the Firm Commitment requiring

that the Borrower operate and maintain the property consistent with the referenced OM+M plan for the duration of the insured mortgage. The project must submit the final OM+M plan to HUD after the radon mitigation system is installed. Given the ongoing risk associated with radon, the OM+M requirement for maintaining mitigation systems must be implemented when a mitigation system is present on the property.

**J. Existing Mitigation Systems**:

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

**K. Cost estimates**:

1. It is the responsibility of the Lender to provide the cost estimate for radon remediation to be included into the overall construction cost. The cost estimate must be accurate to the proposed construction and include ongoing O+M costs. Estimates must be based on the locality of the project as well as the proposed time of construction.

### 9.6.3.3 Requirements for Section 223(f) Projects

**A.** All Section 223(f) projects must be tested for radon.

1. Testing must be performed no earlier than 1 year prior to application submission.
2. Exception: The applicant may elect to proceed directly to mitigation without prior testing.

**B.** For mitigation, see the requirements at Section 9.6.3.2.F, which include post mitigation testing. If estimated costs exceed the allowable cost for the Section 223(f) program, the application cannot be approved but may be considered under the substantial rehabilitation program.

### 9.6.3.4 Requirements for Substantial Rehabilitation and Conversion

**A.** All substantial rehabilitation and conversion projects must be tested for radon.

**B.** Regarding testing prior to substantial rehabilitation or conversion:

1. Early testing may not be feasible. For some proposals, such as a conversion of an existing building from non-residential to residential, the building envelope may change to such an extent that early testing would not be appropriate and in some cases not possible. If this is the case, proceed directly to mitigation as discussed at Section 9.6.3.4.C.
2. When early testing is feasible:
    a. It must be performed no earlier than 1 year prior to application submission in accordance with Section 9.6.3.2.D.
    b. If test results are below the threshold, no mitigation is required.
    c. If test results are at or above the threshold, mitigation must be built into the project design per Section 9.6.3.4.C.

**C.** Regarding mitigation:

1. If mitigation is built into project design, it must be conducted in accordance with the requirements at Section 9.6.3.2.F, which require post mitigation testing.
2. If mitigation is not built into project design, a radon report must be submitted to HUD at the final completion inspection. If testing results are at or above the threshold, retrofit mitigation pursuant to the requirements at Section 9.6.3.2.F is required.

### 9.6.3.5 Requirements for New Construction

**A.** All new construction projects must follow radon resistant construction requirements.

1. Multifamily structures reference ANSI-AARST CC-1000-2018, Soil Gas Control Systems in New Construction of Buildings.
2. Single Family structures reference ANSI-AARST CCAH-2020, Reducing Radon in New Construction of 1 & 2 Family Dwellings and Townhouses.

**B.** Post-construction testing is required prior to final completion inspection. If post-construction testing results are above the threshold, the project must be brought into compliance by activating the mitigation system or through retrofit mitigation.

**C.** All testing and mitigation required as a result of this testing must be performed by, or under the direct supervision of a Radon Professional, in accordance with the protocols referenced in this section.

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*Note—ANSI/AARST MAMF and MALB consolidated into a single publication*

ANSI/AARST MA-MFLB 2023

An American National Standard

# Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily, School, Commercial and Mixed-Use Buildings

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# MA-MAMF 2023

## Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily, School, Commercial and Multi-Use Buildings

## Scope Summary and Introduction

MA-MFLB consolidates ANSI/AARST MAMF (rev. 1/21) and ANSI/AARST MALB (rev. 1/21) into a single publication. This standard of practice specifies procedures and minimum requirements when measuring radon concentrations in shared structures, or portions of shared structures, used for residential, non-residential or mixed-use purposes[1] to determine if radon mitigation is necessary to protect current and future occupants. These protocols address low-rise and high-rise structures and procedures for testing whole buildings but also for testing only one or several individual rooms or dwellings within a shared building.

### Updates for 2023

Updates for 2023 include revised latitude in Section 6.2 (Quality Control for Number of Valid Tests). While recommended for immediate use, the effective date for compliance with this standard is **December 1st, 2023**.

### Purpose

Radon is the leading cause of lung cancer among nonsmokers and the second leading cause of lung cancer in the general population.[2] Radon in U.S. homes causes approximately 21,000 lung cancer deaths each year.[3] This risk is largely preventable. Most people receive their greatest exposure to radon in their home dwellings. Radon concentrations in ground-contact apartments have been found to be similar to those in low-rise residential buildings located in the same area.[4] Be it at home, work or school, an individual's exposure to radon gas combines over time to increase the risk of preventable lung cancer.

### Historical Perspective

In the 1950s, studies confirmed increased incidence of radon-induced lung cancer for workers in underground mines. In the 1980s, studies found that exposure to radon in homes can exceed exposures found for mine workers. This discovery resulted in the Indoor Radon Abatement Act (1988) that authorized U.S. state and federal activities to reduce citizen risk of lung cancer caused by indoor radon concentrations. Since 1988, the United States Environmental Protection Agency (USEPA) and the U.S. Surgeon General have recommended that all homes be tested for radon. Since the early 1990s, the U.S. Environmental Protection Agency (EPA) has advised all U.S. schools to test for radon and to reduce levels to below 4 pCi/L.

In 1999, with publication of the BEIR VI[3] study, the National Academy of Science confirmed that any exposure to radiation, including any concentration of radon, carries risk. In 2009, the World Health Organization's "WHO Handbook on Indoor Radon" confirmed the association between indoor radon exposure and lung cancer, even at the relatively low radon concentrations found in residential buildings.[2]

### Normative References

| | |
|---|---|
| ANSI/AARST MS-QA | (Radon Measurement Systems Quality Assurance) |
| ANSI/AARST MAH | (Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes) *in regards to conducting radon decay product (RDP) measurements*. |
| ANSI/AARST MS-PC | (Performance Specifications for Instrumentation Systems Designed to Measure Radon Gas in Air) |
| ANSI/AARST MW-RN | (Protocol for the Collection, Transfer and Measurement of Radon in Water) |

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[1] As point of reference, see the International Building Code (IBC) as published by the International Code Council.

[2] World Health Organization, "WHO Handbook on Indoor Radon: A Public Health Perspective" 2009

[3] National Academy of Sciences, "Biological Effects of Ionizing Radiation" (BEIR VI Report) 1999

[4] Swedish Radiation Protection Authority, "Radon in Estonia Dwellings, Stockholm" 2003; and Valmari, T, Arvela, T and Reisbacka, "Radon in Finnish Apartment Buildings, Radiation Protection Dosimetry" 2012



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Other ANSI/AARST standards developed to respond to the threat of cancer caused by radon:

| | |
|---|---|
| ANSI/AARST SGM-SF | (Soil Gas Mitigation in Existing Homes) |
| ANSI/AARST SGM-MFLB | (Soil Gas Mitigation in Existing Multifamily, School, Commercial and Mixed-Use Buildings) *Note—Previously published as ANSI/AARST RMS-MF and RMS-LB and now harmonized and consolidated into a single standard.* |
| ANSI/AARST CCAH | (Reducing Radon in New Construction of One & Two Family Dwellings and Townhouses) |
| ANSI/AARST CC-1000 | (Soil Gas Control Systems in New Construction of Multifamily, School, Commercial and Mixed-Use Buildings) |
| ANSI/AARST RRNC | (Rough-in of Radon Control Components in New Construction of 1 & 2 Family Dwellings and Townhouses) |

## Designation of the standard: MA-MFLB

For catalogue identification, "MA-MFLB" stands for Measurement of Air in Multifamily and Large Buildings.

## The Consensus Process

The consensus process developed for the AARST Consortium on National Standards and as accredited to meet essential requirements for American National Standards by the American National Standards Institute (ANSI) has been applied throughout the process of approving this document.

## Continuous Maintenance

This standard is under continuous maintenance by the AARST Consortium on National Standards for which the Executive Stakeholder Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard.

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# MA-MFLB 2023

# Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily, School, Commercial and Mixed-Use Buildings

## 1.0 SCOPE

### 1.1 Scope and Purpose

This standard of practice specifies procedures and minimum requirements when measuring radon concentrations in shared structures, or portions of shared structures, used for residential, non-residential or mixed-use purposes to determine if radon mitigation is necessary to protect current and future occupants. These protocols address low-rise and high-rise structures and procedures for testing whole buildings but also for testing only one or several individual rooms or dwellings within a shared building.

1.1.1 *Multifamily and other residential occupancies*

The protocols in this standard of practice address residential occupancies that include:

a) Buildings having more than one attached dwelling or other occupied unit under the same ownership or designated maintenance or management authority;

b) Buildings or structures, or a portion thereof that are used, for example, as apartment houses, dormitories, military congregate residences, fraternities and sororities, non-transient boarding houses, hotels, convents, monasteries, motels, and live/work units; and

c) Multifamily structures that can include those with shared ownership or maintenance such as co-op units, townhouses, condominiums or vacation timeshare properties.

1.1.2 *Schools, commercial buildings and other non-residential occupancies* [5]

The protocols in this standard of practice also address non-residential occupancies that include:

a) Educational occupancies including for religious and educational purposes through the 12th grade and day care facilities (Group E);

b) Business occupancies including for offices, training and educational facilities to include universities, professional services or service-type transactions (Group B);

c) Assembly occupancies including for civic, social or religious functions (Group A);

d) Factory occupancies including for fabrication or manufacturing, repair or processing (Group F);

e) High-hazard occupancies (Group H);

f) Institutional occupancies including those where people are cared for or live in a supervised environment such as under restraint or security, detained in a penal institution, or for medical, surgical, psychiatric, nursing and custodial care or for childcare facility purposes (Group I); and

g) Mercantile occupancies including for the display and sale of merchandise, goods, wares or merchandise incidental to such purposes and accessible to the public (Group M).

### 1.2 Applicability

The terms "shall" and "required" indicate provisions herein that are mandatory for compliance with this standard. The terms "note", "informative", "should" and "recommended" indicate provisions that are considered to be helpful or good practice but that do not contain a mandatory requirement.

[5] As point of reference, see the International Building Code (IBC) as published by the International Code Council.



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# 2.0 BEFORE YOU TEST

## 2.1 Which Buildings Should be Tested?

*Informative Advisory*
Any building on any parcel of land can have a radon problem. Testing is the only way to know. Radon concentrations cannot be predicted based on national, state or local radon survey maps, or neighborhood radon measurements.

## 2.2 When to Test?

2.2.1 *Where occupied both day and night*

Radon testing is permitted any time of year for locations that are significantly occupied both day and night.

*Informative Advisory*—Measurements are more likely to provide an accurate reflection of occupant exposure to radon hazards when conducted under conditions that most closely align to the normal building operating condition that prevails during the greatest amount of time each year.
See Normative Appendix A for information on how to determine when testing should occur.

2.2.2 *Where not occupied both day and night*

For buildings or portions of buildings that are non-residential and not significantly occupied both day and night, the measurements shall be conducted at a time that is representative of normal occupied building operating conditions, as defined in Section 2.7.2 (Building operating conditions).

Exception: It shall be permitted to test at any time of the year when the purpose of the testing demands timeliness, such as a business transaction or health concerns.

## 2.3 Test Devices

2.3.1 *Approved test devices required*

All test devices used for deciding if mitigation is warranted shall be devices that are listed by one of the following authorities:

a) As required by local jurisdictions that have a program for evaluating and approving devices; or

b) A national certification or listing program, such as the National Radon Proficiency Program (NRPP), the National Radon Safety Board (NRSB), or an equivalent program that verifies device compliance with the latest publication of ANSI/AARST MS-PC (Performance Specifications for Instrumentation Systems Designed to Measure Radon Gas in Air).

Note—Identification of two existing bodies that have a program for evaluating and listing devices that meet specified quality requirements is not an endorsement of either program.

2.3.2 *Device instructions and appropriateness*

Radon measurement devices shall be used in compliance with both this standard and instructions provided by the manufacturer.

Note—Section CG-3 in the attached Companion Guidance provides descriptions of test devices.

2.3.3 *Test device types (defined)*

When the following terms are used to describe radon test devices, the following definitions shall apply:

a) The term "Passive Device" refers to those that collect a time-weighted average and do not provide hourly readings.



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b) The term "Continuous Monitor" refers to monitors that are capable of automatically recording a retrievable time series of numeric measurements of radon concentration averaged over time intervals of 1 hour or less and can be recalibrated periodically. If a device is not capable of these functions or is not set to record readings each hour, it is functioning as a passive device and is not considered a continuous monitor under this protocol.

2.3.4 *Radon Decay Products (RDP)*

The use of radon decay product (RDP) measurement devices shall comply with ANSI/AARST MAH (Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes).

## 2.4 Who Should Conduct the Testing?

To be considered qualified for conducting measurements in multifamily, the person(s) or team, regardless of business organizational structure, shall operate under a quality assurance (QA) program. The QA program shall include individuals who are qualified for their apportioned task and operations conducted under the responsible charge of a qualified measurement professional.

2.4.1 *Qualified measurement professionals*

For testing multifamily, school, commercial or mixed-use buildings, a "Qualified Measurement Professional" is defined as:

"An individual that has demonstrated a minimum degree of appropriate technical knowledge and skills both sufficient to place, retrieve and analyze (as applicable) radon detectors and to design, plan, and implement quality procedures when conducting radon measurements in multifamily buildings, schools and other non-residential or mixed-use buildings:

a) as established in certification requirements of a national program that is compliant with requirements in Normative Appendix D; and

b) as required by local statute, state licensure or certification programs that evaluate individuals for radon specific technical knowledge and skills."

2.4.2 *Testing project oversight*

A qualified measurement professional shall be physically present during all onsite activities for placement and retrieval of radon detectors and shall be immediately available to direct, instruct, oversee and control activities of any other individuals placing and retrieving detectors.

Individuals who are not qualified measurement professionals are permitted to assist in the placement and retrieval of detectors provided that their participation is approved by the qualified measurement professional and permitted by statute, state licensure or certification program. Participant names and qualifications or preparations shall be retained in quality control (QC) records and made available to the client upon request.

If noncertified individuals assist in detector placement and retrieval, the qualified measurement professional shall be responsible to either:

a) Create and present a written work plan specific to apportioned tasks and obtain evidence that the work plan is understood by all participants.

Note—Section CG-4 in the attached Companion Guidance provides guidance for work plan training; or

b) Verify that individuals have demonstrated, within the last 2 years, appropriate training and skills specific to detector placement and retrieval, such as completion of a training class approved by a national program that is compliant with requirements in Appendix D or state licensure or certification program where applicable.



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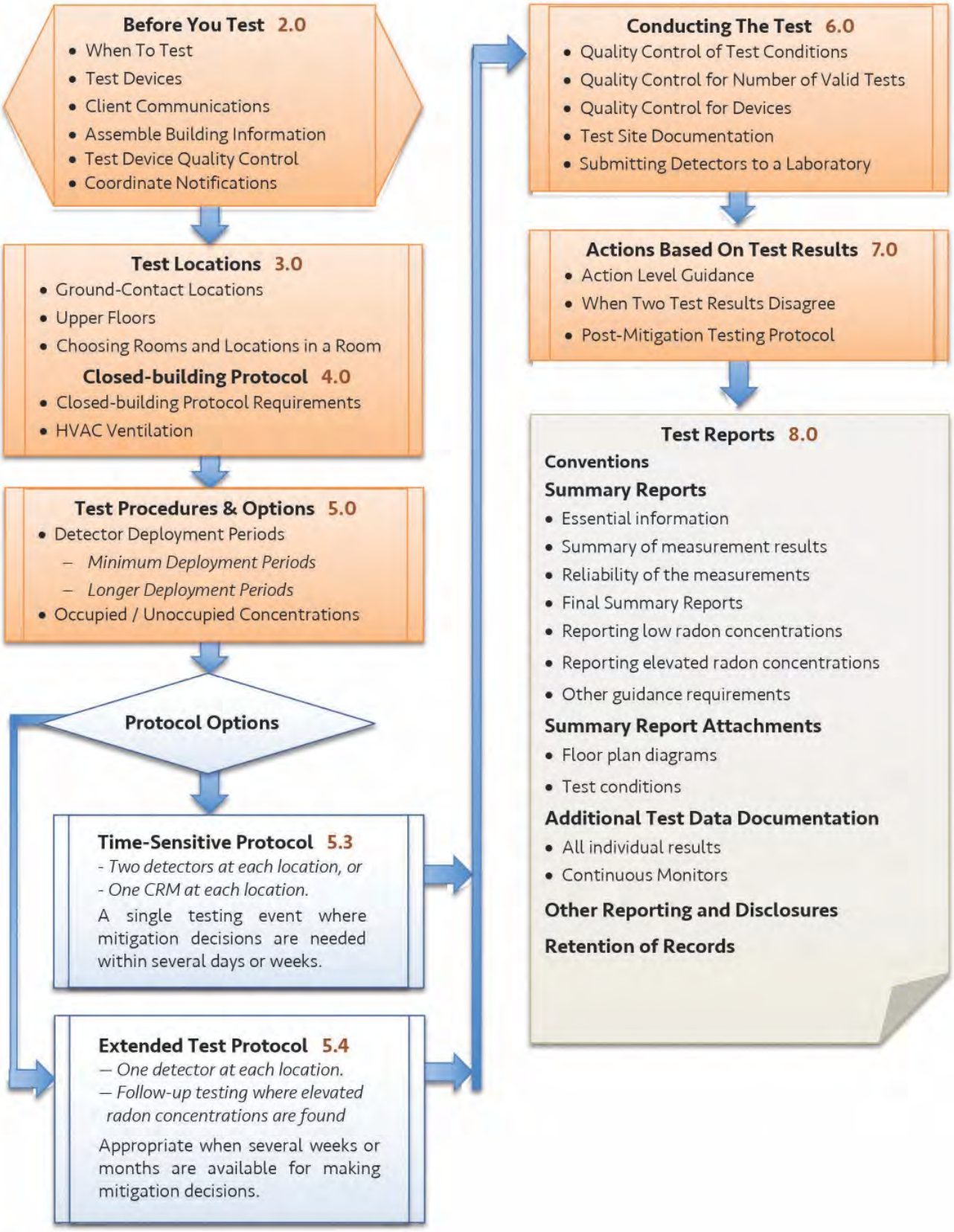
## 2.5 Summary of Testing Procedures

**Flowchart of procedures embodied in this standard**



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## 2.6 Client Communications

2.6.1 *Designing a plan for testing*

Prior to designing a testing plan, the person(s) responsible for quality procedures shall obtain or attempt to obtain information about the building(s) to identify test locations that comply with this standard.

2.6.2 *Client advisories prior to testing*

During initial interactions or in proposals, the client shall be informed in writing regarding;

a) Test plan options that comply with this standard;

b) Required quality control for closed building conditions;

c) The normal occupied building operating condition that prevails during the greatest amount of time each year for similar local buildings, in accordance with Appendix A; and

d) Requirements for a valid measurement at all test locations in each building and the possibility of delays and additional expense when test locations are not readily accessible or where requirements for closed-building conditions are not observed.

2.6.3 *Client authorizations*

Prior to testing, the client shall be requested in writing to provide confirmation regarding:

a) who is authorized by the client to receive test data and any limits the client requests or requires on disclosing test data or results, and

b) at which junctures during the process that the client requests or requires data to be provided.

Note—Exhibit 1 provides an example form for seeking to obtain client authorizations.

2.6.4 *Client commitments*

Prior to testing, the person(s) responsible for quality procedures shall obtain or attempt to obtain a signed statement from the client, or client's authorized agent, and facilitating staff members regarding:

a) Commitments to aid quality control of closed-building conditions.

b) A commitment from the onsite supervisor(s) to:

1. distribute notices prior to testing for both occupants and other staff members, and
2. provide timely access to all test locations.

c) A commitment from the HVAC or building operations supervisor(s) to ensure that building conditions required to achieve reliable radon tests are met. This commitment shall include:

1. providing information about HVAC systems when requested, and
2. affirmation prior to testing that HVAC system(s) have been reviewed and adjusted, as needed, where systems include automated or manual controls or dampers for:
   a. variable outdoor air ventilation, and
   b. variable air volume distribution (VAV) systems

Note 1—Exhibits 2, 3, 4 and 5 provide example forms for meeting these requirements.

Note 2— Exhibit 6 describes HVAC systems of concern that may be encountered.



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## 2.7 Assemble Building Information

### 2.7.1 *Records*

A method to record and track activities for each test location shall be established prior to testing, such as creation or procurement of floor plan diagrams for recording and tracking details.

For tested areas, records shall be updated during test procedures:

a) to match current addresses,
b) the current use of non-residential rooms, and
c) building foundation types such as slab-on-grade, basement and crawl space foundations in the building being tested.

Note—Exhibit 7 provides an example of a floor plan diagram.

### 2.7.2 *Building operating conditions*

Planning and conducting measurements require identification of the normal occupied building operating condition that prevails during the greatest amount of time each year. The predominant building operating condition reported and used for testing procedures shall be based on climate examples in accordance with Appendix A.

Planning and conducting measurements additionally require identification of conditions that temporarily inhibit clear characterization of radon hazards. These are conditions that do not exhibit regularity for at least intermittent periods during a test regarding:

a) Activity of heating or cooling system blowers, where applicable to the HVAC system, and
b) Negative air pressure in the lowest portions of the building relative to outside air.

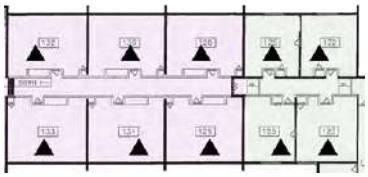
### 2.7.3 *Unique sectors*

Each area served by a unique HVAC system shall be classified as a unique sector. When planning, or no later than when conducting measurements, actions are required to account for temporary conditions that can adversely affect reliability of the test result(s) where HVAC systems are designed with:

a) Variable outdoor air ventilation;
b) Variable air volume (VAV);
c) Return-air ducts laid in soil; and
d) HVAC setback for non-residential locations.

### 2.7.4 *Test devices needed*

The number of test devices for each test procedure shall include all planned test locations relative to the test procedure as specified in this standard and those additionally required for quality control.



## 2.8 Test Device Quality Control

Any person or team conducting radon or radon decay product measurements shall establish, maintain and follow a *quality assurance* plan that complies with ANSI/AARST MS-QA (Radon Measurement Systems Quality Assurance). Among other things, MS-QA requires a system to record and monitor the results of *quality control (QC)* check measurements and training qualifications of staff.



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2.8.1 *Reporting QA checks*

All *quality control (QC)* check measurements for *duplicates*, *comparison checks*, *spikes* and *blanks* associated with a testing project shall be included in report documentation, as required in Section 8.4.

2.8.2 Onsite—*Duplicate and comparison checks*

For each detector configuration, *duplicate* measurements, or *comparison checks* associated with *continuous radon monitors (CRM*), shall be:

a) Not less than 10% of all locations tested during each initial and *follow-up test procedure*, and

b) Distributed as widely as possible across all buildings being tested during the same testing event.

2.8.3 *Blanks required*

The local office(s) directly implementing the testing project(s) shall conduct *blank quality control check* measurements for *charcoal adsorption detectors (CAD)*, *alpha track detectors (ATD)*, and *electret ion chamber detectors (EIC)* in compliance with requirements of both a) and b) of this Section 2.8.3.

a) Project Start-up

For local office(s) directly implementing a testing project or projects that require 50 test locations or more during the same 60-day period, *blanks* shall conducted in accordance with Table 2.8.3.

| Table 2.8.3 **Project start-up** |
|---|
| For *CAD*, *ATD* and *EIC* detectors, no less than nine blanks that meet the following requirements are to be conducted prior to or in conjunction with initiating test deployments: |
| 1. Three *lab-transit blanks* (to look for unexpected exposures during shipping or handling) shall be returned to the laboratory immediately, or in conjunction with, beginning detector deployment. |
| 2. Three *office blanks* (to reveal any unexpected exposures during storage) shall remain where detectors are stored and be returned to the laboratory per normal procedure for the field detectors. |
| 3. Three *field blanks* (to reveal unexpected exposures onsite or from handling procedures) shall be deployed in the field and returned to the laboratory per normal procedure for the field detectors. |
| Standard practice of conducting not less than 5% blanks for all testing locations shall resume when the number of test locations exceeds 180 in accordance with Section 2.8.3 b. |

b) General Requirements (Blanks)

Project startup and throughout the testing project shall be subject to the following requirements:

1. The total number of blank measurements conducted and analyzed for each different detector configuration shall be not less than 5% of all testing locations where the detector configuration is deployed.
2. A portion of the required 5% *blanks* shall be field blanks with additional *blanks* dedicated to other evaluations, if and where deemed necessary, such as environments where test device inventories are stored (i.e., office blanks) and anomalies that might occur because of shipping (i.e., lab-transit blanks).
3. *Blank* measurement results associated with other *quality control* activities at the local office(s) implementing the testing project are acceptable to include for meeting testing project reporting requirements in Section 8.4.
4. For *CAD* and *ATD* detectors where storage locations have not been evaluated and monitored, *blank* measurements shall be conducted prior to deployment for detectors that have been



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stored for more than 30-day durations. Alternatively, where storage locations are monitored under an ongoing program, monitoring records shall be made available upon request that verify inventories are stored in an environmentally controlled location that prevents unintended exposure to radon, high relative humidity and extreme temperatures beyond manufacturer's recommendations.

2.8.4 *Spiked measurements required*

For *CAD*, *ATD* and *EIC* measurement methods, requirements a) and b) of this Section 2.8.4 are required to provide evidence of continued accurate measurement system operation by comparing reported *spike* analyses results to a recognized reference authority for radon concentration.

a) The number of *spiked measurements* conducted and analyzed for each detector configuration associated with the testing project(s) shall be not less than 3% of *EIC* detectors and not less than 3% from each *lot* of *CAD* and *ATD* detectors placed into local inventories.

   Exception: For each detector configuration associated with the testing project(s), the maximum required is six *spikes* per month for both *EIC* detectors and from each lot of CAD and ATD detectors with no less than three *spikes* conducted each year; and

b) Spiked measurement results from *EIC* detectors and from each *lot* of *CAD* and *ATD* detectors associated with the testing project that are also associated with other quality control activities shall be acceptable to include for meeting test project reporting requirements in Section 8.4.

## 2.9 Coordinate Notifications

*Informative Advisory*—Failure to comply with required test conditions is most likely to occur when building staff and occupants are not properly informed about the necessary test conditions.

2.9.1 *Prior notification of facilitating staff*

Once a testing activity is confirmed, the property management team shall be instructed in writing to distribute notices of radon testing that inform and appropriately instruct individual facilitating staff members, such as authorized building supervisors, maintenance staff, teachers or office managers.

Notifications for facilitating staff shall comply with requirements in a) and b) of this Section 2.9.1.

a) Instructions shall be provided for distributing notices for both tested and non-tested units, and for posting of publicly viewable notices. The occupant notices provided shall include:
   1. Scheduled dates and times for test device placement and retrieval;
   2. Essential closed-building requirements portrayed in Table 4-A and that these conditions are required no later than 12 hours prior to the test and throughout the test period;
   3. Information on how to obtain federal or state radon health guidance; and
   4. Local contact information for inquiries, such as the authorized building supervisor.

   Note—Exhibits 3 and 4 provide examples of occupant notifications.

b) In addition to coordination of access, instructions shall be provided for duties required of facilitating staff, such as closing windows and adjustments to HVAC units or controls.

   Note—Exhibit 5 provides an example of written instructions for building operations staff.

2.9.2 *Prior notification of occupants*

The property management team shall be instructed and informed in writing to post notices of radon testing, as applicable, and distribute notices of radon testing no less than 24 hours prior to testing to all occupants in all buildings being tested.



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## 3.0 TEST LOCATIONS

### 3.1 Ground-Contact Locations

A measurement shall be conducted in all dwellings and all nonresidential rooms that are occupied, or intended to be occupied, that:

a) have floors or walls in contact with the ground, and

b) are closest to ground over untested ground-contact locations, to include the lowest level of the building over a crawl space, utility tunnel, parking garage or other non-habitable space that is in contact with ground.

#### 3.1.1 *Ground-contact dwellings*

For each ground-contact dwelling or living unit, a measurement shall be conducted in the lowest level that serves or could serve as a living area, sleeping quarters, office, playroom or otherwise be occupied for residential use at some time in the future.

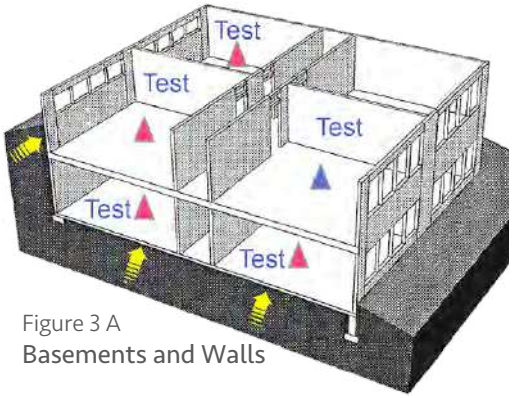


Figure 3 A
Basements and Walls

#### 3.1.2 *Non-residential ground-contact locations*

For non-residential ground-contact locations, a measurement shall be conducted in all ground-contact rooms, offices, classrooms and other general use areas that are occupied or intended to be occupied.

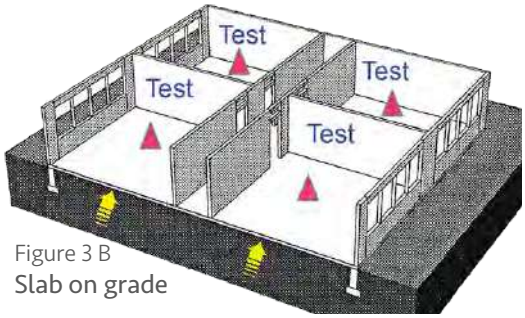


Figure 3 B
Slab on grade

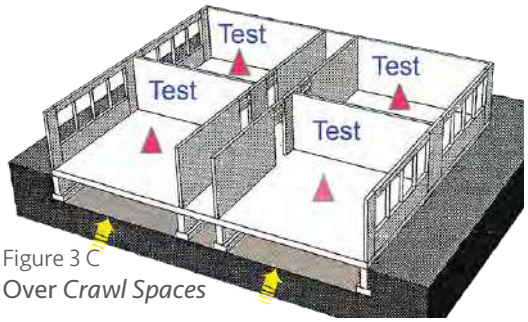


Figure 3 C
Over *Crawl Spaces*

### 3.2 Upper Floors

On each upper floor, a measurement shall be conducted in at least one and not less than 10% of all dwellings and nonresidential rooms that are occupied or intended to be occupied. These measurements shall be in addition to tests performed in ground-contact locations and rooms or dwellings that adjoin immediately above untested ground-contact locations.

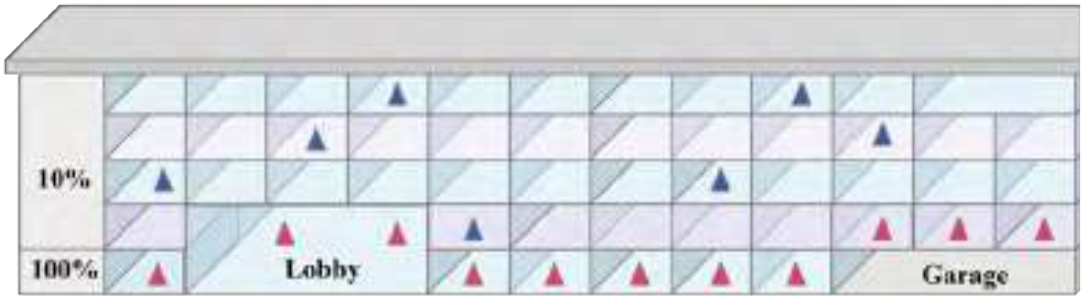


Figure 3 D
Upper floors

### 3.3 Locations Not to Test

Unless for investigative purposes, test locations shall not include hallways, closets and bathroom or shower areas unless they are open to other rooms that are occupied for other purposes.

Note—Table 3.8 provides additional requirements regarding rooms that are not to be tested.



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### 3.4 Large Rooms or Open Plan Design

For large rooms and open plan designed areas that may include partitioned rooms that do not have closeable doors, one or more detectors shall be placed for every 2,000 square feet (186 $m^2$) of the room or open area and for any remaining portion of the area that is less than 2,000 square feet (186 $m^2$).

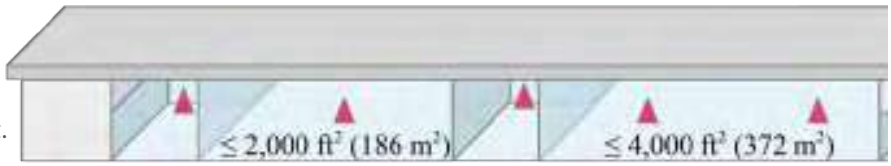


Figure 3 E
2,000 Sq. Ft.

#### 3.4.1 *Pod Design*

Where an open-plan or pod design area has moveable walls that can physically separate an area into individual rooms, the movable walls shall be configured to divide the area into individual rooms and each resulting room shall be measured separately. Where moveable walls are absent or inoperable, the area shall be measured as one room.

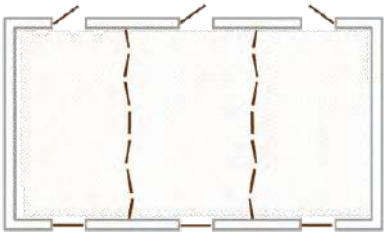

Figure 3 F Moveable walls

### 3.5 Multi-zone HVAC Systems

Informative Advisory—Multi-zone HVAC systems, as described in Exhibit 6, Group 2, are sometimes found for larger open rooms or dwellings. Whenever encountered, it is recommended to place enough additional detectors to adequately characterize and record differences between areas or rooms that are served by the different HVAC systems.

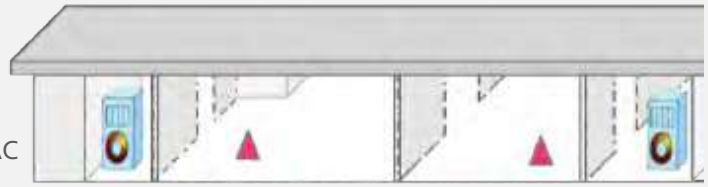

Figure 3 G
Multi-zone HVAC

### 3.6 Inaccessible Ground-Contact Locations

When restricted access is imposed by independent owners of ground-contact locations, the lowest accessible level of the building that is closest to ground shall be tested in accordance with Section 3.1 Ground-contact Locations.

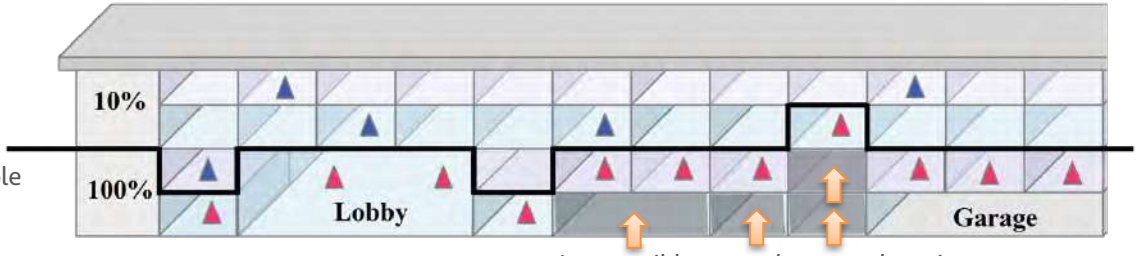


Figure 3 H
Inaccessible

Inaccessible *ground-contact* locations

### 3.7 Choosing A Room

Note—It is best to choose test locations where people are more likely to spend time, such as a finished or occupied room when this choice exists. When this choice does not exist, preferred choices are areas not currently used or finished but that could serve as a work area, playroom or an additional bedroom at some time in the future.

### 3.8 Choosing A Location Within a Room

Detectors shall be placed in accordance with Table 3.8.

Note—As overall guidance, test in the general breathing zone.



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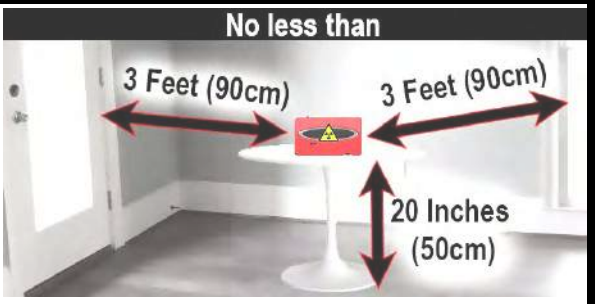
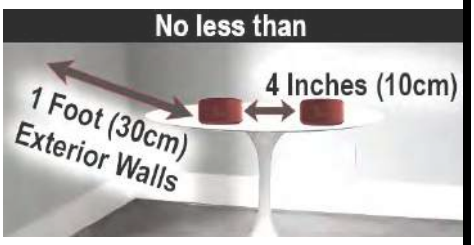
| Table 3.8 | Requirements for Test Locations Within a Room |
|---|---|
| **Detectors shall be located NOT less than:** | ▪ 3 feet (90 cm) from exterior doors and windows or other potential openings to the outdoors.<br>▪ 20 inches (50 cm) above the floor.<br>  |
| | ▪ 1 foot (30 cm) from the exterior wall of the building.<br>▪ 1 foot (30 cm) below the ceiling.<br>▪ 4 inches (10 cm) from other test detectors and objects or surfaces that are above or to the side of the detector.<br>  <br>Exception: Less than 4 inches (10 cm) is permitted for detectors that are not affected by nearby proximity to other objects. Confirm manufacturer or laboratory requirements or recommendations prior to exercising this exception. |
| **Side-by-side detectors** | Detectors are to be not more than 8 inches (20 cm) from each other when seeking to use the average test result of two side-by-side detectors for QC checks and mitigation decisions.<br> |
| **Place detectors where not easily disturbed** | *Informative Advisory*—Select a position within the room where the detector(s) will not likely be disturbed, moved, or have their performance altered during the measurement period. |
| **Detectors shall NOT be located:** | ▪ inside closets, cabinets, drawers, sumps, crawl spaces or nooks in the building foundation. |
| | ▪ near heat sources, such as on appliances, radiators, fireplaces or in direct sunlight. |
| | ▪ near drafts caused by fans or heating and air conditioning vents or within enclosed areas of high air velocity such as mechanical/furnace closets. |
| | ▪ within enclosed areas that accumulate high humidity, such as bathrooms, laundry rooms and kitchens that are isolated by partitions and doors from adjoining less humid areas.<br>Exception: Where regularly occupied by workers for essential tasks, such as for cafeteria food preparation. Testing in such locations requires detector types that are virtually unaffected by high humidity which is to be confirmed by the manufacturer or laboratory prior to exercising this exception. |
| | *Informative Advisory*—Avoid placing detectors on or near objects that may produce radiation such as natural stone, rock collections, granite counter tops, hearths and slate pool tables. |



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## 4.0 TEST CONDITIONS REQUIRED

### 4.1 Closed-building protocol requirements

Closed-building conditions, as they are for occupied conditions in winter heating seasons or summer cooling seasons, in accordance with Tables 4-A, 4-B, 4-C and Section 4.2 are required to be:

a) initiated 12 hours prior to the test for tests lasting less than 72 hours, and

b) maintained throughout the test period for tests lasting up to 90 days.

| Table 4-A ESSENTIAL CLOSED-BUILDING PROTOCOL REQUIREMENTS | |
|---|---|
| Windows | Keep closed on all levels of the building including areas not being tested |
| Exterior doors (except for momentary entry and exit) | |
| Heating and cooling systems | Set to normal occupied operating conditions with normal temperatures between 65˚and 80˚ F (18˚ - 27˚ C) |
| Systems that temporarily ventilate with outdoor air for seasonal comfort or energy savings | Set to the lowest seasonal ventilation |
| Bathroom fans | Operate normally |
| Exhausts Systems (that temporarily draw air from the building such as from laundries, workshops, community kitchens or for local control of fumes) | Avoid excessive operation |
| Fireplaces (that burn solid, liquid or gas fuels unless a primary/normal source of heat for the building) | Do not operate |

### 4.2 HVAC Ventilation

4.2.1 *Outside air for combustion appliances*

Openings to outside air designed to provide air needed for combustion appliances shall not be closed.

4.2.2 *Ventilation with outside air*

Where HVAC operation or design includes temporarily increasing outdoor air ventilation for seasonal comfort or energy savings, outside air inlet dampers shall be configured to provide only the minimum volume of outdoor air that is needed at all times of the year when the building or unique sector is significantly occupied.

Note—Further descriptions are provided in Exhibit 6 for Group 3 HVAC systems.

4.2.3 *Temperature control via air volume*

For variable air volume (VAV) systems that temper room temperatures using thermostats to vary the volume of heated or cooled air coming into rooms, thermostats shall be set to a normal occupied temperature in all portions of the building being tested that are served by the system.

Note—Further descriptions are provided in Exhibit 6 for Group 4 HVAC systems.

4.3 Upper *Floor Rooms and Dwellings*

Note—Sections 6.1.3 adds specific required conditions when not testing adjoining rooms or dwellings.



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| Table 4-B ADDITIONAL REQUIREMENTS FOR NEW CONSTRUCTION, RENOVATIONS AND REPAIRS | |
|---|---|
| All openings to the exterior (due to incomplete construction, structural defect or disrepair) | These openings to the exterior shall be closed or sealed at least 12 hours prior to initiating the test |
| Heating/cooling systems active and set to a normal occupiable temperature | These items shall be completed or installed at least 12 hours prior to initiating the test |
| All windows and exterior doors installed with hardware and seals | |
| All insulation and exterior siding | |
| All wall and ceiling coverings to be completed including interior drywall or paneling but does not include decorative finishing of walls, floors or ceilings | |
| All fireplaces and fireplace dampers installed | |

| Table 4-C ADDITIONAL CLARIFICATION ON CLOSED BUILDING PROTOCOL REQUIREMENTS FOR SPECIFIC COMPONENTS | |
|---|---|
| **Windows and Doors** on all levels of the building including areas not being tested | |
| Broken windows or doors | Seal closed |
| Interior partition or stairway doors | Operate normally |
| Exterior doors into non-residential rooms | Keep closed (except for momentary entry and exit of individuals who customarily enter the building) |
| Garage doors and doors leading into a garage | Keep closed (except for momentary entry and exit). |
| **Small Appliances** | |
| Ceiling fans and portable fans | Do not blow fans directly towards testing devices |
| Window fans | Remove or seal shut and do not operate |
| Humidifiers and dehumidifiers | Operate normally |
| **Crawl Spaces** | |
| Passive crawl space vents | Set vents to the condition that prevails during the greatest amount of time each year |
| Crawl space humidity control systems | Operate normally |
| **Mechanical Systems** | |
| Passive vents for combustion air makeup | Leave open |
| Combustion appliance fans | Operate normally |
| Fans installed in attics to ventilate only attic air | |
| Window air conditioners | Operate in recirculation mode only |
| Evaporative cooling systems | Do not operate and do not cover |



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## 5.0 TESTING PROCEDURES AND OPTIONS

### 5.1 Test Deployment Periods

5.1.1 *Test phase*

All measurement locations in each building shall be tested on the same days for:

a) All locations required in Section 3 within each building; and

b) All locations identified within each building for follow-up test procedures.

5.1.2 *Minimum deployment periods*

While deployment periods should optimally collect at least 48 hours of valid sampling time, tests shall be conducted continuously for durations that are:

a) not less than 46 hours under closed-building conditions that comply with Section 4; and

b) not less than the minimum exposure time recommended by the manufacturer of the device.

Note—For tests extended an additional day or more, it is best to terminate the test at a similar time of day as when the test was started to more evenly account for day-to-night fluctuations of radon entry.

5.1.3 *Non-residential deployment periods*

Where the building or portion of the building is not significantly occupied 24 hours a day, such as a school or office building, testing shall only be conducted, in accordance with Section 5.1.2, during portions of a week when the building is significantly occupied.

Exception—Where HVAC systems are not operated differently during nights, weekends and holidays compared to when occupied by most workers or students.

5.1.4 *Longer test periods*

When longer test periods are chosen with intent to more closely evaluate the annual average radon concentration before deciding if mitigation is warranted, the test period shall include heating season conditions that are not less than the percentage of year when heating systems are active.

Exception: Where heating season conditions are not the normal occupied building operating condition as defined in Normative Appendix A.

### 5.2 Evaluation of Occupied Versus Unoccupied Concentrations

For non-residential buildings or portions of a building that are not significantly occupied day and night most the year, an evaluation of occupied versus unoccupied radon concentrations is recommended and shall be permitted as an additional line of evidence relative to mitigation decisions. When conducting such evaluation, the test devices, procedures and reporting shall comply with Normative Appendix B.

5.2.1 *When to conduct the evaluation*

An evaluation of occupied versus unoccupied radon concentrations is permitted during initial testing, follow-up testing, post-mitigation testing, or in a series of sequential tests. An evaluation that simulates various building operating conditions is also permitted in accordance with Normative Appendix B-2.

5.2.2 *Where to conduct the evaluation*

*Informative advisories:* During initial testing, the evaluation is recommended for each unique sector at locations where airflow from HVAC systems is most representative of occupied rooms within the unique sector. For follow-up testing, the evaluation is recommended for at least the location of the highest radon concentration found during previous measurements within each unique sector.



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## 5.3 The Time-Sensitive Testing Option

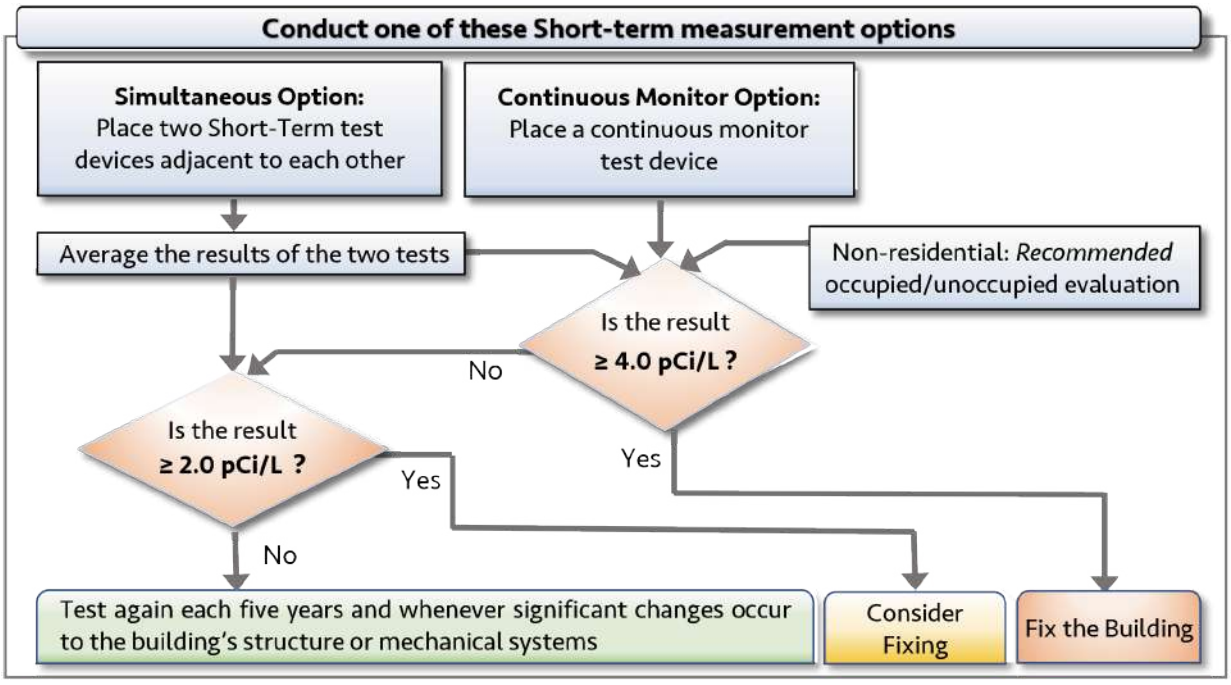
Note—This protocol builds upon protocols developed by EPA, relative to EPA's *"Home Buyer's and Seller's Guide to Radon."*

| Table 5.3 | | Time-Sensitive Testing Option—Required Procedure and Summary |
|---|---|---|
| **Step 1 Options** | *Simultaneous Testing Option* | Tests at each test location are conducted using two short-term test devices at the same time, 4 to 8 inches (10-20 cm) apart. |
| | *Continuous Monitor Option* | Tests at each test location are conducted using a monitor that records retrievable hourly measurements. |
| | | Evaluations of occupied versus unoccupied radon concentrations are additionally recommended for non-residential locations. |
| **Step 2** | **Decisions to Fix the Building** | |
| | Mitigation decisions are to be based on the average result from a continuous monitor or the average of two test results conducted at the same time in the same location. [1, 2]<br><br>Fix the building<br>if test results meet or exceed the action level, e.g., 4 pCi/L. Consider fixing the building if results are greater than half the action level, e.g., between 2 and 4 pCi/L. | |

[1] Where evaluations of occupied versus unoccupied concentrations have been conducted in accordance with Section 5.2, report recommendations shall account for radon exposures indicated by the evaluation.

[2] Section 7.2 provides requirements for when the test result from two short-term test devices disagree in terms of making a mitigation decision.

Figure 5.3 **Time-Sensitive Testing Option Flowchart**



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## 5.4 The Extended Testing Option

Note—This protocol builds upon those developed by EPA, relative to EPA's *"A Citizen's Guide to Radon."*

| Table 5.4 | Extended Testing Option—Required Procedure and Summary | |
|---|---|---|
| **Step 1** | *Initial Test* | Testing at each location is conducted using a single short-term device. |
| | | Evaluations of occupied versus unoccupied radon concentrations are additionally recommended for non-residential locations. |
| **Step 2** | *Follow-up Test Options* | **Retest locations that meet or exceed the action level, e.g., 4 pCi/L. Follow-up testing requirements allow the following options:** [1, 2] |
| | a) | A second test with a short-term device is conducted. Where a first test is twice the action level or greater, this confirmation test should be conducted without delay; or |
| | b) | Where a first test is less than twice the action level, testing can be conducted with a long-term test device for an extended period if the situation allows a closer evaluation of annual average to radon concentrations; or |
| | c) | Evaluation of occupied versus unoccupied radon concentrations for non-residential locations. |
| **Step 3** | **Decisions to Fix the Building** | |
| | Mitigation decisions are to be based on the average of the two test results from short-term devices or the results from long-term testing [3, 4]<br><br>Fix the building<br>if test results meet or exceed the action level, e.g., 4 pCi/L. Consider fixing the building if results are greater than half the action level, e.g., between 2 and 4 pCi/L. | |

[1] Where follow-up testing is not completed within 12 months after completing Step 1, the testing procedure shall be restarted with Step 1, in accordance with either Section 5.3 or this Section 5.4.

[2] Note—While decisions to mitigate at any time are not prohibited, the second test aids confidence that decisions are not being made based on a faulty test device or unexpected conditions.

[3] Note—Section 7.2 provides requirements for when the test result from two short-term test devices disagree in terms of making a mitigation decision.

[4] Where evaluations of occupied versus unoccupied concentrations have been conducted in accordance with Section 5.2, report recommendations shall account for radon exposures indicated by the evaluation.

### 5.4.1 *Client Advisory required*

If choosing to use the Extended testing option in Table 5.4 under a time-sensitive situation, the client shall be informed in writing prior to conducting tests that:

a) Test results from Steps 1 and 2 of the Extended testing protocol are to be used for mitigation decisions, and

b) Time-sensitive situations will often not permit long test periods to more closely evaluate annual exposures to radon.



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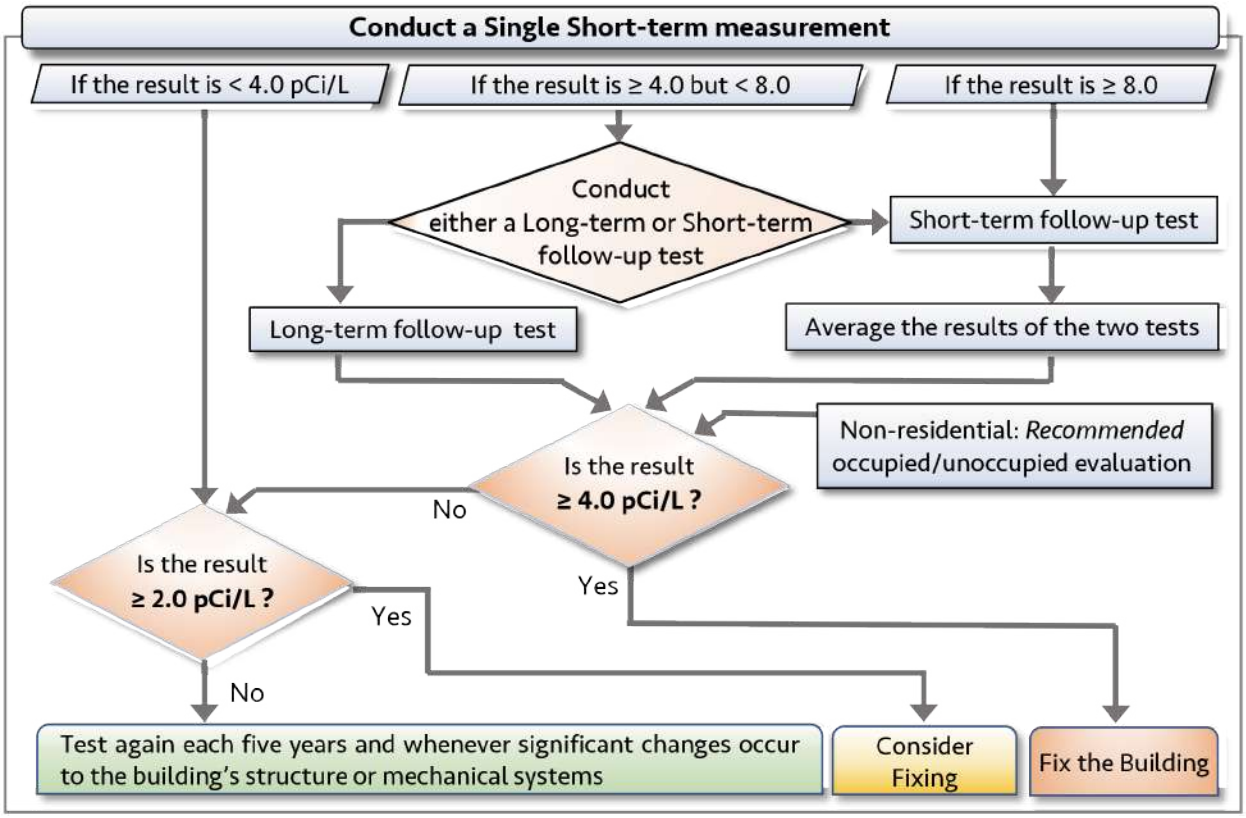
Figure 5.4 **Extended Testing Option Flowchart**




5.4.2 *Long-term test option*

Mitigation decisions are permitted to be based solely upon testing that is conducted with a long-term test device at each test location where the test period meets requirements in Section 5.1.4 to account for seasonal conditions and either:

a) the test location is a residential dwelling or living space, or

b) the test location is non-residential with HVAC systems that are not operated differently during nights and weekends compared to when occupied by most workers or students.

Note—Test periods employed for this purpose in the U.S. are commonly those greater than 90 days. Tests that are longer than 2-7 days can reduce the influence of short-lived temporary conditions on test results. However, regardless of test duration, any correlation between the test result and the annual average radon concentration depends upon building conditions during the test.

## 5.5 Testing A Single Room or Dwelling

Note—Section 6.1.3 adds additional required conditions when testing only individual rooms or dwellings.

## 5.6 New Construction

For buildings constructed with radon-resistant features, initial testing shall be conducted normally, such as required in accordance with either Section 5.3 (Time-Sensitive Testing Option) or Section 5.4 (Extended Testing Option).

## 5.7 Post-Mitigation Testing Protocols

Testing after mitigation efforts shall be conducted in accordance with Section 7.3 where effectiveness is judged based on one test event with one or more test devices at each location to be tested.



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# 6.0 CONDUCTING THE TEST

## 6.1 Quality Control of Required Test Conditions

*Informative advisory*—Avoid testing during weather that is unusually severe for local weather if the test period is less than 72 hours. When this occurs during a test, retesting may be appropriate.

### 6.1.1 *Where closed-building conditions cannot be maintained*

Tests shall not be conducted if closed building conditions, as required in Section 4, cannot be maintained across the test period for tests lasting up to 90 days.

### 6.1.2 *Where closed-building conditions did not occur prior to the test*

Where closed-building conditions were not maintained for twelve hours prior to deployment, as required in Section 4, the radon testing shall be conducted with one of the following options:

a) The testing is postponed until at least 12 hours of closed-building conditions have been maintained prior to initiating the test; or

b) The test period is extends not less than 72 hours after closed-building conditions are initiated; or

c) The test period is extended, if testing with a continuous monitor. For this option, device features or other methods shall be employed to obtain an average test result that represents no less than 46 hours of contiguous data collected after 12 hours of closed building conditions were maintained.

### 6.1.3 *Individual dwellings or rooms*

When testing only one or several dwellings or rooms that are part of a shared building, such as when testing upper floors identified in Section 3.2 or an individual apartment, classroom or office, minimum requirements include closed-building conditions in accordance with Section 4 for dwellings and non-residential enclosed rooms:

a) immediately adjoining above and below the test location(s), and

b) on all floors directly below test location(s) that are 3 stories or less above grade.

### 6.1.4 *Failed closed conditions*

Where compliance with closed-building conditions in Section 4 did not occur for non-residential rooms, dwellings or untested ground-contact spaces, retest procedures shall include retesting those rooms or dwellings and any tested rooms or dwellings:

a) that immediately adjoin the side, above and below such locations, and

b) that share the same heating or cooling air ducts.

### 6.1.5 *Where closed conditions pose a health hazard*

If observing that closed-building conditions present a health hazard, the test shall not be conducted under conditions that place an occupant in harm's way.

Note—Hot weather is an example where closed building conditions can pose a health hazard in buildings that have no cooling systems. Safe conditions can violate requirements of this standard such as use of outdoor air ventilation, window fans or evaporative cooling systems.

### 6.1.6 *Fulfilling minimum requirements*

To fulfill minimum requirements for verifying test conditions, all the following steps, which are covered in greater detail elsewhere in this standard, are required:

a) Inform the person responsible for building operation of the required test conditions;

b) Ensure that notifications of a "Radon Test in Progress" are posted in conspicuous locations.

Note—Exhibits 4 and 8 provide examples of public notices, door hangers and device placards;



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c) Obtain or attempt to obtain a signed statement from the onsite supervisor or other facilitating staff member(s) regarding a commitment to aid in the quality control of closed-building conditions; and

d) Conduct visual inspections.
Visual inspections to evaluate observed conditions and document deviations from protocol or temporary conditions that might affect the reliability of the test result shall be conducted:

1. Upon detector placement to help ensure all closed-building conditions and other protocol requirements are met, and
2. Upon retrieval of detectors to help verify that closed-building conditions and other protocol requirements are still being maintained.

e) Surveillance not required
The measurement professional is not required to inspect for closed-building conditions during the 12-hour period before the start of the test or between placement and retrieval of the detectors.

6.1.7 *Visual Inspections*

Where observations suggest reliability of the testing may be compromised, the observations shall be transmitted in a timely manner to person(s) responsible for quality control and recorded in testing records. To that end, the scope of visual inspections required in Section 6.1.6 d shall include requirements a), b), c) and d) of this Section 6.1.7.

a) Testing records shall include any observed deviations from basic closed-building requirements in Section 4.1; Tables 4-A, 4-B and 4-C; and Section 6.1.3 (Individual dwellings or rooms). Testing records shall also include where efforts to influence the outcome of the test are observed, to include tampering with devices or otherwise influencing test conditions.

b) Where, in accordance with Section 4.2, unique sectors of the building have been identified or found to be served by HVAC operation or designs that temporarily vary ventilation, requirements include:

1. Variable outdoor air ventilation
Testing records shall include a description of any observed outdoor air intakes that do not appear to be configured to provide the minimum volume of outdoor air ventilation needed at all times of the year when a building or unique sector is significantly occupied.
2. Variable air volume (VAV)
Testing records shall include a description of any observed thermostats or controls for variable air distribution (VAV) systems that are not set to a normal occupied temperature in portions of the building served by the system(s).

c) Return-air ducts laid in soil
Testing records shall include if return-air ducts are observed under slabs or otherwise surrounded by soil where this relates to:

1. Compliance with reporting requirements in Section 8.2.3 b Temporary conditions, or
2. Decisions on whether an evaluation of occupied versus unoccupied concentrations, in accordance with Section 5.2, may be warranted.



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d) HVAC setback for non-residential locations
Testing records shall include if non-residential rooms are observed to be operating with HVAC setback temperatures when not significantly occupied that are outside of normal occupied temperatures of 65˚and 80˚ F (18˚ - 27˚ C) where this relates to:

1. Compliance with provisions in Section 5.1.3 (Non-residential deployment periods), or
2. Decisions on whether an evaluation of occupied versus unoccupied concentrations, in accordance with Section 5.2, may be warranted.

## 6.2 Quality Control for Number of Valid Tests

Unless it is decided at any juncture to proceed with mitigation, testing and follow-up testing shall continue until a valid test, compliant with all requirements of this standard, is achieved at all locations intended to be tested.

Exception: Allowances shall be permitted due to inaccessible locations or missing detectors upon retrieval, to the extent allowed by requirements in a), b) and c) of this Section 6.2.

These allowances shall be applicable individually for two distinctly different areas within each building: (1) the number of required ground-contact test locations, and (2) the number of tests required on upper floors.

a) Where all valid measurement results at the property are less than 4.0 pCi/L (150 Bq/m$^3$) and all valid measurement results in the building are less than 2.7 pCi/L (100 Bq/m$^3$), the number of missing valid tests shall not exceed the allowance in Table 6.2.1.[6]

**Table 6.2.1**

| Test Locations: | 3-5 | 6-10 | 9-11 | 12-16 | 15-20 | 18 or more |
|---|---|---|---|---|---|---|
| Allowance: | 1 | 2 | 3 | 4 | 5 | ≤ 33% |

b) Where any valid measurement at the property is 4.0 pCi/L (150 Bq/m$^3$) or more, or where any valid measurement result in a building is 2.7 pCi/L (100 Bq/m$^3$) or more, the number of missing valid tests for the property or for the building, respectively, shall not exceed the allowance in Table 6.2.2.[7]

**Table 6.2.2**

| Test Locations: | < 4 | 4-7 | 8-11 | 12-15 | 16-19 | 20 or more |
|---|---|---|---|---|---|---|
| Allowance: | 0 | 1 | 2 | 3 | 4 | ≤ 25% |

*Note—This allowance observes that the parcel of land where buildings reside has been shown to produce radon in soil sufficient to lead to elevated indoor radon concentrations.*

c) An allowance is not extended for two side-by-side ground-contact units or rooms that did not achieve a valid test, even though they were both intended to be tested.

[6] MIL-STD-105E, MILITARY STANDARD (1989): Sampling Procedures and Tables for Inspection by Attributes.

[7] Evaluating and Assessing Radon Testing in Housing with Multifamily Financing (EARTH).



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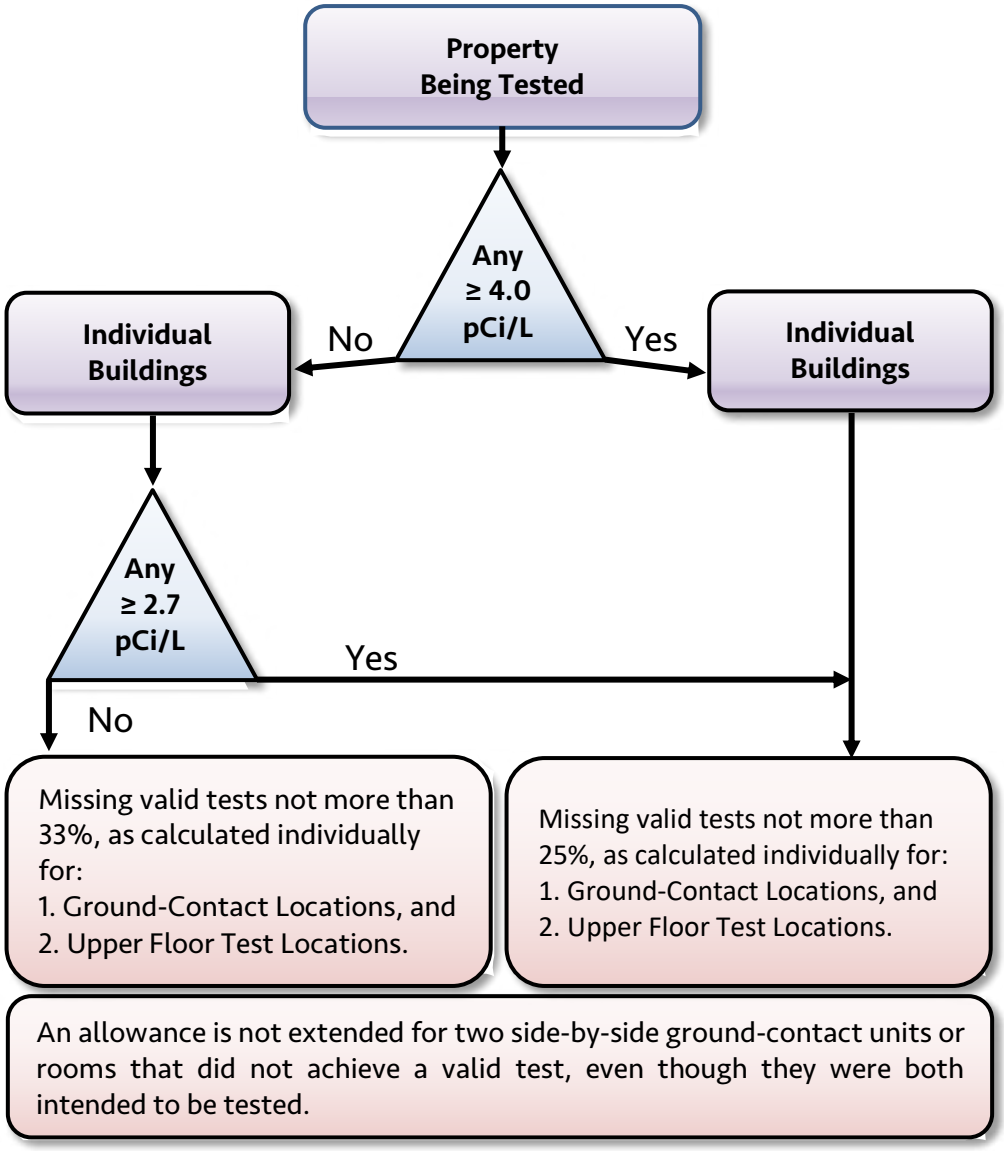
Figure 6.2

**Quality Control Flowchart for Number of Valid Tests**




*Informative advisory*—Characterization of radon hazards for each occupant within a shared building requires achieving a valid radon measurement in each location required in Section 3. [8] [9]

[8] Using the Monte Carlo method to evaluate the reliability of screening multifamily housing for radon. David Wilson, Research Staff, Oak Ridge National Laboratory. AARST Radon Reporter, March 2020

[9] Evaluation of Percentage-Base Radon Testing Requirements for Federally-Funded Multi-Family Housing Projects. Antonio Neri MD, MPH, Centers for Disease Control and Prevention. Journal of Occupational Health and Hygiene, January 2019 https://www.ncbi.nlm.nih. gov/pubmed/30620246



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## 6.3 Quality Control for Test Devices

Quality control check measurements deployed and retrieved shall include:

a) Duplicate measurements or comparison checks for all device types at not less than 10% of all locations being tested in accordance with Section 2.8.2; and

b) Field Blank measurements for *CAD*, *ATD* and *EIC* detectors, in accordance with Section 2.8.3.

## 6.4 Test Site Documentation

### 6.4.1 *Update testing records*

Floor plan diagrams or other records for tracking test locations shall be updated to achieve a record of:

a) Test locations, addresses, rooms and mechanical systems or conditions observed that were inadvertently omitted or different than found during initial efforts to assemble building information;

b) The nature of non-residential occupancies, such as locations occupied for educational, retail, food, beverage, or office purposes. This includes noting if significantly occupied hours of the day, portions of the week or months of the year are different than typically expected for such establishment; and

c) Building foundation types such as slab-on-grade, basement and crawl space foundations in the building being tested.

### 6.4.2 *Test device logs*

No later than in conjunction with retrieval of devices and detectors, site testing logs shall be completed to include:

a) Essential tracking details

1. Test location identification or address with any location specific notes,
2. Detector identification/serial numbers,
3. The start and stop dates and times of the measurement period; and

b) Test reliability

1. A record of conditions that are known or suspected to impact the reliability of the test at any location, and
2. Annotation for each quality control check measurement to indicate its purpose.

## 6.5 Submitting Detectors to a Laboratory

Detectors shall be forwarded to the laboratory as soon as possible in accordance with laboratory requirements to ensure quality of analysis procedures. Information provided to the laboratory shall include:

a) The address of the property tested to include street address, city, state, and zip code.

b) Detector identification/serial numbers, and

c) The start and stop dates and times of the measurement period.



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## 7.0 ACTIONS BASED ON TEST RESULTS

### 7.1 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 (≥ 150 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 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$^3$).

  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$^3$).

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

### 7.2 When Two Test Results Disagree

7.2.1 *Acceptable difference*

When two test devices were deployed to test the same testing location, the average of the two test results shall be reported as the value used for determining needs for mitigation if:

a) both test results are above the action level, or

b) both test results are below the action level.

7.2.2 *Where test results disagree on exceeding the action level*

When one test result is above the action level and the other test result is below the action level:

a) Acceptable Difference

   If the higher result is less than twice the lower result, the average of the test results shall be reported as the value used to determine if this location needs mitigation; and

b) Not Acceptable

   If the higher test result is more than twice the lower test result:

   1. For two collocated (side-by-side) tests conducted at the same time, a repeated collocated test for this location is required to obtain a valid measurement; and
   2. For two short-term detectors deployed at different times in the same location, obtaining confirmation on whether or not mitigation is warranted requires additional testing unless it is decided to proceed with mitigation.

      This degree of uncertainty requires a precautionary stance to include that the higher test result shall be regarded as correct for making mitigation decisions unless further testing indicates otherwise.



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Test results to be regarded as a more accurate reflection of occupant exposure to radon hazards shall be those that most closely align to the predominant normal occupied building operating condition for the location tested, as defined in Section 2.7.2.

When conducting confirmation testing:

a. the testing shall be conducted under building conditions that are representative of the predominant normal occupied building operating condition, as defined in Section 2.7.2.
b. testing shall be initiated within 1 year after initial testing unless the evaluation is relative to older, historic test results; and
c. the evaluations shall be permitted based on data from short-term or long-term test devices or data from evaluations of occupied versus unoccupied radon concentrations.

## 7.3 Post-Mitigation Testing Protocol

The following procedures are required for determining if additional mitigation efforts are warranted.

### 7.3.1 *General procedures—Post-mitigation testing*

One or more short-term test devices shall be deployed at each test location to evaluate the effectiveness of the mitigation efforts. These measurements shall be conducted no sooner than 24 hours after activation of a mitigation system fan or completion of other mitigation efforts. In addition, closed-building conditions, in accordance with Section 4, shall be maintained 12 hours prior to and throughout the test period. Testing shall be either:

a) postponed until both conditions are met, or
b) extended if testing with a continuous monitor where device features or other methods shall be used to obtain an average reading that represents no less than 46 hours of contiguous data collected after both conditions are met.

### 7.3.2 *Clearance Testing*

Clearance testing to verify all portions of a building are below the action level shall comply with all requirements in a) and b) of this Section 7.3.2.

a) Test locations
   1. Test locations shall include all ground-contact dwellings and non-residential rooms, in accordance with Section 3, to include not less than 10% of the dwellings and non-residential rooms on each upper floor; and
   2. Where any active soil depressurization (ASD) system exhausts below the roof, a test shall also be conducted in the room(s) immediately adjoining the outside exhaust location.

b) Clearance testing—Failed locations

   Where clearance testing reveals a need for additional mitigation efforts, testing specific locations after additional mitigation efforts shall be sufficient for meeting clearance test requirements if the following requirements are met:

   1. Where the mitigation method is active soil depressurization (ASD) and the mitigated locations are served by individual HVAC systems described in Exhibit 6 for Group 1 (Basic Heating and Cooling): Testing shall include all locations where clearance testing revealed elevated radon concentrations.
   2. Where mitigation methods are based on passive mitigation efforts: Testing shall include all locations where clearance testing revealed elevated radon concentrations.



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3. Where mitigation methods rely on HVAC mechanical systems to provide dilution or pressurization of indoor air, testing shall include:
    a. All locations required in Section 3 within each unique sector mitigated, and
    b. At least one measurement in each adjoining sector served by a different HVAC system.

7.3.3 *System Performance Testing*

Performance testing mitigation systems by testing only locations where elevated radon concentrations have been found shall not be reported as clearance testing verification that a building has been fixed. Performance testing mitigation systems shall be limited to evaluations of active systems prior to clearance testing or related to maintenance of active systems.



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# 8.0 TEST REPORTS

## 8.1 Conventions

### 8.1.1 *Units and Rounding*

When reporting radon gas concentrations, the unit of measurement shall be picocuries per liter (pCi/L) reported to only one digit after the decimal (e.g., 3.2 pCi/L). Where the average of two measurements produces a second decimal digit that is "5" or greater, the value shall be rounded up. For example, 3.95 pCi/L shall be reported as 4.0 pCi/L.

Exception: Where conventionally appropriate, reports that use Becquerel per cubic meter ($Bq/m^3$) as the unit of measurement for radon gas concentration activity shall be permitted.

### 8.1.2 *Averaging*

Measurement results reported in summary reports, on floor-plan diagrams and in other test result narratives shall be reported in accordance with requirements a) and b) of this Section 8.1.2.

a) Collocated (side-by-side) measurements
Where collocated (side-by-side) measurements were conducted, the average of valid results shall be reported in accordance with Section 7.2. Measurement devices located more than 8 inches (20 cm) from the outer surface of each other shall be regarded as being in separate locations. Measurements made in separate locations shall not be averaged.

b) Follow-up measurements
At each location where short-term detectors are used for follow-up testing under the Extended Testing Protocol prescribed in Section 5.3, the average of initial and follow-up test results shall be reported in accordance with Section 7.2.

## 8.2 Summary Reports

All reports shall include a summary report that complies with all requirements in this Section 8.2.

### 8.2.1 *Essential information*

Essential information provided in summary reports shall include all requirements in this Section 8.2.1.

a) Measurement company
The name, address and contact information for the company or entity responsible for the overall quality of content provided in the test report shall be provided;

b) Site location
The complete address with zip code of the building(s) measured shall be provided;

c) Scope of the measurements conducted
A summary of testing conducted shall be provided to include identification of the testing protocol used for testing, such as ANSI/AARST MA-MFLB, and a description of:

1) The intended purpose of the testing procedure,
2) The measurement system to include method and test devices or detectors used, and
3) The dates when the testing was conducted.

d) Laboratory
The name, address and relevant certification or license number(s) of the service or organization(s) used to analyze detectors shall be provided;



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e) Radon Information Sources
Information shall be provided for obtaining federal or state guidance documents and contacting the State Radon Office or equivalent authority where the test is conducted; and

f) Measurement professional(s)
The measurement professional(s) responsible for adherence to protocols onsite, during deployment and retrieval activities, and the measurement professional(s) responsible for quality procedures, such as during planning, implementation and reporting, shall be identified, to include:
1) their name, address and phone number(s),
2) their relevant radon measurement certification or license number(s), and
3) their legally binding signature (manual, or electronic in conformance with the Electronic Signatures in Global and National Commerce [E-SIGN] Act).

8.2.2 *Summary of measurement results*

Summary reports shall provide a summary of information that is pertinent to further actions or procedures that may be required relative to mitigation decisions, to include information required in a), b), c) and d) of this Section 8.2.2.

a) Elevated concentrations
Summary reports shall describe locations where test results meet or exceed the action level.

b) Upper floors
When elevated radon concentrations are found in upper floor test locations, summary reports shall clearly recommend that evaluations for determining the cause be conducted without delay. Procedures for conducting such evaluations are provided in Normative Appendix C.

c) Follow-up procedures
Summary reports shall identify all locations that still need to be tested or retested to comply with requirements in this standard.

d) Unoccupied non-residential rooms
Where nonresidential ground-contact locations, that are part of conditioned space, were not tested because they were not occupied, summary reports shall recommend either testing or that testing be conducted if occupied in the future.

8.2.3 *Reliability of the measurements*

Summary reports shall provide statements regarding reliability and shortcomings of the measurement procedures in accordance with requirements a), b), c), d) and e) of this Section 8.2.3.

Detailed elaboration is permitted to be included in summary report attachments.

a) Quality assurance summary statements
A summary statement regarding QC measurements shall be provided that conveys:
1. Confirmation of compliance with QC measurements requirements; and
2. Descriptions of any QC measurements that were missing or fell outside of control tolerances established in ANSI/AARST MS-QA (Radon Measurement Systems Quality Assurance).

b) Temporary conditions
Where temporary building conditions or other factors are observed that are known or suspected to cause a test to not reflect occupant risk from radon, summary reports shall recommend retesting the affected location(s). Temporary conditions subject to this requirement include:



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1. The property, dwelling or portion of the building tested was not operated under occupied operating conditions because it was vacant during the test period;
2. Systems were temporarily ventilating with outdoor air for seasonal comfort or energy savings during the test period, including:
    a. Closable passive crawl space vents that were open during the test but would be closed more than 50% of the year for energy savings, comfort or to prevent frozen pipes,
    b. Window air conditioners did not have closed outside air dampers during the test period,
    c. Evaporative cooling systems were operating or not covered during the test period,
    d. Energy recovery ventilators, heat recovery ventilators or economizer ventilation systems were operating under one or both of the following conditions:
        — the system was not set to the lowest outdoor air ventilation rate that occurs during all seasons.
        — not all thermostats in areas served by these systems were set to normal occupiable temperatures;
3. Sub-slab return ducts observed, and minimal air handler activity occurred during the test; and
4. If weather events occurred that were unusually severe for local weather.

c) Deviations from protocol
Where deviations from this standard were observed that are known or suspected to cause a test to not reflect occupant risk from radon, summary reports shall recommend retesting the affected location(s). Deviations from protocol subject to this requirement include, but are not limited to:

1. observed noncompliance with required conditions, such as closed-building conditions 12 hours prior to, or during the test period;
2. observed deviation from a normal occupiable indoor temperature; and
3. where noninterference controls indicate concerns regarding protocol compliance.

d) Radon mitigation system status (if applicable)
Where a mitigation system or efforts to mitigate radon are observed, summary reports shall include:

1. a statement that a mitigation system was observed and whether it appeared to be operating;
2. a statement regarding the condition of any temporary radon mitigation strategies that are not permanent installations; and
3. a statement on the limits of the inspection. It is permitted to provide a statement in the report that the test company offers no findings as to the proper installation and operation of the mitigation system.

8.2.4 *Final Summary Reports*

Summary reports provided when all test procedures required by this standard are complete for the building(s) shall include a statement confirming that valid measurements were achieved at all required test locations unless missing valid tests exceed allowances in Section 6.2. Where exceeding those allowances, the summary report shall instead provide a description of efforts for locations where conditions could not be overcome to achieve the required number of valid tests.



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8.2.5 *Low Radon Concentrations*

Guidance in summary reports and otherwise provided where test results are below the action level shall comply with all applicable requirements in a), b) and c) of this Section 8.2.5.

a) Specific messages

The final summary report shall include equivalent statements for each of the guidance messages shown in Table 8-A where test results are below the action level.

Table 8-A **Reporting Low Radon Concentrations**

EQUIVALENT STATEMENTS FOR THESE ADVISORIES SHALL BE INCLUDED IN THE REPORT.

"Consider fixing the building if test results indicate radon concentrations greater than half the action level, (e.g., between 2 and 4 pCi/L).

Responsible care requires repeating initial testing procedures for all building(s) at least every 5 years and in conjunction with any sale of a building.

Radon testing should also be conducted when any of the following circumstances occur:

- ✓ a new addition is constructed or alterations for building reconfiguration or rehabilitation occur;
- ✓ a ground contact area not previously tested is occupied, or a building is newly occupied;
- ✓ heating or cooling systems are significantly altered, resulting in changes to air pressures or pressure relationships;
- ✓ ventilation is significantly altered by extensive weatherization, changes to mechanical systems or comparable procedures;
- ✓ significant openings to soil occur due to:
  - — groundwater or slab surface water control systems that are altered or added (e.g., sumps, perimeter drain tile, shower/tub retrofits, etc.) or,
  - — natural settlement causing major cracks to develop;
- ✓ earthquakes or construction blasting, fracking or formation of sink holes nearby; or
- ✓ a mitigation system is altered, modified or repaired.

Should testing indicate concentrations that meet or exceed the action level, conduct evaluations, corrections and further testing until radon concentrations have been mitigated to below the action level."

b) Seasonal reliability

If not already accounted for, additional testing shall be recommended, no later than within the first year after occupancy or ownership of property management, where:

1. Testing was not conducted under conditions that are representative of the normal occupied building operating condition that prevails during the greatest amount of time each year; or
2. Testing was conducted under conditions that inhibit clear characterization of a radon hazard.

c) Post-mitigation

Where the low test result is related to verifying mitigation effectiveness, the final summary report shall include all applicable requirements in b), c), d) and e) of the following Section 8.2.6.



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8.2.6 *Elevated Radon Concentrations*

Guidance in summary reports and otherwise provided where test results meet or exceed the action level shall comply with all applicable requirements in a), b), c), d) and f) of this Section 8.2.6.

a) Specific messages

Summary reports shall include equivalent statements for each of the guidance messages shown in Table 8-B where test results meet or exceed the action level.

Table 8-B **Reporting Elevated Radon Concentrations**

EQUIVALENT STATEMENTS FOR THESE ADVISORIES SHALL BE INCLUDED IN THE SUMMARY REPORT.

"Fix the building. Test results indicate occupants may be exposed to radon concentrations that meet or exceed the action level.

Efforts to reduce radon concentrations are not complete until retests provide evidence of effectiveness. The initial retest should be conducted within 30 days after mitigation efforts and system installations.

- Post-mitigation clearance testing to confirm each building is fixed requires testing all buildings that demonstrated elevated radon concentrations:
  1) in all ground-contact rooms and dwellings,
  2) in not less than 10% of non-residential rooms and dwellings on each upper floor.
- Should testing indicate concentrations that meet or exceed the action level, conduct evaluations, corrections and further testing until radon concentrations have been mitigated to below the action level."

b) Mitigation Prior to Test Completion

When multiple test locations in nearby dwellings or non-residential rooms indicate elevated concentrations, recommendations to mitigate are permitted prior to completion of all planned test procedures. When reporting that mitigation could be warranted:

1. The recommendations shall include the following or equivalent statement: "Decisions on whether to mitigate are more fully informed once all testing is complete;" and
2. The recommendations shall be disclosed in a manner approved by the client in accordance with a client's pre-established directives on disclosing test data, as described in Section 2.6.3.

c) Clearance Testing

Recommendations shall be consistent with clearance testing requirements in Section 7.3.

Testing the effectiveness of mitigation efforts only in locations where elevated radon concentrations have been found shall be reported as performance tests with observance that the testing is not conclusive for fully verifying if the building has been fixed.

d) Seasonal Verification

It shall be recommended to conduct additional clearance testing within the first year after occupancy, or ownership of property management:

1. Where post-mitigation clearance testing has not been conducted under the predominant normal occupied building operating conditions, for the building or unique sector, in accordance with Section 7.3.2, and



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2. Where mitigation methods are based on passive methods or mechanical dilution or pressurization of indoor air and clearance testing has not been conducted during two different seasons.

e) Upper Floors and Radon Sources Other Than Soil Gas

Where testing indicates a possible radon source other than soil gas entry on upper floors or elsewhere in the building, recommendations regarding evaluations and post-mitigation testing shall be consistent with Normative Appendix C.

f) Ongoing operation, maintenance and monitoring (OM&M)

Where post-mitigation testing has indicated concentrations that are below the action level, summary reports shall:

1. recommend retesting every 2 years to verify continued mitigation system effectiveness, and
2. include guidance required in Section 8.2.5 whenever reporting low test results.

Note—As more explicitly required in Section 10.5 (OM&M Manuals) within ANSI/AARST SGM-MFLB, (Soil Gas Mitigation Standards for Existing Multifamily, School, Commercial and Mix-Use Buildings):

"Where a radon mitigation system is installed or found in a building at the property, OM&M procedures provided in the OM&M manual shall include all of the following:

1. Quarterly inspection to verify operation of fans and other mechanical components;
2. Testing all buildings at the property at least every 5 years. All radon measurements shall be conducted in compliance with ANSI/AARST MA-MFLB. The clearance test procedure required includes testing all ground-contact dwellings and non-residential rooms that are occupied or intended to be occupied; not less than 10% of dwellings and non-residential rooms on each upper floor; and any mitigated areas on upper floors.
3. After post-mitigation clearance testing and in between 5-year clearance test events, test all previously tested locations for mitigated areas at nominally 2-year intervals, to ensure continued effectiveness.

   It is permitted to suspend testing at 2-year intervals where the required effectiveness of a mitigation system has consistently demonstrated for a period of not less than eight years, and such systems are:

   a. inspected quarterly to verify fan operation,
   b. inspected biennially for mechanical equipment performance and integrity,
   c. all buildings at the property and mitigated areas are retested every 5 years;
4. Each of these stewardship testing events to include mechanical inspections conducted by a qualified professional to verify continued performance of equipment; and
5. The following or equivalent instructions:

   Testing to verify continued effectiveness is to be conducted in conjunction with any sale of a building and after any of the following events occur:

   - ✓ New adjoining additions, structures or parking lots;
   - ✓ Building reconfiguration or rehabilitation;
   - ✓ A ground contact area not previously tested is occupied or a building is newly occupied;
   - ✓ Heating or cooling systems are altered with changes to air distribution or pressure relationships;



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- ✓ Ventilation is altered by extensive weatherization efforts;
- ✓ Sizable openings to soil occur due to:
  - — groundwater or slab surface water control systems or sewer lines are added or altered (e.g., sumps, drain tiles, shower/tub retrofits, etc.) or
  - — natural settlement causing major cracks to develop;
- ✓ Earthquakes, blasting, fracking, or formation of sink holes nearby; or
- ✓ An installed mitigation system is altered."

8.2.7 *Other guidance requirements*

Guidance in summary reports and otherwise provided shall comply with all requirements of this Section 8.2.7.

a) Opinions and interpretations

When opinions and interpretations on any topic are included, the basis upon which the opinions and interpretations have been made shall be included in test reports. Opinions and interpretations shall be clearly marked as such in a test report.

b) Health guidance

Health and action level guidance provided in reports or otherwise furnished shall be consistent with federal guidance or as required by the state or equivalent local jurisdiction of authority where the test is conducted.

Note—Section 7.1 provides an additional informational resource related to such guidance.

c) Longer test periods

Longer test periods, such as those greater than 90 days, shall not be reported as a closer evaluation of annual average radon concentrations when, in accordance with Section 5.1.4, heating season conditions during the test were less than the percentage of year when heating systems are active.

d) Occupied versus unoccupied evaluations

Evaluations of occupied versus unoccupied radon concentrations shall be permitted in summary reports to aid mitigation decisions when conducted in accordance with Section 5.2.

e) Extended testing protocol

Where the Extended Testing protocol option was chosen, it shall be recommended that test results achieved from Steps 1 and 2 of the protocol, in accordance with Section 5.4.1, are to be used for mitigation decisions.

## 8.3 Summary Report Attachments

Immediately attached to or otherwise accompanying a summary report, there shall be supplemental clarity provided in accordance with all requirements of this Section 8.3.

8.3.1 *Test Results Across the Building*

Floor plan diagrams shall be provided with summary reports that show the average of each test result from all locations where valid test resulted were achieved.

**Exception:** Where residential addresses are not expected to change, narrative identification and vicinity within the building shall be permitted in lieu of floor plan diagrams.

8.3.2 *Test Conditions*

For current or future evaluations for the effect of weather and building operating conditions on the reliability of a test to reflect occupant risk from radon, the summary report attachments shall include:



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a) The minimum, maximum and average outdoor temperature that existed 12 hours prior to and during the test period;

b) If the degree of precipitation was near to flood or drought conditions and if the ground is covered by snow or ice; and

c) The seasonal relationship between test conditions and annual average conditions, in accordance with Normative Appendix A. Reporting this relationship shall include:

1. The percentage of time across the year for each differing occupied operating condition, and
2. The operating condition(s) that occurred during the test.

Fig. 8.3.2 **Example Report Format**

| | | | | |
|---|---|---|---|---|
| *Outdoor Temperatures* | *Averages* | **Annual** | | **During the Test** |
| | | 45˚ | | 70˚ |
| *Operating Conditions* | *Heating Conditions* | 75% | *compared to* | 25% |
| | *Cooling Conditions* | - | | - |
| | *Mixed Conditions* | 25% | | 75% |
| *Prevailing Operating Condition* | *Averages* | Heating Conditions | *compared to* | Mixed Conditions |
| *Condition less likely to inhibit characterization of a radon hazard* | | Air distribution systems active | | Air distribution systems intermittent |

*Informative advisories:*

1. Fluctuations in radon concentrations are usually caused by either:
   — changes in the strength of indoor air pressures that draw soil gas into a building; or
   — changes in the volume of outside air entering a building.
2. Clear characterization of a radon hazard is more likely to occur when:
   — Outdoor temperatures extend below 65˚F (18˚C), at least intermittently, which causes natural indoor air pressures that draw radon laden soil gas into a building; and
   — Heating or cooling distribution fans are at least intermittently active during a test.
3. Measurements more likely to reflect an occupant's exposure to radon are measurements conducted under conditions that most closely align to the building operating conditions that prevail during the greatest amount of time each year.

8.3.3 *Elaborations*

Where detailed elaborations are warranted in summary report attachments regarding concerns of testing reliability or extenuating circumstances, such elaborations shall be prominently identified.

## 8.4 Additional Test-Data

Test data, in accordance with Sections 8.4.1 through 8.4.3, shall be provided with each test report.

8.4.1 *All individual results*

The test results from all individual valid measurements from each detector or test device, including results from individual quality control check detectors or devices, shall be provided along with:

a) Detector identification/serial numbers;

b) The start and stop dates and times of the measurement period;



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c) Test location notes, as appropriate; and

d) Annotation for QC measurement results to indicate their purpose.

8.4.2 *Continuous Monitors*

Additional requirements when using and reporting continuous radon monitor test results include:

a) hourly data shall either be included in the test report or made available to be provided to the client upon request;

b) the calibration date of each continuous monitor shall be included on the test report; and

c) removal of or "backing out" portions of hourly data imbedded within the contiguous sampling period reported (such as to account for weather or other conditions) shall invalidate the measurement.

Exceptions:

1. The first 4 hours of data are to be discarded or incorporated into the calculated test result reported using system correction factors (EPA 402-R-92-004, EPA 1992);
2. The first 12 or more hours are to be discarded in the calculated test result reported where required for meeting closed-building requirements in Sections 4, 6.1.2 and 7.3.2;
3. The first 24 or more hours are to be discarded in the calculated test result reported where required in Section 7.3.2 after activation of a mitigation system fan or completion of other mitigation efforts, for evaluation of post-mitigation effectiveness; and
4. Where hourly data is intentionally used to evaluate occupied versus unoccupied concentrations, in accordance with Section 5.2.

8.4.3 *Test notifications*

Records of client notifications and dates distributed shall be included with each report, to include:

a) Communications regarding client advisories, client authorizations and client commitments, as required in Section 2.6; and

b) Communications regarding the content of occupant notices that the client's facilitating staff were to distribute, as required in Section 2.9.1.

## 8.5 Other Reporting and Disclosures

It shall be incumbent upon all measurement professionals responsible for adherence to protocols during onsite activities and quality procedures during planning and reporting to ensure compliance with requirements in a), b), c) and d) of this Section 8.5:

a) All valid test results shall be reported in accordance with local statutes and requirements of the state radon office or other local authority where the testing is conducted;

b) Test location details submitted voluntarily to a state, federal authority or research project shall include no less than:

1. The address of the property tested to include street address, city, state and zip code,
2. Detector identification/serial numbers,
3. The start and stop dates and times of the measurement period, and
4. The test results.

c) The client shall be informed in writing that the chain of custody for test devices is available upon request.



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d) The client shall be informed in writing of their responsibility to identify and comply with local statutes regarding obligations that may exist for disclosing test results to occupants and affected third parties.

**8.6 Retention of Records**

The detector placement log, floor-plan diagrams, supporting documentation with evidence of compliance with this standard and other records related to the testing shall be maintained for at least 6 years after testing.

## 9.0 DEFINITION OF TERMS

Terms not defined herein shall have their ordinary meaning within the context of their use. Ordinary meaning shall be defined in "Webster's Eleventh New Collegiate Dictionary."

| | | |
|---|---|---|
| 9.1 | **Action Level** | A threshold for when mitigation of exposure to harmful elements is recommended or required. |
| 9.2 | **Active Soil Depressurization (ASD)** | A radon control system involving fan-powered soil depressurization, including but not limited to sub-slab and sub-membrane depressurization. |
| 9.3 | **Alpha Track Detector (ATD):** | A radon detector constructed from a piece of plastic, typically of either allyl diglycol carbonate or cellulose nitrate, inside a chamber usually made of electrically conducting plastic. Radon diffuses passively into the chamber, where it subsequently decays. Alpha particles emitted from radon and two of its short-lived progeny, Polunium-218 and Polunium-218, strike the plastic detector and create damaged volumes or "latent tracks." The plastic is etched in a caustic solution, which produces tracks that are visible with a microscope because the latent tracks are more soluble than the surrounding undamaged material in such a solution. |
| 9.4 | **Basic Heating and Cooling** | A dedicated heating and cooling system that does not supply additional outside air for ventilation. See Exhibit 6, Group 1. |
| 9.5 | **Batch** | The set of material that is homogenous regarding characteristics that determine the calibration relationship. For example, activated carbon is prepared and sold in batches, which are then used by laboratories to construct devices with that carbon; a single plastic melt is sold to laboratories who manufacture many ATDs from that batch. |
| 9.6 | **Becquerel per Cubic Meter ($Bq/m^3$)** | A unit of radioactivity representing one disintegration per second per cubic meter: 1 $Bq/m^3$ (0.027 pCi/L). |
| 9.7 | **Blank Measurements** | Blanks are detectors deployed to verify and document the absence of effects on the measurement resulting from sources other than the air being tested. Since blanks are not exposed (i.e., not left open to permit radon to enter the detector), their measurement value should be below the minimum detectable concentration of the measurement system. See field blanks, office blanks and lab-transit blanks. |
| 9.8 | **Calibration** | To adjust or determine or both, the response of an instrument or device relative to a series of conventionally true values. |
| 9.9 | **Charcoal Adsorption Device (CAD) Methods:** | This class of device employs a material such as activated charcoal that adsorbs radon from the air. The amount of radon adsorbed depends on the design of the device, the type of charcoal, the exposure time and the radon concentration, temperature and relative humidity in the surrounding air. This class of device can |



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provide an accurate representation of the average radon concentration during the exposure period if there are no large changes in radon concentration or the environment (e.g., temperature, humidity) during the exposure. Because of the half-life of radon and the time it takes for radon to adsorb, they are typically limited to exposure durations from 2 to 7 days. Calibration of a charcoal adsorption system is accomplished through exposures of representative sets of devices in a STAR for various time periods and different temperatures and humidities.

9.10 **Clearance Testing** A test procedure for obtaining evidence that radon concentrations in all dwellings and occupied areas of a building are below the predefined action level.

9.11 **Client** The individual(s) or parties who hire(s) or pay(s) for radon test services.

9.12 **Collocated** Two or more simultaneous measurements within 4-8 inches (10-20 cm) of each other in the same location, or side-by-side.

9.13 **Comparison Checks** Collocated, simultaneous measurements conducted for the purpose of assessing and monitoring measurement reliability. Comparison checks include but are not limited to duplicate measurements that are defined as collocated, simultaneous measurements using measurement devices of the same manufacturer, model, and most recent calibration date and facility.

9.14 **Conditioned Space** Areas within the heated and cooled envelope of the building where HVAC systems maintain temperatures to facilitate comfort of occupants. Basement areas that maintain occupiable temperatures by virtue of ambient sources of heat or cooling, such as from the earth or adjoined air spaces are considered conditioned spaces within the heated and cooled envelope of the building.

9.15 **Continuous Radon Monitor (CRM**) A CRM is an electronic device that is capable of automatically recording a retrievable time series of numeric measurements of radon concentration averaged over time intervals of 1 hour or less. If a device is not capable of these functions or is not set to record readings each hour, it is functioning as a passive device and is not considered a continuous monitor under this protocol.

9.16 **Crawl Space** An open area beneath part or all of the livable space of a dwelling that typically has either a concrete slab or dirt floor. The dirt floor may be covered with gravel or a membrane. The crawl space can have an open height of a few inches to several feet. The crawl space can be storage space but is not living space.

9.17 **Duplicates** Collocated, simultaneous measurements conducted with instruments or devices that are identical (including manufacturer, model, and, for continuous monitors, the same most recent calibration facility and schedule) for the purpose of assessing and monitoring the measurement system imprecision. (See Comparison Check for a different category of QC measurements that do not require the use of identical devices.)

9.18 **Dynamic Equilibrium:** The state where radon and dilution air entering a building have reasonably stabilized under closed-building conditions. Buildings are typically closed more than 70% of the year and 12 hours is usually sufficient for dynamic equilibrium to occur in most buildings.

9.19 **Economizer Systems** An HVAC systems that provides additional outside air to a building in variable volumes, depending on outdoor temperature, to save expenses of operating air conditioning equipment.



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9.20 **Electret Ion Chamber (EIC) Method**: This type of device uses an ion chamber made of, or lined with, an electrically conductive material with an electret as the detecting mechanism. The surface voltage of the positively charged electret is measured before and after the exposure to radon. During the exposure, radon passively diffuses into the ion chamber and subsequently decays. The radon decay and its short-lived progeny ionize the air inside the chamber. Electrons are attracted to the electret and discharge it. From the surface voltage of the electret measured before and after the exposure, and the duration of the exposure, the average radon concentration during the exposure can be calculated using calibration factors determined through exposures of devices in a STAR. Ambient gamma rays also ionize air inside the chamber, and the effects of ambient gamma radiation must be taken into account when calculating test results. Different electret sensitivities and chamber sizes can be used in combination to measure a range of radon concentration ranging from 2 days to 1 year. The EIC QA requirements apply to all combinations of electrets and chambers used to measure radon concentration in ambient air.

9.21 **Extended Testing** An initial test where, if a radon concentration is found to be elevated, a follow-up confirmation test is conducted. Alternatively, initial tests conducted over an extended period, such as more than 90 days

9.22 **Facilitating staff** Individuals who work at the property being tested or work for property owners or managers such as building supervisors, maintenance staff or office managers.

9.23 **Field Blanks** These detectors serve to reveal any unexpected exposures that might result onsite or from handling procedures.

9.24 **Follow-up Test Procedures** Procedures for radon measurement events such as confirmation testing to verify initial test results, post-mitigation testing and other measurements conducted to better evaluate radon hazards.

9.25 **Ground-Contact** Indoor locations that are habitable, or could be made habitable, and:

a) have floors or walls in contact with ground, or
b) are closest to ground, such as rooms over a crawl space, utility tunnel or parking garage.

9.26 **HAC Systems** Heating and cooling (air conditioning) systems that are not designed to also supply fresh air ventilation. HAC systems are common to single-family residences.

9.27 **High-rise Structures** Buildings containing one or more occupied floors located higher than 75 feet (23 m) above the lowest level.

9.28 **HVAC Setback** HVAC "setback" is normally the automated or manual manipulation of system controls to vary operation of heating, cooling and ventilation systems between occupied periods as compared to unoccupied periods.

9.29 **HVAC System** Heating and cooling (air conditioning) systems that are additionally capable of supplying outdoor air ventilation. If systems do not supply outdoor air ventilation, they are more technically referred to as HAC systems.

9.30 **Intended to be Occupied** Locations where there are plans to occupy rooms even though unoccupied at the time of the testing procedure. Examples include, vacant locations being leased or sold and locations where renovation or repurposing is planned.

9.31 **Lab-transit Blanks** These detectors serve both to evaluate the quality of the laboratory and to look for unexpected exposures that might result from shipping or handling



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| | |
|---|---|
| 9.32 **Long-Term Test Device** | A radon measurement device or detector that can produce a time weighted average for radon concentrations for test periods that may extend for weeks, months or a year. |
| 9.33 **Lot** | The term "lot" refers to bundled sets of unexposed detectors received from manufacturers or other sources at local office(s) as distinguished by the date of purchase. |
| 9.34 **Mitigation** | Efforts to reduce radon concentrations in the indoor air of a building. |
| 9.35 **Mitigation System** | A system designed to reduce radon concentrations in the indoor air of a building. |
| 9.36 **Multifamily Building** | Buildings having more than one attached dwelling or other occupied unit under the same ownership or designated maintenance or management authority. |
| 9.37 **Multi-Zone Systems** | Independent systems and controls for different areas within the same dwelling, room or unique sector. See Exhibit 6, Group 2. |
| 9.38 **Normal occupiable indoor temperatures** | Indoor temperatures of between 65˚and 80˚ F (18˚ - 27˚ C). |
| 9.39 **Normal Occupied Operating Condition** | The operational condition for the building or unique sector of the building that exists during the greatest amount of significantly occupied time. See "Significantly occupied" |
| 9.40 **Notice of Radon Testing** | Written notices to inform occupants and facilitating staff about testing and required test conditions associated the radon testing. |
| 9.41 **Occupied** | Any area of the building that is occupied on a regular basis for more than 4 hours a day. See "Significantly occupied" and "Occupied Weeks" |
| 9.42 **Occupied Work or School Weeks** | Those weeks that do not include vacation days such as national or religious holidays, winter breaks or similar weeks where test conditions do not represent normal occupied operating conditions for the building. See "Normal Occupied Operating Condition", "Occupied" and "Significantly Occupied" |
| 9.43 **Office Blanks** | These detectors serve to reveal any unexpected exposures that might result from storage or handling. |
| 9.44 **Passive Device** | Radon measurement detectors or systems that collect a time-weighted average and do not provide hourly readings. Passive detectors include electret ion chambers; activated charcoal kits; liquid scintillation vials; alpha-track detectors; and continuous monitoring devices that are not set to or capable of automatically recording a retrievable time series of 1-hour measurements. |
| 9.45 **Performance Testing (Mitigation)** | A test procedure to characterize the degree of general effectiveness for mitigation efforts within a specific area of a building. |
| 9.46 **Picocurie per Liter (pCi/L)** | A unit of concentration of radioactivity corresponding to 0.037 decays per second or 2.22 decays per minute in a liter of air or water. 1 pCi/L = 37 becquerels per cubic meter ($Bq/m^3$). |
| 9.47 **Quality Assurance (QA)** | A complete program designed to produce results that are valid; scientifically defensible; and of known precision, bias, and accuracy, including planning, documentation, and quality control activities. |
| 9.48 **Quality Control (QC)** | The system of activities to ensure a quality product, including measurements made to ensure and monitor data quality. For radon measurement devices includes calibrations and background, duplicate, blank and spiked measurements; inter-laboratory comparisons; audits; and other control activities. |



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9.49 **Radon (Rn)** A colorless, odorless, naturally occurring, radioactive, inert, gaseous element formed by radioactive decay of radium (Ra-226) atoms. The atomic number is 86. Although other isotopes of radon occur in nature, in this document, radon refers to the gas Rn-222.

9.50 **Radon Decay Products (RDP)** Often termed "radon progeny," each radon atom after emitting an alpha particle transforms to become different radioactive elements in a series where the short-lived decay products of radon (Po-218 and Po-214) also emit alpha particles as they decay. These decay products are solid elements rather than gaseous and are left suspended in the air we breathe.

9.51 **Radon Test Detector** The element of a radon measurement device or system that detects radon. The detector may be a separate component from the analysis equipment such as for many passive radon measurement systems or may be housed within a device that functions as a combined detector and analysis instrument.

9.52 **Radon Test Device** A radon measurement system, regardless of if configured as a combined detector and analysis instrument or as a system where detectors and analysis equipment are separate components.

9.53 **Return-Air** Air being pulled towards an HVAC air handling fan unit. When the HVAC fan activates, air enters return air vent openings and gaps in ductwork. This air then travels through return air ductwork to the HVAC air handling unit. When the HVAC fan activates, air within the ductwork is under negative pressure relative to indoor air or other surrounding environment.

9.54 **Setback** See HVAC Setback.

9.55 **Short-Term Test Device** A radon measurement device or detector that can produce a time weighted average for radon concentrations for periods that may extend for multiple days or weeks.

9.56 **Significantly Occupied** The period when the building is typically occupied by the majority of the workers or students. See "Normal Occupied Operating Condition", "Occupied", "Significantly Occupied" and "Occupied Weeks".

9.57 **Single-Family Dwelling** A residence or home intended to house a single family.

9.58 **Spiked Measurements** Spikes are detectors that have been exposed in an approved chamber to a known concentration of radon (i.e. "spiked" with radon). Spikes help evaluate the accuracy of a laboratory analysis and/or how accurately detectors supplied by a laboratory measure radon.

9.59 **Structurally Isolated Airspace** A portion of a building where structural components, such as doors and walls result in an isolated airspace that resists air movement between the isolated airspace and surrounding portions of the building.

9.60 **State Radon Office** An office established by a state government to provide information about radon and in some cases, to regulate radon activities in a manner as required by local statute.

9.61 **Summary Report** A summary or executive summary report is a short section of a document that summarizes a longer report or a group of related reports in such a way that readers can rapidly become acquainted with a large body of material without having to read it all.

9.62 **Test Interference** The altering of test conditions prior to or during a measurement to change the radon or radon decay product concentrations, or the altering of the performance of the measurement equipment.



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9.63 **Time-Sensitive** Situations where mitigation decisions are needed quickly, such as within several days or weeks. Time sensitive measurement strategies entail a single phase of testing with enhanced quality control measures.

9.64 **Unique Sector** Portions of a common building that are classified by the general design and intended purpose of each active heating, cooling and ventilation system (HVAC).

9.65 **Valid Sample Time** The period representing occupied conditions after stabilizing building conditions with initiation of the closed-building protocol. Examples of valid sampling times include: The period beginning 12 hours after closed-building protocols are initiated or 24 hours after activation of a radon mitigation system. Valid sampling time is further defined by all other related requirements within this standard.

9.66 **Variable Air Volume Systems (VAV)** HVAC designs where airflow from a single air handle is distributed among multiple dwellings or rooms that temper room temperatures using thermostats to vary the volume of heated or cooled air delivered into rooms. See Exhibit 6, Group 4 Systems.

9.67 **Variable Outdoor Air Ventilation** Systems that seasonally vary outdoor air ventilation for seasonal comfort or energy savings. See Exhibit 6, Group 3 Systems.

9.68 **Working Level (WL)** A unit of radon decay product concentration. One WL equals any combination of short-lived radon decay products in 1 liter of air that will result in the ultimate emission of $1.3 \times 10^5$ MeV of potential-alpha energy. It is approximately the alpha-particle energy released from the decay products in equilibrium with 100 pCi of Rn-222.



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# INFORMATIVE EXHIBIT 1

## SAMPLE FORM— AUTHORIZATIONS AND LINES OF COMMUNICATION

Dear Client and Managing staff,

Please return this form as soon as possible to help us clarify lines of communication and responsibilities.

### Client Authorizations

**Staff authorized for responding to occupant and public inquiries:**

Title/name: _____ Phn#_____

Title/name: _____ Phn#_____

**Person(s) authorized to receive report data and any incremental reports:**

Title/name: _____ Phn#_____

Title/name: _____ Phn#_____

**Frequency of reports:** ( ) Prior to testing ( ) After each phase of testing ( ) When testing is complete

Client or Authorized Agent Name: _____

Signature: _____ Date _____

***Please ensure all contacts and authorizations are provided prior to testing events.***

### Client and Facilitating Staff Member Contact Information

Client or Authorized Agent: _____ Phn#_____

Onsite logistics supervisor: _____ Phn#_____

Building/dwelling access: _____ Phn#_____

HVAC operations: _____ Phn#_____

Other contact title/name: _____ Phn#_____

### Radon Testing Professional Contact Information

Scheduling and logistics: _____ Phn#_____

Overseeing Professional: _____ Phn#_____

Jobsite Quality Control: _____ Phn#_____

Jobsite Quality Control: _____ Phn#_____

Field Technician: _____ Phn#_____

Field Technician: _____ Phn#_____



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# INFORMATIVE EXHIBIT 2

## SAMPLE FORM—CLIENT COMMITMENT TO COMPLANCE

### MANAGEMENT COMMITMENT

To the extent reasonably possible, I, on behalf of _____, commit to helping ensure that building conditions required to achieve reliable radon tests are met, as portrayed herein.

Client or Authorized Agent Name: _____

Signature: _____ Date _____

### BUILDING ONSITE SUPERVISOR COMMITMENT

To the extent reasonably possible, I commit to helping ensure that building conditions required to achieve reliable radon tests are met, as portrayed herein, by accepting the following responsibilities:

1) **Prior Notifications:** Notices will be distributed to all tested, non-tested dwellings and posted in publicly accessible areas such as in corridors, elevators and offices in a timely manner, no later than required by local law for gaining access to a dwelling or not later than the day before testing; and

2) **Access:** Access will be provided to each location being tested within a building with intent to access all locations within a building on the same day for both the event of placing test devices and a second event for retrieving test devices.

Onsite Logistics Supervisor —Name: _____

Signature: _____ Date _____

### BUILDING OPERATIONS STAFF COMMITMENT AND ATTESTATIONS

To the extent reasonably possible, I commit to helping ensure that building conditions required to achieve reliable radon tests are met, as portrayed herein, by accepting the following responsibilities:

1. **Building Preparation**: I accept responsibility that, no later than 12 hours prior to testing, each building scheduled for testing will be reviewed for compliance with closed-building requirements.

2. **Compliance Verification:** I accept responsibility for taking actions that could include adjustments to HVAC units and repairs, such as for broken windows, where completion is required no later than 12 hours prior to testing. Verification will be provided as initialed below or initialed on a log sheet to be provided.

HVAC Operations Supervisor—Name: _____

Signature: _____ Date _____

Building address(s) _____ Date completed _____ Initials ___

Building address(s) _____ Date completed _____ Initials ___

Building address(s) _____ Date completed _____ Initials ___



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# INFORMATIVE EXHIBIT 3

## SAMPLE NOTICE—GENERAL NOTICE PRIOR TO TESTING

Note—Text versions of this exhibit in *both English and Spanish* can be downloaded at www.standards.aarst.org/public-review by choosing "Measurement, User Tools"

# Radon Testing Scheduled

Dear Residents,

An important step is being taken to help protect the health of all occupants in this building. Radon testing is being conducted in portions of this building.

Radon is a naturally occurring radioactive gas often found in soil that can be present in buildings at concentrations greater than recommended.

The only way to know what the radon concentrations are for any building is to test.

Starting Day: _____ Date_____ **(Windows must be closed the night before)**

Ending Day: _____ Date_____ Ending Time: Close of business hours.

**Access into your unit is: [ ] required on _____**
**[ ] not required**

| **Please help to maintain these required test conditions throughout the building (12 hours before the test and during the test).** | |
|---|---|
| **Windows** | **Keep closed** on all levels of the building including areas not being tested |
| **Exterior doors** (except for momentary entry and exit) | |
| **Heating and cooling systems** | **Set to normal** occupied operating conditions with normal temperatures between 65˚and 80˚ F (18˚ - 27˚ C) |
| **Systems that temporarily ventilate with outdoor air for seasonal comfort or energy savings** | **Set to the lowest seasonal ventilation** |
| **Bathroom fans** | **Operate normally** |
| **Exhausts Systems** (that temporarily draw air from the building such from laundries, workshops, community kitchens or for local control of fumes | **Avoid excessive operation** |
| **Fireplaces** (that burn solid, liquid or gas fuels unless a primary/normal source of heat for the building) | **Do not operate** |

**For general health information:**

Copies of EPA's *A Citizen's Guide to Radon* can be found online at **www.epa.gov/radon**.

**For inquiries or reporting concerns.**

Contact Person: _____Phone: _____



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# INFORMATIVE EXHIBIT 4

## SAMPLE PRIOR NOTICE—PUBLIC NOTICE POSTER

Note—Text versions of this exhibit in *both English and Spanish* can be downloaded at www.standards.aarst.org/public-review by choosing "Measurement, User Tools"

# Radon Survey in Progress

Dear Residents,

An important step is being taken to protect your health. Radon testing is being conducted for this building.

Radon is a naturally occurring radioactive gas that can be present in some buildings at concentrations greater than recommended. Testing for radon is recommended for all homes. Radon gas is the second leading cause of lung cancer and the leading cause of lung cancer for nonsmokers in the United States.

The only way to know what the radon concentrations are for any building is to test.

### Radon testing is scheduled for:

Building(s): _____

Building Area(s): _____

Test Deployment: Day_____ Date _____ (please close windows the night before)

Test Completion: Day_____ Date _____ Time: Before close of business hours

| **Please help to maintain these required test conditions throughout the building (12 hours prior the test and during the test).** | |
|---|---|
| **Windows** | **Keep closed** on all levels of the building including areas not being tested |
| **Exterior doors** (except for momentary entry and exit) | |
| **Heating and cooling systems** | **Set to normal** occupied operating conditions with normal temperatures between 65˚and 80˚ F (18˚ - 27˚ C) |
| **Systems that temporarily ventilate with outdoor air for seasonal comfort or energy savings** | **Set to the lowest seasonal ventilation** |
| **Bathroom fans** | **Operate normally** |
| **Exhausts Systems** (that temporarily draw air from the building such from laundries, workshops, community kitchens or for local control of fumes | **Avoid excessive operation** |
| **Fireplaces** (that burn solid, liquid or gas fuels unless a primary/normal source of heat for the building) | **Do not operate** |

**For general health information:**

Copies of EPA's *A Citizen's Guide to Radon* can be found online at **www.epa.gov/radon**.

**For inquiries or reporting concerns.**

Contact Person: _____Phone: _____



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# INFORMATIVE EXHIBIT 5

## SAMPLE NOTICE—BUILDING OPERATIONS STAFF INSTRUCTIONS

Note—Text versions of this exhibit in *both English and Spanish* can be downloaded at www.standards.aarst.org/public-review by choosing "Measurement, User Tools"

| **Actions required at least 12 hours prior to initiating the test** | |
|---|---|
| **Building Component** → | **Action Required** |
| **Windows**<br>**Exterior doors** (except for momentary entry and exit)<br>**Other openings to the exterior** as a result of disrepair, incomplete construction or structural defect. | Close or seal on all levels of the building, including areas not being tested<br>Exception: Do not close openings to outside air designed to provide air needed for combustion appliances. |
| **Heating and cooling systems** | Set to operate at normal occupied temperatures: 65˚ - 80˚ F (18˚ - 27˚ C).<br>Note—Maintenance inspections of HVAC systems are recommended, but not required. |
| **Variable Outdoor Air Ventilation Systems (if any)**<br>Automated or manually operated systems that seasonally vary outdoor air ventilation for energy savings or comfort, for:<br>— individual rooms and dwellings<br>— multiple rooms and dwellings; or<br>— the whole building.<br>Such systems include: Manually operated dampers, Energy Economizer systems, Energy Recovery Ventilators (ERV) and Evaporative cooling systems. | Close outside air inlet dampers or set to minimum outdoor air intake settings that apply at all times of the year when a building is *significantly occupied.*<br>For other systems, such as window air conditioners, dampers to outside air shall be closed. |
| **Variable Air Volume (VAV) Systems (if any)**<br>Systems that temper room temperatures using thermostats to vary the volume of heated or cooled air coming into rooms. | Set all thermostats to between 65-80˚ F (18-27˚ C) in all rooms that are served by the system. |
| **Return-Air Ducts laid In Soil (if any)**<br>Where return-air air ductwork is located under a slab, or otherwise laid in soil. | **Alert the testing company immediately** |
| ***HVAC setback* in non-residential locations**<br>If non-residential rooms are operating with *HVAC setback* temperatures during nights or weekends that are outside of normal occupied temperatures of 65˚and 80˚ F (18˚ - 27˚ C). | Alter to retain temperatures within the range of 65˚and 80˚ F (18˚ - 27˚ C)<br>**Or contact the testing company** |



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# INFORMATIVE EXHIBIT 6

## HVAC GROUP DESCRIPTIONS



Definitions of basic and complex HVAC systems as applicable to this standard of practice.

*Advisory*—If it is unclear what type of system is present, consult with the building representative, a mechanical engineer or a qualified heating and air conditioning contractor.

| HVAC - DEFINITIONS AND SPECIAL CONSIDERATIONS | |
|---|---|
| **Group 1: Basic Heating and Cooling**<br>A dedicated system for each dwelling or unique area that does not provide seasonally variable outdoor air ventilation for added comfort or energy savings.<br>• **Forced-air** heating and air conditioning (HAC) systems such as normally seen in single-family residences.<br>• **Ductless Systems**<br>— Non-Forced-Air Hot and Cold Water Circulation (sometimes called radiator systems).<br>— Window AC (w/fresh air closed).<br>— Unit Ventilators (w/fresh air closed).<br>— Wall or Baseboard heating/cooling.<br>• **Ductless Split Systems:** One system for cooling and one for heat (e.g., Window AC for cooling and Baseboard heat). | No Special Consideration |
| **Group 2: Multi-zone Systems**<br>Independent systems and controls for different areas within the same dwelling or unique sector. | See Section 3.5 for testing recommendations |
| **Group 3: Variable Outdoor Air Ventilation**<br>HVAC systems that temporarily vary outdoor air ventilation for seasonal comfort or energy savings in:<br>- individual dwellings;<br>- multiple dwellings; or<br>- the whole building.<br>Such systems include those known as: Energy Economizer systems, Energy Recovery Ventilators (ERV) and Evaporative (swamp) cooling systems. | See Section 4.2.2<br>for additional testing requirements |
| **Group 4: Variable Air Volume Distribution**<br>HVAC systems where airflow from a single air handler is distributed among multiple dwellings with independent thermostat controls in each dwelling that variably open and close dampers for heated or cooled supply air.<br>Such systems are commonly called Variable Air Volume (VAV) systems. | See Section 4.2.3<br>for additional testing requirements |



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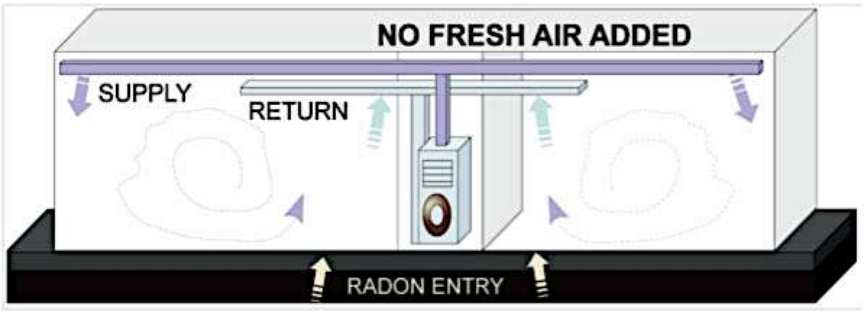
## Group 1: BASIC HEATING AND COOLING (HAC)

Dedicated system(s) that do not supply additional outdoor air for ventilation.

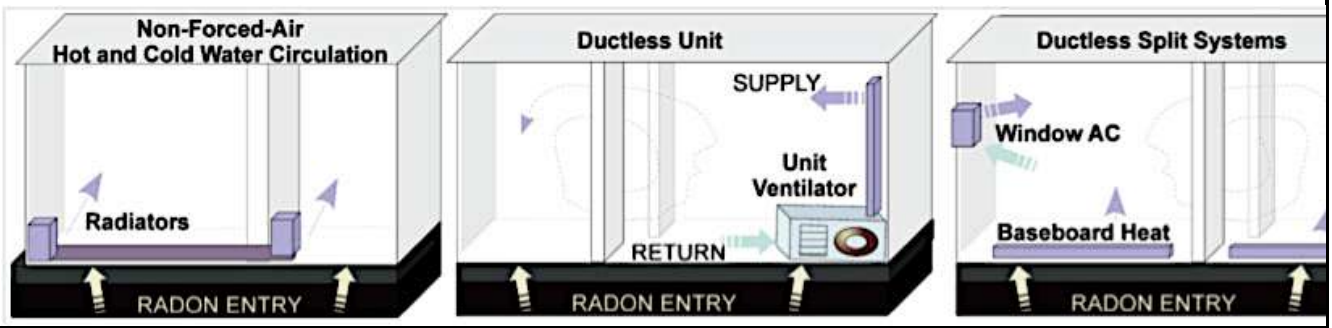



**HAC Systems:**
Many buildings have forced-air heating and air conditioning (HAC) systems.

Supply and return ducts distribute air around the building.

**Ductless Systems:**
Some rooms or dwellings do not have ducted forced-air distribution.

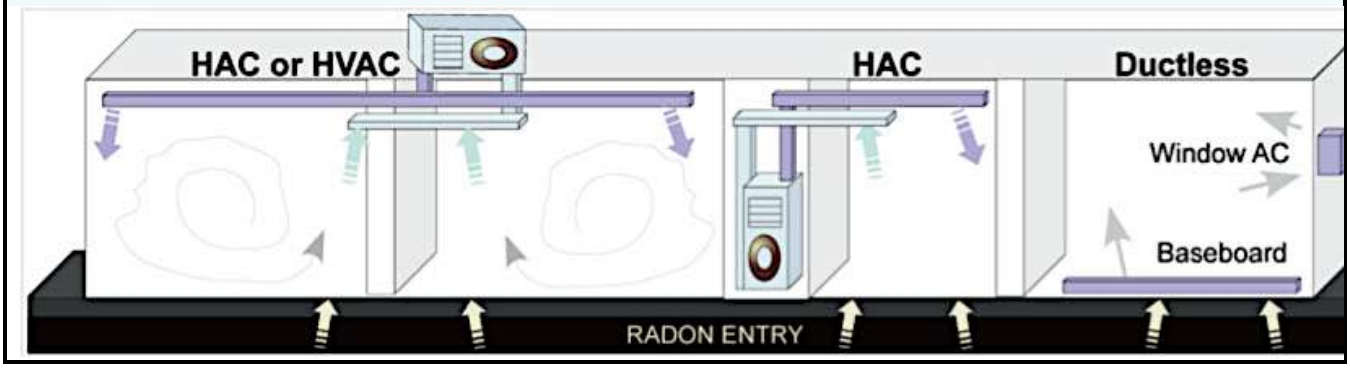
- Hot and Cold-Water Circulation (sometimes referred to as "radiator" systems).
- Window Air Conditioners.
- Wall or Baseboard Heating/Cooling Systems.
- Ductless Split Systems with one unit for cooling and another unit for heat (i.e., Window AC for cooling and Baseboard or Wall units for heat).




## Group 2: MULTI-ZONE SYSTEMS

*Multi-zone systems* are those where different air handlers or systems are employed and independently controlled for different areas within the same dwelling or common use area of a building.

Radon concentrations can vary from room to room based upon variances in system operations.



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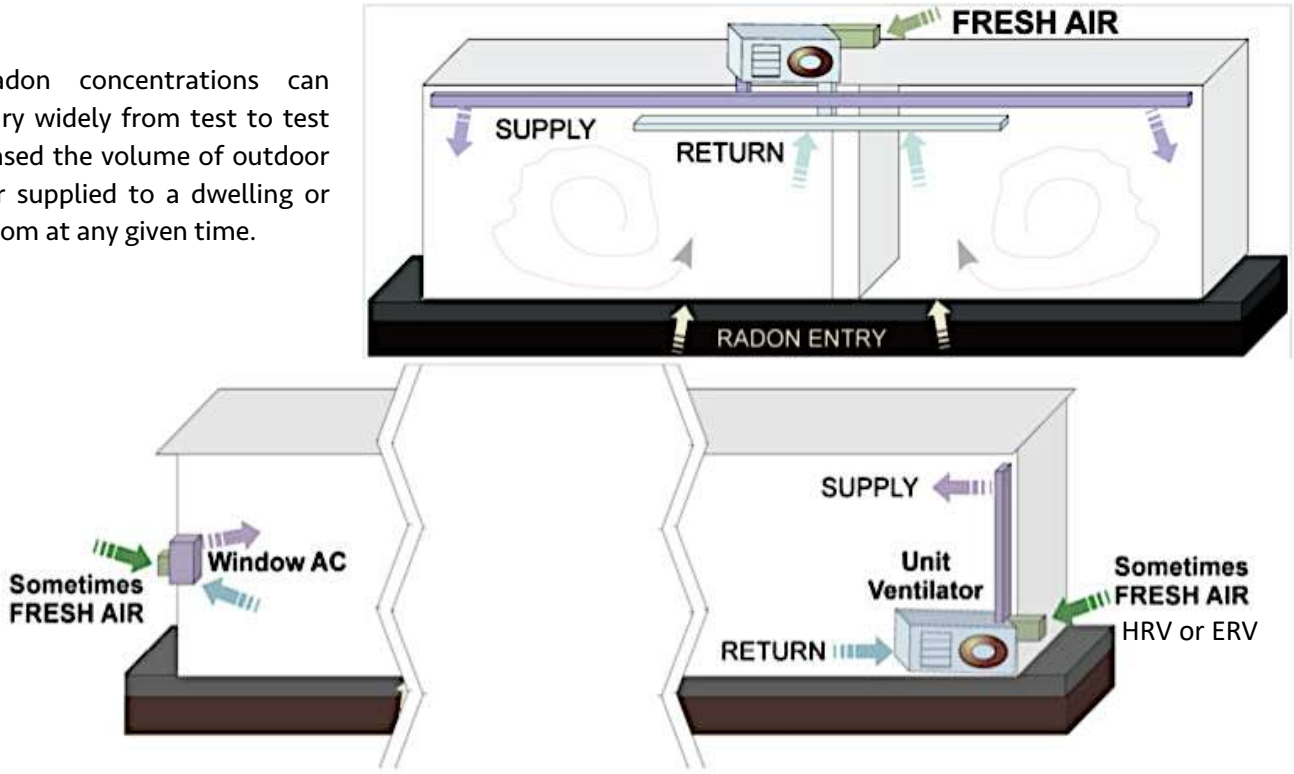
## Group 3: VARIABLE OUTDOOR AIR VENTILATION

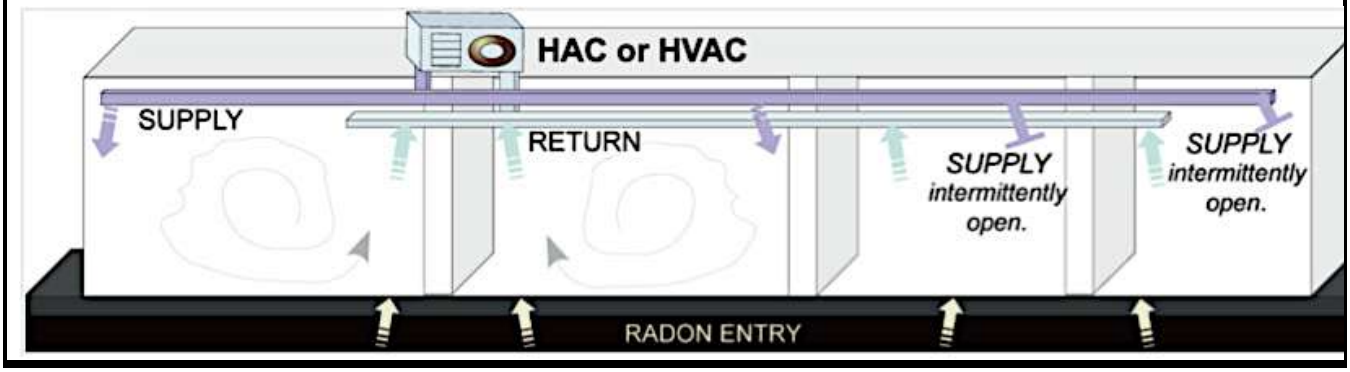
*Variable Outdoor Air Ventilation* (HVAC) systems are those that add outdoor air ventilation for seasonal comfort or energy savings. Such systems may service a whole building, multiple dwellings or a single dwelling or unit ventilator.

Radon concentrations can vary widely from test to test based the volume of outdoor air supplied to a dwelling or room at any given time.




## Group 4: VARIABLE AIR DISTRIBUTION

*Variable Air Distribution* systems are those where airflow from a single air handler is distributed to multiple dwellings, rooms or common use areas with independent controls within each area that open and close duct dampers. The normal operation of these systems can cause changes in distribution of radon or ventilation air and can also affect pressure relationships that can enhance or diminish radon entry.



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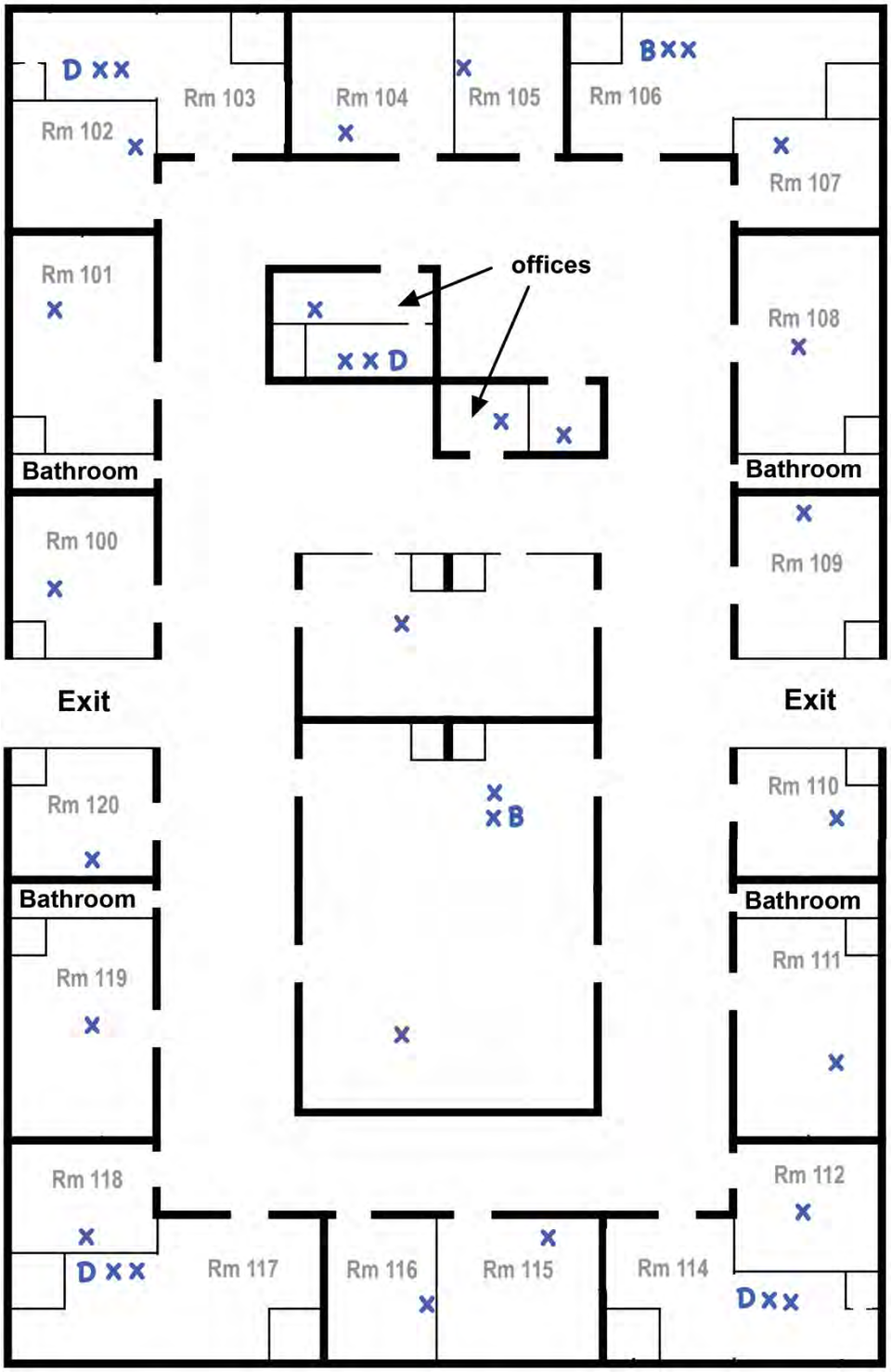
# INFORMATIVE EXHIBIT 7

## EXAMPLE—FLOOR PLAN DIAGRAM

**"X"** = *Detectors*
**"D"** = *Duplicate Detectors*
**"B"** = *Field Blank Detectors*



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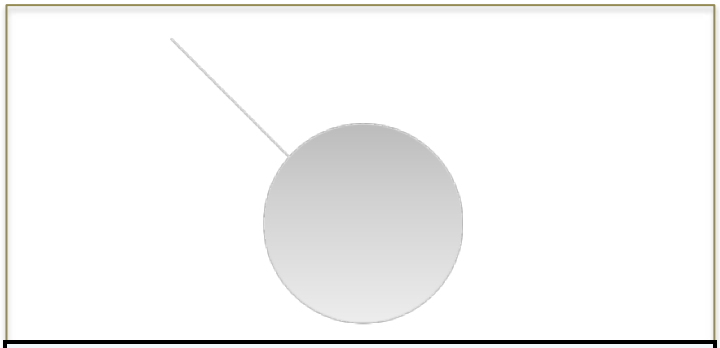
## INFORMATIVE EXHIBIT 8
### SAMPLE—DOOR HANGER NOTICE & PLACARDS



# RADON TEST IN PROGRESS

**Required closed-building conditions**
(12 hours prior to the test and during the test)

| | |
|---|---|
| **Keep closed** | **Windows & Exterior doors** *(except for momentary use)* |
| **Set to normal** | **Heating & Cooling systems** *keep between about 65˚ - 80˚ F)* |
| **Set to lowest outdoor ventilation** | **Systems that temporarily ventilate with outdoor air for seasonal comfort or energy savings** |
| **Avoid excessive operation** | **Clothes dryers, range hoods and bathroom fans** |
| **Do not operate** | **Whole-house and window fans** |
| | **Fireplaces that burn solid, liquid or gas fuels,** unless they are the primary sources of heat for the building |

Radon Company
Anytown, USA 800-000-0000

**Do not disturb test devices.**

*Note—Text versions of the door hanger in both English and Spanish can be downloaded by choosing "Measurement, User Tools" at www.standards.aarst.org/public-review*

**Radon Test Device**
**Do not discard or disturb**
For questions, call _____

**Radon Test Device**
**Do not discard or disturb**
For questions, call _____

**Radon Test Device**
**Do not discard or disturb**
For questions, call _____

**Radon Test Device**
**Do not discard or disturb**
For questions, call _____

**Radon Test Device**
**Do not discard or disturb**
For questions, call _____



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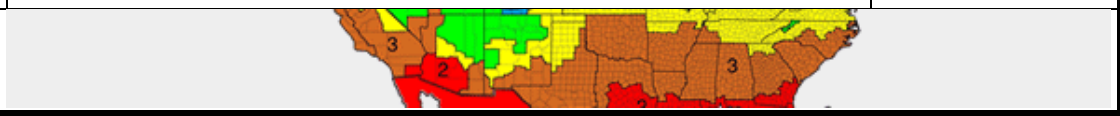
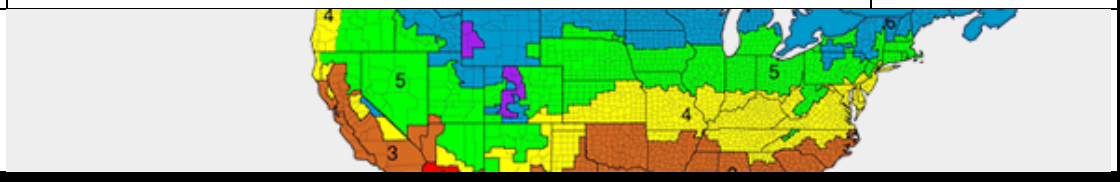
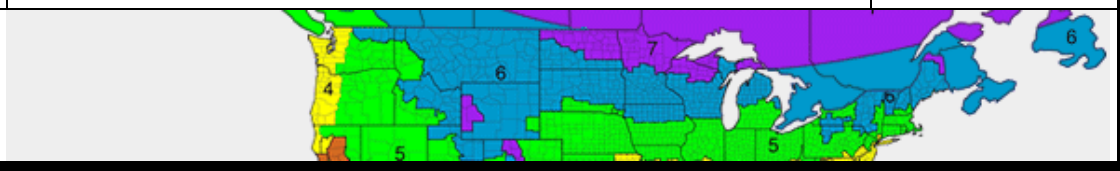
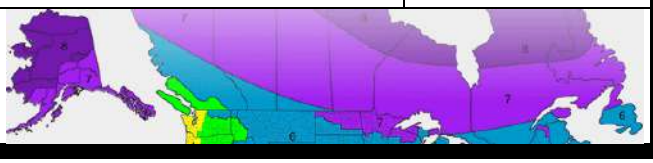
# NORMATIVE APPENDIX A

## REPORTING REQUIREMENTS FOR BUILDING OPERATING CONDITIONS

**TEMPERATURE ZONES**
as designated in ASHRAE standards 90.1 and 90.2
(The American Society of Heating, Refrigerating and Air-Conditioning Engineers) https://www.ashrae.org

| Climate Zone | Example North American States or Cities | Average Annual Temperature |
|---|---|---|
| 1 Very Hot | Southern Florida and Hawaii | Miami 76˚ F (24 C) |
| 2 Hot | Florida, New Orleans, Houston, Mexico | New Orleans 68˚ F (20 C) |
| | | |
| 3 Warm | North Carolina to Southern California | Atlanta 61˚ F (16 C) |
| |  | |
| 4 Mixed | NYC, PA, NJ, VA, KT, TN KS, MO, Seattle WA, and Portland OR. | Kansas City 54˚ F (12 C) |
| 5 Cool | MA, NY, OH, MI, IN, IL, IA, NE, CO, UT and NV. | Chicago 49˚ F (9 C) |
| |  | |
| 6 Cold | ME, NH, VT, WI, MN, ND, WY, SD and ND. | Montreal 43˚ F (6 C) |
| |  | |
| 7 Very Cold | Minot, ND; Anchorage, AK; Winnipeg, Canada | Winnipeg 36˚ F (2 C) |
| 8 Subarctic | Fairbanks Alaska; Cambridge Bay, Canada | Fairbanks 26 ˚ F (-3 C) |
| |  | |



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## A-1.0 Reporting Operating Condition Comparisons

Data from the applicable climate table(s) in this Appendix A, Tables A-1 through A-8, shall be provided for reporting the normal occupied building operating condition(s) for buildings and unique sectors within a building.

Exception: Calculations based on Section CG-5 of the Companion Guidance are permitted.

### A- 1.1 *Data and format*

Table A-1 specifies data and information that shall be reported. Information that compares normal occupied building operating conditions to the operating conditions that occurred during a test shall be portrayed together for easy comparison, such as in Table A.

**Table A**
***Comparison of building operating conditions***
* Required data

| | | Prevailing Annually | Prevailing During the Test |
|---|---|---|---|
| *Outdoor Temperatures* | *Average* | *Avg. annual outdoor temperature* * | *Average temperature during test* * |
| *Operating Condition* | | | |
| | *Heating Conditions* | *percentage of year* * | *percentage during test* * |
| | *Cooling Conditions* | *percentage of year* * | *percentage during test* * |
| | *Mixed Conditions* | *percentage of year* * | *percentage during test* * |
| *Prevailing Operating Condition* | | | |
| | *Average* | *prevailing operating condition* * | *prevailing condition during test* * |
| Condition less likely to inhibit characterization of a radon hazard | | *conditions for clear characterization* * | *conditions during test* * |

### A-2.0 *Calculating test conditions*

Note—Table A-0 (Climate Zone Overview) provides a quick reference for expected building operating conditions relative to average outdoor temperatures during a test that complies with requirements of this Section A 2.

### A-2.1 *Operating Conditions*

Outdoor temperature conditions that dictate the building operation condition at any point in time shall be used to report the percentage of time that each building operation condition occurs during a test, or period of interest, as required in provisions a), b) and c) of this Section A 2.1.

a) Heating conditions shall be expressed based on durations when outdoor temperatures are less than 65°F (18° C).

b) Cooling conditions shall be expressed based on durations when outdoor temperatures exceed 83° F (28° C).

c) Mixed conditions, where neither heating nor cooling conditions prevail, shall be expressed based on durations when outdoor temperatures are in the range of 65°F (18° C) to 83° F (28° C).

Outdoor air ventilation systems with fixed minimum settings or conditions as they will be at all times of the year shall be regarded as an "as is" condition, much the same as small gaps to outside air around windows and doors that allow infiltration of outside air.



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A-2.2 *Test period calculations*

The duration of outdoor temperatures that dictate the building operating condition shall be based on local weather data using methods a) or b) of this Section A 2.2:

a) It shall be acceptable to total the hours of each building operation condition, based on hourly data published by local weather services, and report the percentage of time during the test that each operating condition occurred, as defined in Section A 2.1; or

b) It shall be acceptable to use average outdoor temperatures that occur during the test, or time period of interest, for estimating the percentage of building operations across time. When using this method, the percentage of each operating condition shall be based on the percentage of outdoor temperature values, as defined in Section A 2.1, that fall between the high and low outdoor temperatures during the test or time period of interest.

Note—Table A-0 provides a quick reference for expected building operating conditions relative to average outdoor temperatures during a test.

A-2.3 *Variable outdoor air ventilation*

Because the duration and volume of outside air is dynamically variable for energy recovery ventilation and economizer systems, additional testing that meets requirements in a) or b) of this Section A 2.3 are required before any valid assumptions can be made. In absence of these procedures, no assumptions shall be reported regarding the effects of varying the volume of outdoor air ventilation.

a) Simulation of conditions requires both:

   1. A calculation that plots incremental changes of outdoor temperatures across a 365-day period and the corresponding volumes of modulated outdoor air introduced into the building at any given time, and
   2. Radon testing to confirm the degree of outdoor air required for maintaining concentrations to below the action level.

b) For radon testing of dwellings, or other 24-hour occupancies, the test duration shall be nominally 365 days or 180 days. The 180-day option shall include half of the heating season, half of the cooling season and the duration in between.

Note—These testing options account for widely varying degrees of outdoor air introduced into the building where the outdoor air volume is modulated in response to incremental changes in outdoor temperature.



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**Table A-0** **Climate Zone Overview—Quick Reference***

| | Zone 8 Subarctic | | Zone 7 Very Cold | | Zone 6 Cold | | Zone 5 Cool | | Zone 4 Mixed | | Zone 3 Warm | | Zone 2 Hot | | Zone 1 Very Hot | | Acutely Hot | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Annual Average Outdoor Temperatures | | | | | | | | | | | | | | | | | |
| *Home & Work** | *Hm* | *Wk* | *Hm* | *Wk* | *Hm* | *Wk* | *Hm* | *Wk* | *Hm* | *Wk* | *Hm* | *Wk* | *Hm* | *Wk* | *Hm* | *Wk* | *Hm* | *Wk* |
| | **27 F** | **32 F** | **39 F** | **45 F** | **45 F** | **50 F** | **49 F** | **54 F** | **55 F** | **59 F** | **62 F** | **67 F** | **69 F** | **73 F** | **76 F** | **80 F** | **83 F** | **86 F** |
| | -3 | 0 C | 4 C | 7 C | 7 C | 10 C | 9 C | 12 C | 13 C | 15 C | 17 C | 19 C | 21 C | 23 C | 24 C | 27 C | 28 C | 30 C |
| % per year | 100 % | 92 % | 83 % | 75 % | 75 % | 66 % | 75 % | 66 % | 66 % | 58 % | 58 % | 42 % | 42 % | 25 % | 50 % | 25 % | 100 % | 100 % |
| Heating | < Freezing | < Freezing | 16 % | 25 % | 25 % | 16 % | 25 % | 16 % | 16 % | 16 % | 16 % | 25 % | 16 % | 33 % | 50 % | 75 % | | |
| Cooling | | 8% | | | | 16 % | | 16 % | 16 % | 25 % | 25 % | 33 % | 42 % | 42 % | | | | |
| Neither | | | | | | | | | | | | | | | | | | |

Climate zone temperatures based 30-year averages published online (e.g., the National Centers for Environmental Information-NOAA) for a major city located within each climate zone. Zone classifications reflect ASHRAE (The American Society of Heating, Refrigerating and Air-Conditioning Engineers) standards 90.1 / 90.2. For additional information, visit www.ashrae.org.

* *More detail for each climate zone is provided in the following tables.*

* *Home (Hm) is based on 24-hour temperature averages. Work (Wk) is based daytime temperatures only.*

Note—For discussion purposes, this table illustrates both:

1) Seasonal expectations, and
2) Expected percentages of time that different building operating conditions occur across test periods of multiple days, weeks or months when the outdoor temperature average across the test period is nominally equal to any temperature shown in the table.

Each operating condition influences test results. The measured concentration in each building or unique sector within a building across any span of time is the product of dynamic interactions between factors that include: building capacity for stack effect strength; soil permeability that relates to the volume of soil gas available to enter a building; natural (closed building) ventilation rates with outdoor air; and both natural and mechanical air distribution within the building.



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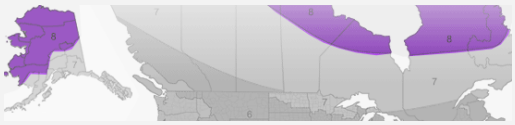
**Table A-8**

| | |
|---|---|
| **Subarctic**<br>**Climate Zone 8**<br>The utmost northern portions of North America.<br>This data is based on Fairbanks, Alaska |  |

**24 Hour Averages**

For dwellings and other 24 hour occupancies

| 24 Hour | | Annual Avg | | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 SubArctic | Fairbanks, AK | 27 | 17 | 45 | 25 | 4 | -6 | -8 | -2 | 11 | 31 | 49 | 60 | 62 | 57 |

| | | ***Prevailing Annually*** | |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *100%* | |
| | *Cooling Conditions* | - | |
| | *Mixed Conditions* | - | |
| **Normal Operating Condition** | | • Heating Conditions | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active | |
| Additional Considerations | | Avoid radon testing under extreme weather conditions, such as during periods when outdoor temperatures are continually < 0˚ F (-18˚C) | |

**Daytime Averages**

For non-residential ocupancies

| Daytime | | Annual Avg | School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 8 SubArctic | Fairbanks, AK | 32 | 21 | 50 | 29 | 8 | -3 | -4 | 3 | 18 | 37 | 55 | 65 | 67 | 62 |

| | | ***Prevailing Annually*** | ***School (prevailing across 9 months)*** |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *92%* | *100%* |
| | *Cooling Conditions* | - | - |
| | *Mixed Conditions* | *8%* | - |
| **Normal Operating Condition** | | • Heating active | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active | |
| Additional Considerations | | Avoid radon testing under extreme weather conditions, such as during periods when outdoor temperatures are continually < 0˚ F (-18˚C) | |



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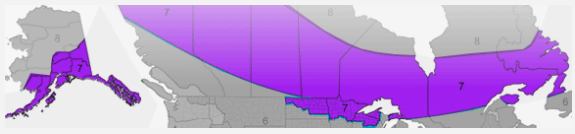
**Table A-7**

**Very Cold**

**Climate Zone 7**

Includes many Canadian provinces, mountain tops, and utmost northern locations in the United States

This data is based on Minot, ND



## 24 Hour Averages

For dwellings and other 24 hour occupancies

| 24 Hour | | Annual Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7-Very cold | Minot, ND | 39 | 56 | 45 | 26 | 14 | 6 | 11 | 21 | 41 | 53 | 61 | 68 | 67 |

| | | ***Prevailing Annually*** | |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *83%* | |
| | *Cooling Conditions* | - | |
| | *Mixed Conditions* | *16%* | |
| **Normal Operating Condition** | | • Heating conditions<br>• No variance in outdoor air ventilation | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active | |

## Daytime Averages

For non-residential occupancies

| Daytime | | Annual Avg | School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 7-Very cold | Minot, ND | 45 | 36 | 63 | 51 | 31 | 19 | 11 | 16 | 26 | 47 | 59 | 67 | 75 | 74 |

| | | ***Prevailing Annually*** | ***School (prevailing across 9 months)*** |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *75%* | *100%* |
| | *Cooling Conditions* | - | - |
| | *Mixed Conditions* | *25%* | - |
| **Normal Operating Condition** | | • Heating conditions<br>• No variance in outdoor air ventilation | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active | |

### Some Cities in This Climate Zone

*Note—Exact percentages will vary slightly depending upon location*

Caribou ME
Quebec, CA
Marquette MI
Duluth MN
Winnipeg, CA
Grand Forks, ND
Anchorage, AK
Breckenridge, CO
Aspen, CO



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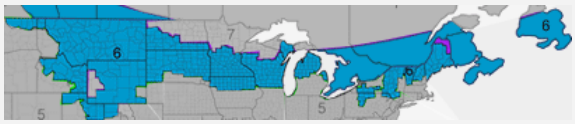
**Table A-6**

**Cold**

**Climate Zone 6**

Includes portions of ME, NH, VT, WI, MN, ND, WY, SD, ND and Canada.

This data is based on Minneapolis, MN




## 24 Hour Averages

For dwellings and other 24 hour occupancies

| 24 Hour | | Annual Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 Cold | Minneapolis, MN | 45 | 61 | 50 | 33 | 19 | 13 | 18 | 31 | 46 | 59 | 68 | 73 | 71 |

| | | ***Prevailing Annually*** | |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *75%* | |
| | *Cooling Conditions* | *-* | |
| | *Mixed Conditions* | *25%* | |
| **Normal Operating Condition** | | • Heating conditions<br>• No variance in outdoor air ventilation | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active | |

## Daytime Averages

For non-residential ocupancies

| Daytime | | Annual Avg | School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 6 Cold | Minneapolis, MN | 50 | 41 | 66 | 55 | 37 | 23 | 17 | 23 | 35 | 51 | 64 | 73 | 78 | 76 |

| | | ***Prevailing Annually*** | ***School (prevailing across 9 months)*** |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *66%* | *88%* |
| | *Cooling Conditions* | *16%* | *11%* |
| | *Mixed Conditions* | *16%* | *-* |
| **Normal Operating Condition** | | • Heating conditions<br>• No variance in outdoor air ventilation | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active | |

### Some Cities in This Climate Zone

*Note—Exact percentages will vary slightly depending upon location*

Portland, ME
Buffalo, NY
Burlington, NH
Milwaukee, WI
Minneapolis, MN
Bismarck, ND
Pierre, SD
Cheyenne, WY
Billings, MT
Helena, MT



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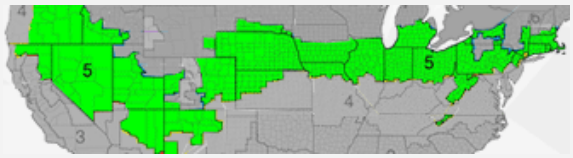
**Table A-5**

**Cool**

**Climate Zone 5**

Includes portions of MA, NY, OH, MI, IN, IL, IA, NE, CO, UT and NV.

This data is based on Chicago, IL




## 24 Hour Averages

For dwellings and other 24 hour occupancies

| 24 Hour | | Annual Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 Cool | Chicago, IL | 49 | 65 | 53 | 40 | 27 | 22 | 26 | 37 | 49 | 59 | 69 | 74 | 72 |

| | | ***Prevailing Annually*** | |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *75%* | |
| | *Cooling Conditions* | - | - |
| | *Mixed Conditions* | *25%* | - |
| **Normal Operating Condition** | | • Heating conditions<br>• No variance in outdoor air ventilation | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active | |

## Daytime Averages

For non-residential occupancies

| Daytime | | Annual Avg | School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 5 Cool | Chicago, IL | 54 | 46 | 70 | 58 | 44 | 31 | 26 | 30 | 41 | 54 | 65 | 75 | 79 | 77 |

| | | ***Prevailing Annually*** | ***School (prevailing across 9 months)*** |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *66%* | *88%* |
| | *Cooling Conditions* | *16%* | - |
| | *Mixed Conditions* | *16%* | *11%* |
| **Normal Operating Condition** | | • Heating conditions<br>• No variance in outdoor air ventilation | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active | |

### Some Cities in This Climate Zone

*Note—Exact percentages will vary slightly depending upon location*

Boston,
Albany, NY
Pittsburg, PA
Cleveland, OH
Columbus, OH
Indianapolis, IN
Chicago, IL
Des Moines, IA
Omaha, NE
Denver, CO
Colorado Springs, CO
Albuquerque, NM
Salt lake, UT
Reno, NV
Boise, ID



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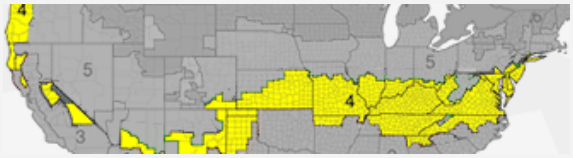
**Table A-4**

**Mixed**

**Climate Zone 4**

Includes portions of NY, NJ, PA, MD VA, KT, TN, KS, MO, WA and OR.

This data is based on Philadelphia, PA




## 24 Hour Averages

For dwellings and other 24 hour occupancies

| 24 Hour | | Annual Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 Mixed | Phillidelpia, PA | 55 | 68 | 57 | 47 | 36 | 32 | 34 | 42 | 53 | 63 | 72 | 77 | 76 |

| | | ***Prevailing Annually*** | |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *66%* | |
| | *Cooling Conditions* | *16%* | |
| | *Mixed Conditions* | *16%* | |
| **Normal Operating Condition** | | • Heating conditions<br>• No variance in outdoor air ventilation | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active | |

## Daytime Averages

For non-residential occupancies

| Daytime | | Annual Avg | School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 Mixed | Phillidelpia, PA | 59 | 52 | 73 | 62 | 51 | 40 | 36 | 38 | 47 | 58 | 68 | 77 | 82 | 81 |

| | | ***Prevailing Annually*** | ***School (prevailing across 9 months)*** |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *58%* | *78%* |
| | *Cooling Conditions* | *25%* | - |
| | *Mixed Conditions* | *16%* | *22%* |
| **Normal Operating Condition** | | • Heating conditions<br>• No variance in outdoor air ventilation | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active | |

### Some Cities in This Climate Zone

*Note—Exact percentages will vary slightly depending upon location*

New York, NY
Philadelphia, PA
Richmond, VA
Washington, DC
Baltimore, MD
Louisville, KY
Cincinnati, OH
Nashville, TN
Saint Louis, MO
Kansas City, MO
Amarillo, TX
Portland, OR
Seattle, WA



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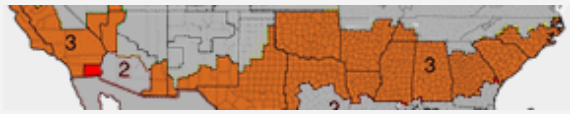
**Table A-3**

**Warm**

**Climate Zone 3**

Includes portions of various states ranging from North Carolina to Southern California.

This data is based on Atlanta, GA




## 24 Hour Averages

For dwellings and other 24 hour occupancies

| 24 Hour | | Annual Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 Warm | Atlanta, GA | 62 | 73 | 63 | 53 | 45 | 43 | 46 | 53 | 62 | 70 | 77 | 79 | 79 |

| | | *Prevailing Annually* | |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *58%* | |
| | *Cooling Conditions* | *25%* | |
| | *Mixed Conditions* | *16%* | |
| **Normal Operating Condition** | | • Heating active | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active<br>• No variance in outdoor air ventilation | |

## Daytime Averages

For non-residential oocupancies

| Daytime | | Annual Avg | School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 Warm | Atlanta, GA | 67 | 61 | 78 | 68 | 58 | 50 | 48 | 51 | 59 | 68 | 75 | 82 | 84 | 84 |

| | | *Prevailing Annually* | *School (prevailing across 9 months)* |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *42%* | *55%* |
| | *Cooling Conditions* | *33%* | *11%* |
| | *Mixed Conditions* | *25%* | *33%* |
| **Normal Operating Condition** | | • Heating active | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active<br>• No variance in outdoor air ventilation | |

### Some Cities in This Climate Zone

*Note—Exact percentages will vary slightly depending upon location*

Atlanta, GA
Charlotte, SC
Montgomery, AL
Birmingham, AL
Jackson, MS
Memphis, TN
Little Rock, AR
Oklahoma City, OK
Dallas, TX
San Antonio TX
Austin, TX
El Paso, TX
Las Vegas, NV
San Diego, CA
Los Angeles, CA
Fresno, CA
San Francisco, CA



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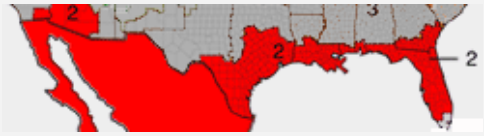
**Table A-2**

| | |
|---|---|
| **Hot**<br>**Climate Zone 2**<br>Includes portions of FL, LA, TX, AZ and many southern portions of North America.<br>This data is based on New Orleans, LA |  |

**24 Hour Averages**

For dwellings and other 24 hour occupancies

| 24 Hour | | Annual Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Hot | New Orleans, LA | 69 | 79 | 70 | 61 | 55 | 52 | 55 | 62 | 69 | 76 | 81 | 82 | 82 |

| | | ***Prevailing Annually*** | |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *42%* | |
| | *Cooling Conditions* | *42%* | |
| | *Mixed Conditions* | *16%* | |
| **Normal Operating Condition** | | • Virtually equal portions of the year for heating or cooling. | |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating and air distribution systems active<br>• No variance in outdoor air ventilation | |
| Additional Considerations | | | |

**Daytime Averages**

For non-residential occupancies

| Daytime | | Annual Avg | School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 Hot | New Orleans, LA | 73 | 69 | 83 | 75 | 66 | 60 | 57 | 60 | 67 | 74 | 80 | 85 | 87 | 86 |

| | | ***Prevailing Annually*** | ***School (prevailing across 9 months)*** |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | *25%* | *33%* |
| | *Cooling Conditions* | *42%* | *22%* |
| | *Mixed Conditions* | *33%* | *44%* |
| **Normal Operating Condition** | | • Cooling systems active. | • Intermittent heating and cooling conditions. |
| Condition less likely to inhibit characterization of a radon hazard | | • Heating conditions at least some portion of the test period.<br>• No variance in outdoor air ventilation. | |
| Additional Considerations | | • Consider additional testing to evenly account for each condition or an Assessment of Occupied Versus Unoccupied Conditions. | |

## Some Cities in This Climate Zone

*Note—Exact percentages will vary slightly depending upon location*

Melbourne, FL
Tampa, FL
Mobile, AL
New Orleans, LA
Houston, TX
Brownsville, TX
Phoenix, AZ
Tucson, AZ



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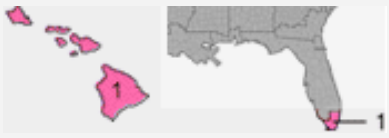
**Table A-1**

| | |
|---|---|
| **Very Hot**<br>**Climate Zone 1**<br>Certain tropical areas such as Hawaii and the southern tip of Florida<br>This data is based on Miami, FL |  |

**24 Hour Averages**

For dwellings and other 24 hour occupancies

| 24 Hour | | Annual Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Very Hot | Miami, FL | 76 | 82 | 79 | 74 | 69 | 68 | 69 | 72 | 75 | 79 | 82 | 83 | 83 |

| | | ***Prevailing Annually*** | |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | - | |
| | *Cooling Conditions* | *50%* | |
| | *Mixed Conditions* | *50%* | |
| **Normal Operating Condition** | | • Virtually equal periods of cooling and inactive HVAC. | |
| Condition less likely to inhibit characterization of a radon hazard | | • When each day tested includes periods of both:<br>a) outdoor temperatures below 84˚ F (29˚ C), and;<br>b) cooling systems active with some degree of regularity.<br>• No variance in outdoor air ventilation | |
| Additional Considerations | | Consider Long-Term or additional testing to account for both conditions. | |

**Daytime Averages**

For non-residential occupancies

| Daytime | | Annual Avg | School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Very Hot | Miami, FL | 80 | 78 | 85 | 82 | 77 | 73 | 72 | 73 | 76 | 79 | 83 | 85 | 86 | 87 |

| | | ***Prevailing Annually*** | ***School (prevailing across 9 months)*** |
|---|---|---|---|
| *Operating Condition* | *Heating Conditions* | - | - |
| | *Cooling Conditions* | *75%* | *66%* |
| | *Mixed Conditions* | *25%* | *33%* |
| Normal Operating Condition | | • Cooling systems active | |
| Condition less likely to inhibit characterization of a radon hazard | | • When each day tested includes periods of both:<br>a) daytime outdoor temperatures below 84˚ F (29˚ C), and;<br>b) cooling systems active with some degree of regularity.<br>• No variance in outdoor air ventilation | |
| Additional Considerations | | • Consider additional testing to evenly account for each condition or an *Assessment of Occupied Versus Unoccupied Conditions.* | |

Some Cities and Locations in This Climate Zone

*Note—Exact percentages will vary slightly depending upon location*

Miami, FL
Puerto Rico
Virgin Islands
Honolulu, HI
Guam



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# NORMATIVE APPENDIX B

# EVALUATION OF OCCUPIED VERSUS UNOCCUPIED CONCENTRATIONS

When conducting an evaluation of occupied versus unoccupied radon concentrations as an additional line of evidence relative to mitigation decisions, the evaluation shall comply with requirements of this Appendix B.

B-1.1 *Measurement equipment or processes*

Devices, such as CRMs, or other testing processes that can accurately measure the difference between average radon concentrations during occupied compared to unoccupied conditions are required.

B-1.2 *Measurement duration*

Testing shall be conducted for durations of not less than 46 hours to achieve average concentrations at each location for at least two occupied days compared to two unoccupied nights, as proportional to the percentage of significantly occupied and unoccupied durations.

B-1.3 *Reporting the evaluation*

Reported measurements shall include:

a) The average radon concentration for the full measurement period;

b) One average derived from the combined averages of the occupied periods across a test duration; and

c) A second average derived from the combined averages of the unoccupied periods across a test.

B-1.4 *Simulation Testing*

When unable to test under the normal occupied operating condition for the building or unique sector, testing to simulate those conditions is permitted. Simulations to evaluate occupied versus unoccupied influences on radon concentrations shall be conducted by manipulating HVAC controls to simulate various HVAC operating conditions. The procedure shall include provisions a), b) and c) of this Section B-1.4.

a) The evaluation shall include:

   1. Building operating conditions that simulate normal occupied operating conditions, in accordance with Section 2.7.4, and
   2. Conditions required regarding minimum outdoor air ventilation and variable air distribution, as applicable, in accordance with Section 4.2;

b) Details that shall be recorded and provided in reports include:

   1. HVAC control settings and duration of activation for each simulated condition, and
   2. Radon concentration measurements associated with each simulated condition; and

c) The simulation measurements shall be made in each operational mode of concern for durations that are compatible with:

   1. HVAC system capacity to achieve dynamic equilibrium for radon concentrations in the building or unique sector, and
   2. Measurement device capabilities to achieve statistically accurate measurements for the duration of each operating condition.

*Informative advisory*—Simulations to evaluate occupied versus unoccupied radon concentrations should only be made in coordination with building staff responsible for HVAC operations.



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# NORMATIVE APPENDIX C

# ELEVATED RADON CONCENTRATIONS IN UPPER FLOORS

## C-1 Evaluation Procedures

Where elevated radon concentrations are found in upper floor test locations, an evaluation shall be conducted to determine the extent and cause of the elevated concentrations. A report that complies with all applicable portions of Section 8 (Test Reports) shall be provided relative to the results of each step of the evaluation. The report shall recommend that mitigation efforts are to comply with national standards. [10]

### C.1.1 Step 1—*Soil gas and water*

C.1.1.1 Soil Gas

It shall be permitted to mitigate known or suspected sources of soil gas entry prior to initiating radon measurement evaluations of upper floors. When making this choice, post-mitigation testing shall include upper floor measurements in accordance with Section C.1.2 Step 2.

C.1.1.2 Water

It shall be permitted to conduct measurements, in accordance with national standards[11], and mitigation for radon in water prior to initiating radon measurement evaluations of indoor air on upper floors. Where mitigation included reducing radon in water supplies, post-mitigation testing shall include testing indoor air for radon in one or more locations within each dwelling or non-residential room where elevated radon concentrations had been found.

### C.1.2 *Step 2—Measurement Evaluations*

Measurements shall be conducted to characterize elevated radon concentrations in upper floor areas of the building that include:

a) a radon measurement in all dwellings and nonresidential rooms intended for occupancy on the floor closest to ground where elevated radon concentrations were found, and

b) a radon measurement in all dwellings and non-residential rooms for no less than one additional upper floor, regardless of whether elevated radon concentrations were initially found there.

**Exception:** Where the cause and extent of elevated concentrations are confirmed to be radon in water.

### C.1.3 *Step 3—Localized ventilation or building materials*

C.1.3.1 Step 3 A: Visual Evaluation

Where the measurements conducted in accordance with Section C.1.2 Step 2 indicate inadequate ventilation or building materials specific to certain dwellings or non-residential rooms are the cause of elevated concentrations:

a) A visual review shall be conducted for all other locations in the building where lack of ventilation or similar building materials could be the cause of elevated radon concentrations; and

b) Confirmation that these conditions are the cause of elevated radon concentrations is not required. However, it shall be permitted to attempt confirmation by simultaneous radon measurements:

1. in a room where poor ventilation or building materials are suspected as the cause, and
2. in a nearby room suspected of having radon concentrations that are below the action level.

---

[10] ANSI/AARST SGM-MFLB *(Soil Gas Mitigation in Existing Multifamily, School, Commercial and Mixed-Use Buildings).*

[11] ANSI/AARST MW-RN *(Protocol for the Collection, Transfer and Measurement of Radon in Water).*



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A report shall be provided with a summary of the visual review and any measurements conducted to include recommendations or guidance consistent with the findings of this characterization.

C.1.3.2 Step 3 B: Common To The Structure

Where evaluations indicate inadequate ventilation or building material sources are a cause of elevated concentrations common to the entire building or portions of the building, the measurement evaluation in Section C.1.2 shall be repeated on one or more additional upper floors unless there is reliable evidence to support a different course of action. Where evaluations confirm concerns that the cause is common to the entire building or portion of the building, reports shall recommend mitigation for all floors or portions of the building identified with similar conditions.

C.1.3.3 Step 3 C: Clearance Testing—Inadequate Ventilation or Building Materials

Where elevated radon is identified to be caused by inadequate ventilation or building materials, clearance testing after attempts to mitigate resulting indoor radon concentrations shall be conducted for:

a) All dwellings and non-residential rooms where efforts have been made to mitigate radon from inadequate ventilation or building materials; and

b) All locations not tested but that demonstrate similar potential for causing elevated radon concentrations.

Where mitigation efforts include enhanced ventilation techniques, post-mitigation clearance testing shall include seasonal verification in accordance with Section 7.3.2 b within the first year of occupancy or ownership of property management.



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# NORMATIVE APPENDIX D

## NATIONAL CERTIFICATION/LISTING PROGRAMS

### D-1 National Certification/Listing Programs

For private sector certifications of qualified measurement professionals identified in Section 2.4, this standard requires a national program that evaluates and lists qualified individuals, training courses and other products or services, such as laboratory services, integral to achieving public health goals intended by this standard. Programs meeting the purpose, need and requirements of this standard are those with policies as established in a), b) and c) of this Appendix D.

a) Programs with published policies that:

1. require persons to undergo education and an impartial examination process prior to granting personal certification or certificates of educational achievement; and
2. require surveillance of continued competence, not less than as demonstrated by continuing education on standards updates, compliance and other related technical knowledge and skills, prior to granting recertification or renewed certificates or listings; and
3. require, for the certification of radon measurement laboratories, initial demonstration and scheduled ongoing surveillance of compliance with ANSI/AARST MS-QA (Radon Measurement Systems Quality Assurance).

b) Programs that:

1. have a written policy and means for receiving and adjudicating complaints against individuals or companies who have been granted a credential; and
2. have publicly published educational and examination requirements for each credential or listing available online where readily accessible for consumers of credentialed services.

b) Programs that include educational prerequisites as follow:

1. Qualified Radon Measurement Professional—Multifamily and Commercial

   Listing or certification credentials granted that qualify individuals as proficient in placement, retrieval, and analysis (as applicable) of *radon* detectors and to design, plan, and implement quality procedures when conducting *radon* measurements in multifamily, school, commercial and mixed-use buildings are to include:

   a. current certification as a qualified radon measurement professional in homes; and
   b. additional education and processes approved by the program relative to tasks required in the most current version of this standard ANSI/AARST MA-MFLB (Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily, School, Commercial and Multi-Use Buildings) prior to granting this advanced level certification or listing and recertifications or relisting.

2. Qualified Radon Measurement Professional—Homes

   Certifications granted that qualify individuals as proficient in conducting radon measurements in existing homes are to include:

   a. no less than 16 hours education prior to granting certification that focuses on tasks required in ANSI/AARST MAH (Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes); and



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b. biennial recertifications after completing continuing education requirements and any other program surveillance activities.

Informative Note 1—The National Radon Proficiency Program (NRPP), the National Radon Safety Board (NRSB), or equivalent programs that also meet requirements of a), b) and c) of this normative Appendix D meet the requirements of this standard.

Note that identification of existing certification bodies is not an endorsement of their programs.

Informative Note 2—The purpose of requirements in this Appendix D is to ensure contractors have an appropriate degree of technical, engineering, and scientific knowledge to protect occupants by providing reliable measurements of *radon gas* present in indoor air.



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# Acknowledgments

***Sincere appreciation is both expressed and deserved for contributions of time and wisdom***

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Non-voting Assist Team: Gary Hodgden (KS)

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## MAMF Consensus Body Members 2015-2016

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Non-voting Assist Team: Gary Hodgden (KS)

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| (Environmental Cons. alternate) | Mike Walther (MD) | Professional Service Provider |
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# MA-MFLB
# Companion Guidance

AARST CONSORTIUM

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*Note—Text versions in both English and Spanish can be downloaded at* www.standards.aarst.org/public-review *by choosing "Measurement, User Tools"*

**CG Section 2: Guidance for Building Managers**

**CG Section 3: Descriptions of Test Devices**

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**CG Section 5: Calculating Average Building Operating Conditions**

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# Informational
# Introduction to Radon

## A. Radon Facts

Radon is a naturally occurring radioactive gas that is a part of the uranium-238 decay chain. The immediate parent of radon-222 is radium-226. Radon comes from the breakdown (radioactive decay) of uranium that is found in soil and rock all over the world. Radon is a component of the air in soil that enters buildings through cracks and other pathways in the foundation. Eventually, it decays into radioactive particles (decay products) that can become trapped in your lungs when you inhale. As these particles decay, they release small bursts of radiation that can damage lung tissue and lead to lung cancer over the course of a lifetime. Studies by the U.S. Environmental Protection Agency (EPA) have found that radon concentrations in outdoor air average about 0.4 pCi/L (picocuries per liter) of air. However, radon can reach much higher concentrations inside a building.

Radon gas is colorless, odorless and tasteless. The only way to know whether elevated concentrations of radon are present in any building is to test.

## B. Radon's Health Effects

Radon is a known human carcinogen. Prolonged exposure to elevated radon concentrations causes an increased risk of lung cancer. Like other environmental pollutants, there is some uncertainty about the magnitude of radon health risks, but EPA calculates that radon may cause 21,000 lung cancer deaths in the United States each year. The U.S. Surgeon General has warned that radon is the leading cause of lung cancer deaths in nonsmokers in the United States. Only smoking causes more lung cancer deaths than radon.

Not everyone who breathes radon decay products will develop lung cancer. An individual's risk of getting lung cancer from radon depends primarily on three factors: the concentration of radon, the duration of exposure and the individual's smoking habits. In addition, some people are more susceptible to lung cancer than others.

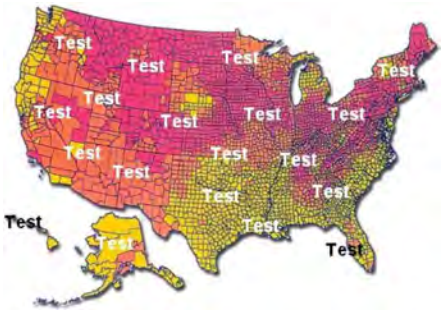
Risk increases as an individual is exposed to higher concentrations of radon over a longer period. Smoking combined with radon is an especially serious health risk. The risk of dying from lung cancer caused by radon is much greater for smokers than it is for nonsmokers.

## C. Radon Exposure

Because many people spend much of their time at home, the home is likely to be where the most significant radon exposure occurs. According to EPA, nearly one out of every 15 homes in the United States is estimated to have radon concentrations that exceed the EPA action level. For most people, the second largest exposure to radon is likely to be at their school or workplace.

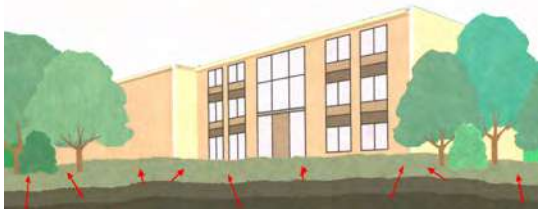
Elevated concentrations of radon have been found in homes and other buildings in every U.S. state and similarly throughout the world. According to EPA studies, nearly one out of every five schools in the United States are estimated to have radon concentrations that exceed the EPA action level in at least one frequently occupied ground-contact room.

While elevated radon may be more common in some areas, any building can have a problem. It is recommended that ALL buildings be tested regardless of the area of the country and that maps should not be used to determine whether to test.




The concentration of radon in the air within a building should be reduced below the federally established radon action level or as established by the state or other local jurisdiction. Action levels, such as 4 pCi/L established in the United States, are based largely on the ability of current mitigation technologies to consistently reduce radon concentrations. Any radon exposure creates some risk; no concentration of radon is safe. Even radon concentrations below the action level pose some risk, and the risk of lung cancer can be reduced by further lowering indoor radon concentrations. Depending on the building characteristics, radon concentrations in some buildings can be reduced well below the action level. In others, reducing radon concentrations below the action level may be more difficult.

## D. Radon Entry into Buildings



Radon in soil gas is the main source of radon problems. Pathways for radon to enter a building include cracks in the slabs and walls, the expansion joints between floor and walls, porous concrete block walls, open sump pits, crawlspaces and openings around utility penetrations. Some buildings have other pathways for radon to enter a building such as sub-slab utility tunnels and heating, ventilating and air conditioning (HVAC) ducts.

Radon gas may also enter buildings in well water. Radon from well water used in a building can off-gas and raise concentrations in the air within the building. For buildings or small communities that use well water, a test of the water



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for radon should be considered, especially if the building is vacant or there is no water use when testing for radon in air. Radon in water testing is covered in a separate document and is beyond the scope of this testing protocol. More information on radon in drinking water is available at state radon offices, local drinking water safety programs or at federal water safety programs (e.g., EPA's Drinking Water Hotline (800) 426-4791

Sometimes building materials that contain uranium and radium can produce radon in sufficient amounts to result in elevated radon concentrations in the air. A radiation professional or local radiation program can help you evaluate this possibility.

### *Factors Influencing Radon Entry*

Many factors contribute to the entry of radon gas into buildings. As a result, building managers cannot know without testing if elevated concentrations of radon are present. The following factors determine why some buildings have elevated radon concentrations and others do not:

- **Source Strength:** The concentration of radon in the soil gas**;**
- **Gas Mobility:** The permeability of the soil or sub-surface geology under the building;
- **Structure and Construction** of a building; and,
- **Mechanical Systems:** The type, design, operation, and maintenance of the heating, ventilating, and air-conditioning system.

**Source strength:** The radon concentration in soil gas under structures can vary greatly from one building to the next. It can even vary greatly under different parts of the same building.

**Gas mobility:** Certain geological features beneath a building, such as cracks, fissures or solution cavities, can serve as a direct connection between the radon-producing minerals and the building's foundation. Such a direct connection can cause one room or portion of a building to have a radon concentration significantly higher than other nearby areas. The permeability of the soil under a building along with the differences between the air pressure inside a building and the air pressure under a building's foundation influence the radon entry rate. For example, if the air pressure in the building is greater than the air pressure under the building's foundation, radon is less likely to enter through the openings of a building's foundation. If the air pressure in the building is less than the air pressure under the building's foundation, radon in the soil gas will enter through any openings in the building's foundation.

**Structure and construction**: Any building can have a radon problem even though building design and construction impact radon entry and ventilation once radon enters. Testing is the only way to know if elevated concentrations of radon are present.

**Heating, cooling and ventilation systems:**

Depending on their design and operation, HVAC systems can influence radon concentrations in buildings:

- Ventilation with outdoor air serves to dilute indoor radon concentrations; however, radon gas potency most often overwhelms the practical limits of increasing ventilation to adequately reduce occupant exposure.
- Poor ventilation provides less dilution of indoor radon concentrations.
- Depressurized buildings draw radon inside.
- Pressurizing a building helps keep radon out.

The frequency and thoroughness of HVAC maintenance can sometimes play an important role. For example, air intake filters that are not periodically cleaned and changed can significantly reduce the amount of outdoor air needed to dilute indoor contaminants. An understanding of the design, operation and maintenance of a building's HVAC system and its influence on indoor air is helpful for managing radon problems and other indoor air quality problems in buildings. However, since HVAC systems are only one of many factors that affect radon concentrations in a building, their modifications are often not an effective stand-alone radon mitigation strategy.

## E. Contacts for Additional Information

**In the United States:**

- EPA website http://www.epa.gov/radon
- State radon offices: https://www.epa.gov/radon/epa-map-radon-zones-and-supplemental-information#datainfo
- Regional EPA offices: https://www.epa.gov/aboutepa/visiting-regional-office
- The National Radon Proficiency Program (NRPP): www.nrpp.info
- The National Radon Safety Board (NRSB) - Radon Proficiency Program: www.nrsb.org

**In Canada:**

- Health Canada https://www.canada.ca/en/health-canada/services/health-risks-safety/radiation/radon.html
- Canadian—National Radon Proficiency Program (C-NRPP): https://c-nrpp.ca/



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## CG Section 2
## Guidance for Building Managers

### A. Introduction and Planning

The purpose of radon testing is to identify locations that have elevated radon concentrations and to determine if radon mitigation is necessary to protect the health of current and future occupants. -n 02

***Planning***

Planning to test a building for radon requires a basic understanding of the testing process and the steps that are necessary to ensure results are reliable. Radon testing requires careful planning and record-keeping. It requires determining appropriate test locations and handling large numbers of devices.

Use a trained professional who has demonstrated a minimum degree of appropriate technical knowledge and skills specific to design and implementation of the radon testing program.

If considering existing staff personnel, they should obtain national, and if applicable, local state certification or licensure prior to testing. Demonstration of personal proficiency by means of a license or certification is required by some jurisdictions.

***Preparation***

Poorly designed studies can lead to unnecessary expense, disruption and misinterpretation of data. Specifically, to plan for radon testing, you will need to:

- Become familiar with testing methods;
- Become familiar with building conditions required to conduct reliable radon tests;
- Gather building information pertinent to the design of a radon testing plan, including floor plan diagrams for ground-contact dwellings and non-residential rooms;
- Review logistics and estimate the number of detectors, including those for quality control (QC), when evaluating costs and competitive bids from companies providing radon testing services;
- Design, implement and document a plan to coordinate activities between staff and radon professionals;
- Investigate whether any previous tests have been conducted and collect any available test results; and
- Become familiar with radon reduction recommendations.

### B. Communication Plan

Develop a written communication plan for disseminating information throughout the process to all affected parties. Include senior staff, health and safety staff, appropriate communications staff, maintenance staff, and the radon measurement professional when developing the communication plan. This plan should be agreed to and signed by the responsible parties.

***Prior to the test:***

- Develop notices (with general information, instructions, and point of contact for inquiries) that can be made specific for each affected audience, including:
  - — Facilitating staff
    These are people responsible for oversight of test devices and building conditions during the testing period such as building managers, maintenance managers, teachers, and other supervisors;
  - — Occupants, which for non-residential occupancies may include students and workers; and
  - — Guardians of occupants under supervised care that may include students
- Develop timetables and methods for distribution of notices.
- Specify the staff member responsible for onsite activities.



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- Specify additional communication paths between senior staff, facilitating staff, maintenance staff and the professional radon service provider.
- Specify the procedure for internal distribution of radon test data including:
  - — Who is designated to receive data or reports from the radon measurement professional.
  - — What situations, if any, warrant reporting interim and incomplete test results prior to completion of all test phases. This should be decided prior to any situation where follow-up testing is a component of the chosen test strategy.
- Identify who is responsible for developing contingency plans for unexpected challenges during the testing.
- Identify who is granted permission to respond to public inquiries.
- Specify the procedure and mechanism for disclosing the radon test results and the person(s) allowed to discuss test results with occupants, parents or other parties.

***Pre-test notifications***

Distribute notices of radon testing at least two weeks in advance of beginning testing and again a few days before the test to appropriate staff and occupants. Poor communications prior to testing can lead to test disruption and unusable data, creating unnecessary expense and aggravation.

Note—Section 2.6 and Exhibits 2 through 5 provide details and sample notification forms.

***After the test – A Recommendation***

Full public disclosure of radon test results for large buildings is strongly recommended and, in some localities, required by law. Failure to disclose test results can deprive current and future occupants of information necessary to avoid risk, thereby increasing the culpability of building owners and managers.

**C. Selecting a Radon Measurement Professional**

The goal is to select a radon measurement professional who will provide reliable services and procedures. Use experienced professionals that have demonstrated a minimum degree of appropriate technical knowledge and skills both sufficient to place, retrieve and analyze (as applicable) radon detectors and to design, plan, and implement quality procedures when conducting radon measurements.

**Test devices:**

All equipment used for measuring radon must meet requirements of the local jurisdiction or be listed by a nationally recognized radon proficiency program if the jurisdiction has no device verification program.

**D. Role of a Facility's Personnel**

Because the facility's personnel frequently have knowledge of the building and the occupants, they can play a key role during the testing process, especially in planning and efficient use of professional services. By providing floor plan diagrams, when available, and timely access to rooms, the facility personnel can help the radon measurement professional to quickly plan the testing strategy and achieve reliable results.

It is strongly recommended that untrained personnel serve only in these support roles for trained and certified or licensed radon measurement professionals. Specific training that includes demonstration of proficiency in the use of detectors should be obtained prior to assisting a qualified radon measurement professional in placing and retrieving detectors.

**E. Documenting the Testing Program**

The building managers or owners should maintain a record of the testing program for future reference.

**F. When to Test**

While testing at any time can provide valuable information, confidence that elevated radon concentrations are not present is best achieved with tests conducted during periods that reasonably represent:

a) The normal occupied operating condition for the building or unique sector of the building.



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b) Testing periods when the operating conditions are most likely to emphasize a clear characterization of a radon hazard.

Note—For most locations in the U.S., this would be during the heating season (e.g., winter). See Appendix A for more information.

## G. Retesting When Tests Have Indicated Low Radon Concentrations

Retesting the building at least every 5 years is recommended. Testing may be conducted more often to gain more information. Many factors can cause indoor radon concentrations in a building to change over time. These changes may produce variations in radon concentrations compared to previous tests.

It is recommended to test again when any of the following circumstances occur:

- ✓ A new addition is constructed, or significant renovation takes place;
- ✓ A ground contact area not previously tested is occupied or subsequent to taking occupancy of a building;
- ✓ Heating or cooling systems are significantly altered resulting in changes to air pressures or distribution;
- ✓ Ventilation is significantly altered by extensive weatherization, changes to mechanical systems or comparable procedures;
- ✓ Significant openings to soil occur due to:
  - — groundwater or slab surface water control systems (e.g., sumps, perimeter drain tile, shower/tub retrofits, etc.); or
  - — natural settlement causing major cracks to develop;
- ✓ Earthquakes, construction blasting, or formation of sink holes nearby; or
- ✓ An installed mitigation system is altered, modified or repaired.

## H. Mitigation

### *Timing*

How quickly to begin the mitigation process will depend on the initial radon concentration detected. Radon concentrations of more than twice the action level requires a more rapid response, e.g., more than 8 pCi/L (296 Bq/m$^3$).

### *The Need for Professional Mitigation Guidance*

Lowering radon concentrations requires special training, skills and experience. Persons qualified in varied disciplines with different skill sets are often needed. It is critical that persons, including radon professionals, be qualified for their apportioned task.

To successfully lower radon concentrations with confidence, the management team, contractor or contracting team needs to include individuals with experience in radon mitigation who have demonstrated a minimum degree of appropriate technical knowledge and skills specific to radon mitigation in the size of building being mitigated.

### Prior Design Diagnostics

Conditions in the entire building must be evaluated. Diagnostic procedures to evaluate air pressure relationships within and under a building are needed to identify the appropriate radon reduction technique and design.



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## Results from the EARTH Study: Partial Testing of Multifamily Buildings Will Misrepresent Radon

"Evaluating and Assessing Radon Testing in Housing with Multifamily Financing" (EARTH) was a HUD-funded Healthy Homes Technical Study led by Health Research Inc. for the New York State Department of Health with assistance from the National Center for Healthy Housing. The primary aim of the study was to develop an evidence-based, statistically sound protocol for measurement professionals to correctly characterize a multifamily building's radon level that is sufficiently protective of occupant health without being unduly burdensome to transactions or property owners.

The below table presents the probability of missing a unit with a radon level above the EPA action level, based on the % of units sampled, according to the analysis of data for units in 276 multifamily buildings in the US. These data indicate, across building sizes, that to characterize radon levels correctly in multifamily buildings with up to 20 ground-contact units, i.e., achieve 95% confidence that no units in the building have radon ≥4 pCi/L, 100% testing is required. For the vast majority of multifamily building sizes, all ground-contact units in the buildings should be tested for radon.

**Average probability (%) of partial sampling missing a unit in a building* with≥4 pCi/L with various sampling percentages.**

| Number of ground contact units | Number of buildings | 10% sampled | 25% sampled | 50% sampled | 75% sampled | 90% sampled |
|---|---|---|---|---|---|---|
| 05-06 | 45 | 58 | 34 | 19 | 4.7 | 0.0† |
| 07-08 | 71 | 55 | 36 | 15 | 4.6 | 0.0† |
| 09-10 | 40 | 65 | 39 | 24 | 8.5 | 3.8 |
| 11-12 | 37 | 52 | 41 | 21 | 8.1 | 2.8 |
| 13-14 | 14 | 51 | 35 | 20 | 7.4 | 2.2 |
| 15-16 | 20 | 47 | 32 | 15 | 5.0 | 1.3 |
| 17-18 | 15 | 59 | 39 | 21 | 8.1 | 1.9 |
| 19-20 | 12 | 69 | 46 | 23 | 8.9 | 2.6 |
| 21-26 | 22 | 52 | 34 | 18 | 6.7 | 2.3 |
| All | 276 | 58% | 38% | 19% | 6.5% | 1.7% |

**Ground contact units only. Includes buildings with at least one unit ≥4 pCi/L.*

†*Note that for 90% sampling all units are tested for buildings with 9 or fewer units.*

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## CG Section 3
## DESCRIPTIONS OF TEST DEVICES

**Passive Device Measurement Systems**

As used in this standard, "Passive devices" are measurement systems that collect a time-weighted average and do not provide hourly readings.

- *Charcoal adsorption detectors (CAD)*
  CAD detectors employ activated charcoal that adsorbs radon from the surrounding air. Exposure durations are typically limited to 2-7 days. After exposure, detectors must be sent to the laboratory without delay. Detectors are configured for either Gamma-ray Spectroscopy or Liquid Scintillation Spectroscopy analysis.

- *Alpha-track detectors (ATD)*
  ATD detectors utilize a piece of plastic inside a container. Alpha particles emitted from radon strike the plastic detector and create damaged "tracks" that are visible with a microscope. The track density is determined by the laboratory to achieve an average radon concentration for the time the detector is exposed.

- *Electret ion chamber detectors (EIC)*
  EIC detectors use a chamber made of, or lined with, an electrically conductive material with an electrically charged electret as the detecting mechanism. The decay of radon discharges voltage from the electret. The radon concentration is calculated by comparing the electret voltage measured before and after exposure.

- *Electronic integrating devices (EID)*
  An EID is an electronic measuring device is like a continuous monitor but is not recording a retrievable time series of 1-hour measurements. EID devices are categorized as passive devices because such devices do not provide the additional measurement data points needed for making mitigation decisions.

**Continuous Radon Monitors (CRM)**

A CRM is an electronic device that is automatically recording a retrievable time series of numeric measurements of radon concentration averaged over time intervals of 1 hour or less. These additional data points can help to judge whether there was an unusual occurrence during the test that might invalidate the overall measurement.

### TERMINOLOGY ASSOCIATED QUALITY CONTROL (QC)

**Duplicate or Comparison Check Measurements**

Duplicates or comparison check measurements are pairs of detectors or monitors deployed in the same location, side-by-side, approximately every tenth measurement (i.e., 10%). The purpose is to evaluate and track imprecision or agreement between detectors or monitors across time. Using calculations for relative percent difference (RPD):

- In an environment with a radon concentration ≥ 4 pCi/L, the goal for agreement is an RDP ≤14%. The warning limit is an RPD ≥ 28% and the control limit is an RPD ≥ 36%.
- Between 2 and 4 pCi/L, the goal for agreement is an RDP of ≤25%. The warning limit is an RPD ≥ 50% and the control limit is an RPD ≥ 67%.

**Calibration**

Calibration means to adjust or determine or both, the response of an instrument or device relative to a series of conventionally true values. Ongoing annual calibration of each CRM is part of all quality assurance efforts.

**Blank Measurements**

Blanks are CAD, ATD or EIC devices deployed for at least 5% of the number of measurements conducted to verify and document the absence of effects on the measurement resulting from sources other than the air being tested. Since blanks are not exposed (i.e., not left open to permit radon to enter the detector), their measurement value should be below the lower limit of detection.

**Spiked Measurements**

Spikes are CAD, ATD or EIC detectors that have been exposed in an approved reference chamber to a known concentration of radon (i.e., "spiked" with radon). Spikes are conducted for at least 3% of the devices deployed for field measurements. Using spiked measurements helps to validate the accuracy of a laboratory analysis and/or detectors supplied by a laboratory.

See ANSI/AARST MS-QA, "Radon Measurement Systems Quality Assurance" for more detailed information.



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## CG Section 4
## CHAIN OF CUSTODY

*For Support Staff under direct supervision of a Qualified Measurement Professional*

**Correlation of Tasks and Technical Skills Commonly Associated with Placing and Retrieving Detectors**

*Note—This informational table is not intended to stipulate what apportioned tasks are assigned to an individual and thereby not intended to stipulate what combination of instructions or training are appropriate for a specific assigned task.*

| Task | Instructions or Training associated with each task | QMP's Required Outcome |
|---|---|---|
| Identify test locations within a room | Sufficient to know where not to test and required distances away from floors; ceilings; exterior windows, doors, and walls; and other devices and objects. | - Devices deployed in compliance with Table 3.8 |
| Manage devices and documentation during placement and retrieval | Sufficient to document test locations, device serial numbers; start and stop dates and times; and where QC check devices were deployed.<br>Sufficient to update addresses and document occupancies, conditions and mechanical systems that are different than anticipated.<br>Sufficient to document and seek guidance if test reliability concerns are encountered.<br>Sufficient to use devices in compliance with manufacturer's instructions. | - 6.4.2: Documented details are recorded that are required for processing test result analysis and reports<br>- 6.4.1: Updated records and floor-plan diagrams<br>- 2.3.2: Devices used in compliance with manufacturer instructions |
| Identifying which dwellings and rooms are to be tested | Sufficient to understands which dwellings and rooms to test, compared to where not to test.<br>Sufficient to seek guidance and document locations that were designated to test but could not be tested or where a valid test could not be completed due to missing, lost and non-retrievable detectors | - 3.0: The required dwellings and rooms are tested<br>- 6.2: Locations intended to test but did not achieve a valid test are identified |
| Quality control of test conditions | Sufficient to inspect for and understand when closed-building conditions were not or cannot be maintained; and to seek guidance if unanticipated conditions are encountered.<br>Sufficient to ensure "radon test in progress" notices are posting in conspicuous locations.<br>Sufficient to identify unexpected HVAC conditions, which can include variable outdoor air ventilation, variable air volume systems and return air ducts under slabs. | - Tables 4-A, 4-B and 4-C and Section 6.1: Compliance with closed-building requirements<br>- 6.1.6: To include posting "Radon test in progress" notices |
| "QC" measurements | Sufficient to integrate duplicate and blank measurement detectors, where instructed. | - 6.3: QC measurements are conducted and reported |
| Temporary conditions and protocol deviations | Sufficient to understand, document or seek guidance on temporary conditions and deviations from protocol that may adversely affect test reliability | - 8.2.3 Report conditions that may adversely affect test reliability |



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## CG Section 5
## CALCULATING AVERAGE BUILDING OPERATING CONDITIONS

The following methodology is intended to be simplistic yet reasonable for use.

1) Know The Average Occupied Indoor Temperature: 74˚ F (23˚ C)
   Due to required comfort for occupants, the average indoor temperature is usually maintained with stability between 68˚ to 82˚ F (20˚ to 28˚ C). Use an average of about 74˚ F (23˚ C) during estimations unless known to be specifically different. HVAC systems are set to respond to needs for maintaining this comfort range during significantly occupied periods.

2) Identify When the Building Is Significantly Occupied

3) Identify The Average Local Outdoor Temperatures During Significantly Occupied Months
   HVAC systems respond to changes in outdoor temperatures by activating heating, cooling and ventilation air handlers including certain designs that introduce outdoor air ventilation into a building.

4) Identify Periods When Heating and Cooling Systems Activate

| | |
|---|---|
| Heating Systems | In response to needs for indoor comfort:<br>Heating systems will often activate when outdoor temperatures drop to below about 65° F (18˚ C). |
| Cooling Systems | In response to needs for indoor comfort:<br>Cooling systems will normally be active when outdoor temperatures exceed about 75° F (28˚ C). |

**Examples of Heating and Cooling Activity**

24 Hour Averages

> 75˚F Cooling

66˚ - 75˚ F Intermittent

< 65˚F Heat

**24 Hour Temp Averages**

| ZONE | | Annual Avg | 9 mo School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Very Hot | Miami, FL | 76 | 74 | 82 | 79 | 74 | 69 | 68 | 69 | 72 | 75 | 79 | 82 | 83 | 83 |
| 2 Hot | New Orleans, LA | 69 | 64 | 79 | 70 | 61 | 55 | 52 | 55 | 62 | 69 | 76 | 81 | 82 | 82 |
| 3 Warm | Atlanta, GA | 62 | 56 | 73 | 63 | 53 | 45 | 43 | 46 | 53 | 62 | 70 | 77 | 79 | 79 |
| 4 Mixed | Phillidelpia, PA | 55 | 48 | 68 | 57 | 47 | 36 | 32 | 34 | 42 | 53 | 63 | 72 | 77 | 76 |
| 5 Cool | Chicago, IL | 49 | 42 | 65 | 53 | 40 | 27 | 22 | 26 | 37 | 49 | 59 | 69 | 74 | 72 |
| 6 Cold | Minneapolis, MN | 45 | 37 | 61 | 50 | 33 | 19 | 13 | 18 | 31 | 46 | 59 | 68 | 73 | 71 |
| 7-Very cold | Minot, ND | 39 | 30 | 56 | 45 | 26 | 14 | 6 | 11 | 21 | 41 | 53 | 61 | 68 | 67 |
| 8 SubArctic | Fairbanks, AK | 27 | 17 | 45 | 25 | 4 | -6 | -8 | -2 | 11 | 31 | 49 | 60 | 62 | 57 |
| 8 SubArctic | Cambridge Bay | 6 | -6 | 32 | 11 | -9 | -21 | -27 | -27 | -22 | -7 | 15 | 36 | 47 | 44 |

Daytime Only Averages

**Daytime Temp Averages**

| ZONE | | Annual Avg | 9 mo School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Very Hot | Miami, FL | 80 | 78 | 85 | 82 | 77 | 73 | 72 | 73 | 76 | 79 | 83 | 85 | 86 | 87 |
| 2 Hot | New Orleans, LA | 73 | 69 | 83 | 75 | 66 | 60 | 57 | 60 | 67 | 74 | 80 | 85 | 87 | 86 |
| 3 Warm | Atlanta, GA | 67 | 61 | 78 | 68 | 58 | 50 | 48 | 51 | 59 | 68 | 75 | 82 | 84 | 84 |
| 4 Mixed | Phillidelpia, PA | 59 | 52 | 73 | 62 | 51 | 40 | 36 | 38 | 47 | 58 | 68 | 77 | 82 | 81 |
| 5 Cool | Chicago, IL | 54 | 46 | 70 | 58 | 44 | 31 | 26 | 30 | 41 | 54 | 65 | 75 | 79 | 77 |
| 6 Cold | Minneapolis, MN | 50 | 41 | 66 | 55 | 37 | 23 | 17 | 23 | 35 | 51 | 64 | 73 | 78 | 76 |
| 7-Very cold | Minot, ND | 45 | 36 | 63 | 51 | 31 | 19 | 11 | 16 | 26 | 47 | 59 | 67 | 75 | 74 |
| 8 SubArctic | Fairbanks, AK | 32 | 21 | 50 | 29 | 8 | -3 | -4 | 3 | 18 | 37 | 55 | 65 | 67 | 62 |
| 8 SubArctic | Cambridge Bay | 9 | -3 | 33 | 14 | -6 | -18 | -24 | -24 | -18 | -2 | 19 | 39 | 51 | 46 |



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## 5) Identify The Normal Average Occupied Operating Condition

A. Calculate the Average Occupied Operating Condition
The operational condition for the building or unique sector of the building that represents the greatest amount of significantly occupancy time.

B. Clear Characterization
Identify the operating conditions most likely to emphasize a clear characterization of a radon hazard. This is primarily time periods when the difference between indoor and outdoor temperatures cause:

a) Some degree of regularity for natural negative air pressure inside the building as compared to outside of the building (e.g., stack effect), and;

b) Some degree of regularity in the activity of heating or cooling system blowers.

This would not include time periods when the volume of outdoor air introduced into the building exceeds the minimum amounts required to maintain occupant health.

**EXAMPLE WORKSHEET**

1) Identify the average occupied indoor temperature: ❑ 74˚ F (23˚ C) ❑ Other _____.

2) Identify the months per year that represent significant occupancy for each unique sector of the building.

❑ 12 months (as common for dwellings and most large buildings that house business occupancies).

❑ 9 months (as common for many school buildings).
❑ Other _____

Identify the hours of the day that represent significant occupancy for each unique sector of the building.

❑ 10-hour occupancies (e.g., Work or school day plus routine afternoon meetings, classes or sports).
❑ 24-hour occupancies (e.g., Dwellings and 24/7 services such as hospitals).
❑ Other _____

3) Identify the average outdoor temperatures during periods of significant occupancy.

| Annual | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ |

4) Calculate average HVAC activity during significantly occupancy periods

| HVAC Mode | Months in each operational mode | Total Months | Yearly % |
|---|---|---|---|
| Heating Active | ❑ Jan ❑ Feb ❑ Mar ❑ Apr ❑ May ❑ Jun ❑ Jul ❑ Aug ❑ Sep ❑ Oct ❑ Nov ❑ Dec | ___ | ___% |
| Cooling Active | ❑ Jan ❑ Feb ❑ Mar ❑ Apr ❑ May ❑ Jun ❑ Jul ❑ Aug ❑ Sep ❑ Oct ❑ Nov ❑ Dec | ___ | ___% |
| None (mixed) | ❑ Jan ❑ Feb ❑ Mar ❑ Apr ❑ May ❑ Jun ❑ Jul ❑ Aug ❑ Sep ❑ Oct ❑ Nov ❑ Dec | ___ | ___% |

**Example for Schools**

Daytime Averages

> 75˚F Cooling
66˚ - 75˚ F Intermittent
< 65˚F Heat

**Daytime Temp Averages**

| ZONE | | Annual Avg | 9 mo School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Very Hot | Miami, FL | 80 | 78 | 85 | 82 | 77 | 73 | 72 | 73 | 76 | 79 | 83 | 85 | 86 | 87 |
| 2 Hot | New Orleans, LA | 73 | 69 | 83 | 75 | 66 | 60 | 57 | 60 | 67 | 74 | 80 | 85 | 87 | 86 |
| 3 Warm | Atlanta, GA | 67 | 61 | 78 | 68 | 58 | 50 | 48 | 51 | 59 | 68 | 75 | 82 | 84 | 84 |
| 4 Mixed | Phillidelpia, PA | 59 | 52 | 73 | 62 | 51 | 40 | 36 | 38 | 47 | 58 | 68 | 77 | 82 | 81 |
| 5 Cool | Chicago, IL | 54 | 46 | 70 | 58 | 44 | 31 | 26 | 30 | 41 | 54 | 65 | 75 | 79 | 77 |
| 6 Cold | Minneapolis, MN | 50 | 41 | 66 | 55 | 37 | 23 | 17 | 23 | 35 | 51 | 64 | 73 | 78 | 76 |
| 7-Very cold | Minot, ND | 45 | 36 | 63 | 51 | 31 | 19 | 11 | 16 | 26 | 47 | 59 | 67 | 75 | 74 |
| 8 SubArctic | Fairbanks, AK | 32 | 21 | 50 | 29 | 8 | -3 | -4 | 3 | 18 | 37 | 55 | 65 | 67 | 62 |
| 8 SubArctic | Cambridge Bay | 9 | -3 | 33 | 14 | -6 | -18 | -24 | -24 | -18 | -2 | 19 | 39 | 51 | 46 |



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ANSI/AARST

MA-MFLB 2023

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

# Multifamily, School, Commercial and Mixed-Use Buildings

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SGM-MFLB 2023

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*Note—ANSI/AARST RMS-MF and RMS-LB consolidated into a single publication*

ANSI/AARST SGM-MFLB 2023

An American National Standard

# Soil Gas Mitigation Standards for existing Multifamily, School, Commercial and Mixed-Use Buildings

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# SGM-MFLB 2023

Soil Gas Mitigation Standards for Existing Multifamily, School, Commercial and Mixed-Use Buildings

## Scope Summary and Introduction

This standard of practice specifies minimum requirements for methods that mitigate risks to occupants posed by the presence of radon gas and chemical vapors or gas in existing multifamily, school, commercial and mixed-use buildings. This standard addresses most all mitigation methods for mitigating radon and other soil gas hazards.

### Updates for 2023

SGM-MFLB is now harmonized for interactive use with ANSI/AARST SGM-SF (Soil Gas Mitigation in Existing Homes).

SGM-MFLB consolidates radon mitigation standard published as ANSI/AARST RMS-MF (rev. 12/20) and ANSI/AARST RMS-LB (rev. 12/20) into a single publication. For clarity when reading, SGM-MFLB provides only:

a) content that is in addition to requirements already rendered in SGM-SF, and

b) content not normally associated with mitigation of homes.

While recommended for immediate use, the effective date for compliance with this standard is December 1st, 2023.

Note 1—These harmonized standards also are rendered in mandatory style where most guidance is not integrated into the body of the standard. This style is necessary to be recognized or adopted by many jurisdictions of authority.

Note 2—Because radon and vapor intrusion mitigation technologies are parallel technologies, provisions that differ are integrated within topics of both SGM-SF and SGM-MFLB are identified as applicable to the topic.

### Significance of Purpose

This document contains minimum requirements and guidance designed to respond to the health threat of radon gas, chemical vapors, and other hazardous soil gases.

**Radon:** Radon is the leading cause of lung cancer among nonsmokers and the second leading cause of lung cancer in the general population. Most people receive their greatest exposure to radon in their homes. Radon in U.S. homes causes approximately 21,000 lung cancer deaths each year.[1] Be it at home, work or school, an individual's exposure to radon gas combines over time to increase the risk of preventable lung cancer.

**Vapor intrusion:** The risk of adverse health effects from inhalation of toxic chemicals in the form of vapor or particulate matter can be significant. The level of concern depends upon the nature, frequency, and duration of exposure to the chemical(s). Where chemicals of concern are present in soils adjoining a building, mitigation methods for chemical vapor concentrations in indoor air are similar.

### Historical Perspective (Radon)

In the 1950s, studies confirmed increased incidence of radon-induced lung cancer for workers in underground mines. In the 1980s, studies found that exposure to radon in homes can exceed exposures found in studies of mine workers. Since 1988, the Indoor Radon Abatement Act has authorized U.S. state and federal activities to reduce citizen risk of lung cancer caused by indoor radon concentrations. Since the early 1990s, USEPA has advised all U.S. schools to test for radon and to reduce levels to below 4 pCi/L[3]. In 1999, with the publication of BEIR VI [1], the National Academy of Sciences confirmed that any exposure to radon holds a degree of risk. In addition, the Academy's BEIR VII committee stated that exposure to radiation, including any concentration of radon, carries risk. In 2009, the World Health Organization's WHO Handbook on Indoor Radon confirmed the association between indoor radon exposure and lung cancer, even at the relatively low radon levels found in residential buildings. [2]

### Normative References

National standards for materials, practices, and building codes are identified in Section 13.3 (Normative References).

### Designation: SGM-MFLB

As used for catalogue identification, "SGM-MFLB" stands for Soil Gas Mitigation in Multifamily and Large Buildings.

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[1] National Academy of Sciences, "Biological Effects of Ionizing Radiation" (BEIR VI Report) 1999

[2] World Health Organization, "WHO Handbook on Indoor Radon: A Public Health Perspective" 2009



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Other ANSI/AARST standards developed to respond to the threat of cancer caused by radon:

| | |
|---|---|
| ANSI/AARST MAH | (Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes) |
| ANSI/AARST MA-MFLB | (Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily, School, Commercial and Mixed-Use Buildings)<br>*Note—Previously published as ANSI/AARST MAMF and MALB and now harmonized and consolidated into a single standard.* |
| ANSI/AARST MW-RN | (Protocol for the Collection, Transfer and Measurement of Radon in Water) |
| ANSI/AARST MS-QA | (Radon Measurement Systems Quality Assurance) |
| ANSI/AARST MS-PC | (Performance Specifications for Instrumentation Systems Designed to Measure Radon Gas in Air) |
| ANSI/AARST CC-1000 | (Soil Gas Control Systems in New Construction of Multifamily, School, Commercial and Mixed-Use Buildings) |
| ANSI/AARST CCAH | (Reducing Radon in New Construction of One & Two Family Dwellings and Townhouses) |
| ANSI/AARST RRNC | (Rough-in of Radon Control Components in New Construction of 1 & 2 Family Dwellings and Townhouses) |

## The Consensus Process

The consensus process developed for the AARST Consortium on National Standards and as accredited to meet essential requirements for American National Standards by the American National Standards Institute (ANSI) has been applied throughout the process of approving this document.

## Continuous Maintenance

This standard is under continuous maintenance by the AARST Consortium on National Standards for which the Executive Stakeholder Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard.

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# Soil Gas Mitigation Standards for Existing Multifamily, School, Commercial and Mixed-Use Buildings

## 1.0 SCOPE

**1.1** This standard of practice specifies minimum requirements for methods that mitigate risks to occupants posed by the presence of radon gas and chemical vapors or gas in existing multifamily, school, commercial and mixed-use buildings. [3]

1.1.1 *Multifamily*

This standard of practice is applicable to a wide range of multifamily buildings including, among others, buildings or structures, or a portion thereof used as townhouses, apartment houses, convents, dormitories, military congregate residences, fraternities and sororities, and boarding houses, hotels, live/work units, monasteries, motels, and vacation timeshare properties.

1.1.2 *Schools and office buildings*

This standard of practice is applicable to a wide range of schools and office buildings including, among others, the use of a building or structure, or a portion thereof for: Business occupancies (Group B ) including for offices, educational and training facilities, professional services or service-type transactions; and Educational occupancies (Group E) including for religious and educational purposes through the 12th grade and day care facilities.

1.1.3 Commercial and mixed-use buildings

The scope of this standard also includes: Assembly occupancies (Group A) including for the gathering of persons for purposes such as civic, social or religious functions; Factory occupancies (Group F) including for fabrication or manufacturing, repair or processing; High-hazard occupancies (Group H); Institutional occupancies (Group I) including for where people are cared for or live in a supervised environment be it under restraint or security, detained in a penal institution, or for medical, surgical, psychiatric, nursing, custodial care or for child care facility purposes; and, Mercantile occupancies (Group M) including for the sale of merchandise, goods, wares or merchandise incidental to such purposes and accessible to the public.

### 1.2 Limitations

*(As replicated in ANSI/AARST SGM-SF)*

1.2.1 *Source materials*

This standard does not address practices associated with characterization, possession, handling, containment, generation, or disposal of radioactive or chemically contaminated materials.

1.2.2 *Mitigation methods*

This standard of practice addresses nearly all methods that reduce occupant exposure to radon or chemical vapors and gas in indoor air. However, it does not specify requirements related to removal or encapsulation of radioactive or chemical sources.

This standard of practice does not specify requirements for practices related to:

a) Removal of radon gas or chemicals from water or outdoor air;
b) Biological or chemical methods that seek to neutralize toxicity of contaminated soil; and
c) Soil Vapor Extraction (SVE), including contaminant capture and disposal methods.

[3] As point of reference, see the International Building Code (IBC) as published by the International Code Council.



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*Informative advisory—Active soil gas depressurization (ASD)* methods prescribed in this standard mitigate occupant risk by preventing soil gas entry into occupied spaces. These designs need only address soil gas volumes that would otherwise intrude into a building. SVE designs that extract volatile organic compounds (VOC) mass from the soil are not inherently designed to mitigate the current risk to occupants unless also demonstrating functional performance as required in Section 9 Post-*mitigation*.

1.2.3 *Combustible gas*

This standard of practice does not address all practices that may be required for *mitigation* of potentially combustible soil gases.

1.2.4 *Jurisdictional compliance*

This standard of practice does not contain all code or other requirements of the jurisdictions where the mitigation system is installed. Adherence to this standard does not guarantee or supersede compliance with the applicable codes or regulations of any federal, provincial, state, or local agency with jurisdiction.

1.2.5 *Safety*

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

1.2.6 *Design and warranties*

This standard of practice is not intended to be used as a complete design manual. Compliance with its provisions will not guarantee reduction of indoor *radon* or soil gas to any specific concentration.

## 2.0 APPLICABILITY

*(As replicated in ANSI/AARST SGM-SF)*

### 2.1 Mandatory Conventions

The terms "shall", "required" and "normative" indicate provisions herein that are mandatory. Terms such as "should," or "recommended" and provisions prefaced by the term "Note" or "Informative" indicate provisions that may be helpful or good practice, but which are not mandatory.

### 2.2 Prior Systems

This standard shall not apply to radon or soil gas mitigation systems installed prior to its effective date, except for:

a) Portions of a previously installed system that are altered. For the purposes of this standard, altering a radon or soil gas *mitigation* system does not include incidental repair, such as replacing worn out fans or equipment with equivalent components, while leaving the remainder of the system unchanged; and

b) Portions of a previously installed system that are not compliant with Section 6.4 (ASD Exhaust Discharge) and Section 6.5.2 (Safe fan locations).

Details of incidental repairs and system alterations shall be documented in jobsite logs for each event.

### 2.3 Use

Where requirements of this standard exceed local, state, provincial or federal requirements for the locale in which the *mitigation* is conducted, minimum requirements in this document shall be followed.



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# 3.0 QUALIFIED CONTRACTORS

## 3.1 Contractors, Teams, and Qualifications

The term *"Contractor"* within this standard shall refer to persons, individuals, or firms, regardless of the organizational structure of the entity, which engage in mitigating occupant risk from *radon* gas or chemical vapors and other soil gases that are present in indoor air.

To be considered qualified, the *contractor*, contracting team, or management team shall include at least one "qualified mitigation professional" as defined by:

a) Section 3.2, where mitigating occupant exposure to radon gas; or

b) Section 3.3, where mitigating occupant exposure to chemical vapors or other soil gases.

## 3.2 Radon Mitigation Professionals

*(Advanced Credential)*

A *"qualified radon mitigation professional"* is defined as:

"An individual who has demonstrated a minimum degree of appropriate technical knowledge and skills specific to design and installation of systems that mitigate occupant exposure to radon gas in existing multifamily, school, commercial and mixed-use buildings as established in listing or certification requirements of:

a) a national program that is compliant with requirements in Section 13.1; and

b) as required by local statute, state or provincial licensure or certification programs that evaluate individuals for radon-specific technical knowledge and skills."

### 3.2.1 *Responsibilities*

Responsibilities for *qualified* ***radon*** *mitigation professionals* shall include compliance with all provisions in this standard except where identified within a provision as specific to only mitigation of chemical vapors or other soil gases.

## 3.3 Soil Gas Mitigation Professionals

*(Advanced Credential)*

A *"qualified soil gas mitigation professional"* is defined as:

"An individual who has demonstrated a minimum degree of appropriate technical knowledge and skills specific to design and installation of systems that mitigate occupant exposure to hazardous chemicals vapors and gas in existing multifamily, school, commercial and mixed-use buildings as established in listing or certification requirements of:

a) a national program that is compliant with requirements in Section 13.1; and

b) as required by local statute, state or provincial licensure or certification programs that evaluate individuals for soil-gas-specific technical knowledge and skills."

### 3.3.1 *Responsibilities*

Responsibilities for *qualified* ***soil-gas*** *mitigation professionals* shall include compliance with all provisions in this standard except where identified within a provision as specific to only mitigation of radon gas.

## 3.4 Quality Management

*Qualified mitigation professionals* shall establish, maintain, and follow a written quality management program that complies with all provisions of Section 3.4 of the most current publication of ANSI/AARST SGM-SF (Soil Gas Mitigation Standards for Existing Homes).

### 3.4.1 *Quality management programs*

### 3.4.2 *Quality control oversight*

### 3.4.3 *Jobsite records*

### 3.4.4 *Managing quality*

*Note—Section headings are provided to help inform or remind that these provisions in SGM-SF contain requirements that apply to this standard.*



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# 4.0 GENERAL PRACTICES

The contractor shall comply with Section 4.0 of ANSI/AARST SGM-SF and as additionally specified herein.

## 4.1 Assemble Building Information

4.1.1 *Insufficient data*

4.1.2 *Diagnostic proposals*

## 4.2 Proposals

4.2.1 *Non-ASD designs*

## 4.3 Notification and Hazards

4.3.1 *Owner occupied—Ventilation*

4.3.2 *Not owner occupied*

Where occupants are not the property owner, action is required in accordance with requirements in a) and b) of this Section 4.3.2.

a) Access Notices

The *contractor* shall request that the *client(s)* provide notices to occupants no less than 24 hours before entering the building and in a manner that meets local statutes and existing agreements between owner or property managers and occupants.

b) Occupant Advisories

The *contractor* shall request in writing that notices to occupants include instructions, warnings, or guidance for specific disruptive or hazardous situations, including:

1. Disruptive Activities
   Whenever disruptive procedures are required to complete building investigations, installations or other work that might include entrance to rooms for drilling into concrete floors and other installation or maintenance needs; and
2. Ventilation
   Whenever application of sealants, caulks, or bonding agents that warrant ventilation of work areas is anticipated. For this situation, the contractor shall request that the client(s) provide notices to occupants that include a general description of the hazardous materials; symptoms that might indicate sensitivity to the materials; actions to take if symptoms are observed; and a local or federal reference where further information can be obtained.

*Note—Section headings are provided to help inform or remind that these provisions in SGM-SF contain requirements that apply to this standard.*

Figure 4.3.2 Example Notice to Occupants (See Exhibits A-1, A-2, A-3, and B)

*"Occupant Advisory: Common construction sealants used to prevent soil gas 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 or persons with disabilities 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. For further information, see: https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality"*



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4.3.3 *Material safety data sheets (SDS)*

Upon request, the *contractor* shall provide *clients* the published safety data sheets for materials used.

## 4.4 Jurisdictional Authorities

*(As replicated in ANSI/AARST SGM-SF)*

4.4.1 *Jurisdictions*

The *contractor* shall comply with all applicable testing, *mitigation* and reporting requirements issued by the federal, provincial, tribal, state, or local jurisdiction that apply to the contract where the *mitigation* is being performed.

4.4.2 *Local jurisdictions (informative)*

Radon—Information to locate State Radon Offices in the United States can be found at https://www.epa.gov/radon/epa-map-radon-zones-and-supplemental-information#datainfo

Vapor Intrusion—Information to locate State Offices in the United States can be found at https://itrcweb.org/membership/state-engagement

4.4.3 *Building codes, licenses, and permits*

All components of the mitigation work shall comply with applicable mechanical, electrical, building, plumbing, energy and fire prevention codes, utility company requirements, and any other regulations of the jurisdiction having authority (JHA) where the work is performed. For localities having no relevant code requirements, the most recent version of nationally published codes shall be observed. Licenses and permits required by the JHA shall be obtained.

# 5.0 SYSTEM DESIGN

System designs shall meet requirements in Section 5.0 of ANSI/AARST SGM-SF and as additionally specified herein.

## 5.1 Appropriate Systems

5.1.1 *General principles*

5.1.2 *Other building systems*

5.1.3 *Permanent systems required*

Mitigation systems shall be designed and installed as an integral, permanent addition to the building.

Time limits on use of temporary mitigation efforts for optimizing system design or methods, including for uncontrollable logistics or rapid response situations, shall comply with Section 13.2.

5.1.4 *Collateral mitigation*

Where a mitigation system impacts or might impact adjoining dwellings or units in a shared building, *contractors* shall:

a) provide disclosures, in accordance with Section 10.6, where a mitigation system might result in *inadvertent collateral mitigation*; and

b) comply with Section 8.7 when designing *intentional collateral mitigation*.

## 5.2 Nondestructive Investigation

An investigation of the common building structure(s) shall be conducted prior to initiating mitigation work. The investigation shall comply with both requirements in the most current publication of ANSI/AARST SGM-SF, Section 5.2 and those additionally require in this Section 5.2.

5.2.1 *Diagrams*

Diagrams or sketches shall be created and retained in jobsite logs that meet requirements of a) and b) of this Section 5.2.1.



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a) Foundation Types and Sizes
A diagram shall be created that portrays the relative size of each building foundation component of the shared foundation system. The diagram shall identify each attached slab-on-grade, basement, and *crawl space* foundation area, including additions to the original building and attached garages

Figure 5.2.1

b) Multiple test locations
Where *radon* or soil gas measurements have been conducted in multiple ground-contact rooms, dwellings or non-residential rooms or units, at least one diagram or sketch shall illustrate available test results and their general location.

5.2.1.1 For large structures, such as a school or large commercial or multifamily building, diagrams and sketches are permitted to be limited to portions of the building to be mitigated.

5.2.1.2 Document Review

*Informative advisory*—The *contractor* should review all available construction drawings, specifications and other information regarding the building that might be of value in determining the *mitigation* strategy. Subject to limitations on what *clients* make available and the extent the *contractor* deems pertinent, the contractor should:

a) Review available radon measurements;
b) Review any information made available by the client regarding known hazards; and
c) Review available specifications, such as:
   1. Foundation specifications;
   2. Heating, cooling and ventilation (HVAC) operational specifications and schedules;
   3. Other mechanical systems such fire protection, electrical service, plumbing and any existing mitigation system for radon or other pollutants; and
   4. Plans, should there be any, for renovations.

### 5.2.2 *Visual inspections*

5.2.2.1 Exterior Visual Inspection

5.2.2.2 Interior Visual Inspection

5.2.2.3 Chemically Contaminated Water

5.2.2.4 Additional Visual Inspections

The visual inspections of the building, including interior, exterior and roof, shall include review for the design of HVAC and other mechanical systems that may influence mitigation system design. Where conditions in Table 5.2.2.4 are observed, jobsite logs shall include notation of components or description of conditions observed that may influence mitigation system design.

| Table 5.2.2.4 | Conditions That May Influence Mitigation Design |
|---|---|
| Exhausts | Exhaust fans capable of causing building depressurization |
| Ventilation With Outdoor Air | Air intakes vents that may enhance ventilation, or observance of a lack of ventilation |
| Air Pressure | Unbalanced air pressure relationships across rooms or unique sectors. |
| Ventilation | Differences in ventilation air across rooms or unique sectors. |



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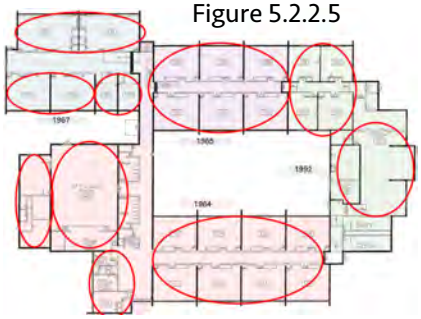
5.2.2.5 Unique Sectors

Where a building contains multiple zones of tempered air, such as buildings with multiple dwellings and non-residential spaces, or resulting from room additions, the following procedure is required to evaluate mitigation design needs for each portion of a building:

Figure 5.2.2.5



a) In each ground-contact area, identify the general design of the HVAC system(s) that are present and classify each of the following areas as a "Unique Sector":
   1. Each ground-contact area of a shared building where the dwellings, non-residential rooms or mixed-use areas are served by individual "Group 1" Basic Heating and Cooling systems, as defined in Table 5.2.2.5; and
   2. Each ground-contact area of a shared building where dwellings, non-residential rooms or mixed-use areas share a central HVAC air handling system. These areas shall be annotated on the diagram(s) or otherwise documented in jobsite logs; and

b) Each unique sector that is served by "Group 3" Variable Outdoor Air Ventilation systems or "Group 4" Variable Air Distribution systems, as defined in Table 5.2.2.5, shall be annotated on the diagram(s) or otherwise documented in jobsite logs.

| Table 5.2.2.5 **Operational Design of HVAC Systems** (as grouped for the purposes of this standard) |
|---|
| **Group 1 Basic Heating and Cooling**<br>A dedicated system for each room or unique area that does not provide seasonally variable outdoor air ventilation.<br>• Forced-air heating and air conditioning (HAC) systems, such as normally seen in single-family residences.<br>• Ductless Systems<br>- Non-forced-air hot and cold water circulation (sometimes called radiator systems).<br>- Window AC (w/fresh air closed).<br>- Wall or baseboard heating/cooling.<br>• Split Systems: Individual heating and cooling systems, such as baseboard heat and window AC for cooling. |
| **Group 2 Multi-Zone Systems**<br>Independent systems with independent controls for different areas within the same room or unique sector. |
| **Group 3 Variable Outdoor Air Ventilation**<br>Systems that seasonally vary outdoor air ventilation for individual rooms, a unique area, or the whole building. Systems include energy economizer systems, heat or energy recovery ventilators and evaporative cooling systems. |
| **Group 4 Variable Air Distribution**<br>Systems where airflow from a single air handler is distributed among multiple rooms with independent thermostat controls in each room or unique area that variably open and close dampers to deliver heated or cooled supply air. |

*Informative advisory*—If it is unclear what type of system is present, consider consulting with the building representative, a mechanical engineer, or a heating and air-conditioning contractor.

Note—See Companion Guidance, Section B and G, for more information on *HVAC* systems.



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5.2.3 *Reporting unexpected conditions*

5.2.4 *HVAC usage evaluations (Informative)*

*Informative advisory*—For more complicated buildings, the *HVAC* design group that serves each unique sector of the building should be documented with either narrative descriptions or annotated on the diagram(s).

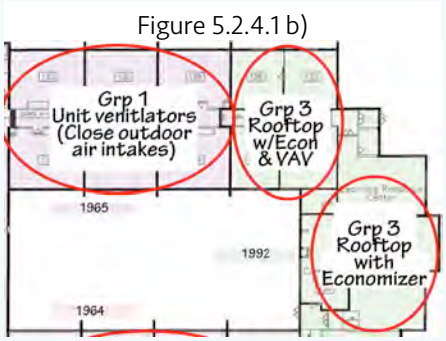
5.2.4.1 HVAC Operations

Note— HVAC operational parameters should be documented with either narrative descriptions or annotated on the diagram(s) to include:

a) HVAC setback schedules in terms of hours each day for each operational mode;
b) Ventilation systems that actively bring outdoor air into the building (as described in Table 5.2.2.5, Group 3) and controls activate these systems.
c) Exhaust systems designed to intentionally cause negative pressure in a unique area of the building (i.e., kitchen, shop, or laboratory areas); and
d) Ventilation airflow measurements and pressure measurements obtained from existing records or as determined by conducting diagnostic procedures.

Figure 5.2.4.1 a)

Figure 5.2.4.1 b)




5.2.4.2 Occupancy Use

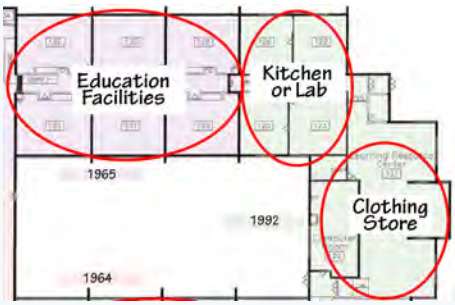
Note—For the purposes of this document:

a) The term "Occupied" is defined as any area of the building that is occupied on a regular basis for more than 4 hours a day;
b) The term "Significantly occupied" is defined as the time period where the building is typically occupied by the majority of the workers or students; and
c) The term "Occupied work or school weeks" are those weeks that do not include vacation days, winter breaks or similar weeks where test conditions do not represent normal occupied conditions.

*Informative advisory*—Diagram(s) or documentation should identify the occupancy use for each unique area and the following details:

a) the number of months per year the building or individual portions of the building are significantly occupied;
b) the hours of the day each individual portion of the building is significantly occupied;
c) other areas where occupants or workers may spend more than 4 hours per day; and
d) areas that are not occupied yet can potentially become occupied.

Figure 5.2.4.2




5.2.4.3 Normal Occupied Operating Conditions

*Informative advisory*—For comparisons required in Section 5.4, for tests and diagnostic testing, see Table 5.2.4.3. Identify testing periods that reasonably represent the normal occupied operating condition for each unique sector of the building. For the purposes of this document, the "Normal Occupied Operating Condition" is defined as: The operational condition for the building or unique sector of the building that exists during the greatest amount of significantly occupied time.



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## Table 5.2.4.3 Identifying Your Local Normal Occupied Operating Conditions

| | Fairbanks | Caribou ME, Quebec, Marquette MI, Duluth MN, Winnipeg, Grand Forks, Anchorage, Breckenridge, Aspen | Portland ME, Buffalo NY, Burlington NH, Milwaukee, Minneapolis, Bismarck ND, Pierre SD, Cheyenne WY, Billings MT, Helena MT | Boston, Albany NY, Pittsburgh PA, Cleveland, Indianapolis, Chicago, Omaha, Denver, Albuquerque, Salt Lake, Reno, NV, Boise, ID | New York, NY, Philadelphia, Richmond, VA, Baltimore, Louisville, Cincinnati, Nashville, Saint Louis, Kansas City, Amarillo TX, Portland, OR, Seattle | Atlanta, Charlotte, SC, Birmingham AL, Jackson, MS, Memphis, Little Rock, Dallas, Austin, Las Vegas, San Francisco, Los Angeles, San Diego | Melbourne, FL, Tampa, FL, Mobile, AL, New Orleans, Houston, Brownsville, Phoenix, Tucson | Miami, FL, Puerto Rico, Virgin Islands, Honolulu, Guam | Certain Asiatic Regions |
|---|---|---|---|---|---|---|---|---|---|
| | **Zone 8 Subarctic** | **Zone 7 Very Cold** | **Zone 6 Cold** | **Zone 5 Cool** | **Zone 4 Mixed** | **Zone 3 Warm** | **Zone 2 Hot** | **Zone 1 Very Hot** | **Acutely Hot** |
| | | | **Annual Average Outdoor Temperatures** | | | | | | |
| *Home & Work** | *Hm* / *Wk* | *Hm* / *Wk* | *Hm* / *Wk* | *Hm* / *Wk* | *Hm* / *Wk* | *Hm* / *Wk* | *Hm* / *Wk* | *Hm* / *Wk* | *Hm* / *Wk* |
| | **27 F** / **32 F** | **39 F** / **45 F** | **45 F** / **50 F** | **49 F** / **54 F** | **55 F** / **59 F** | **62 F** / **67 F** | **69 F** / **73 F** | **76 F** / **80 F** | **83 F** / **86 F** |
| | -3 / 0 C | 4 C / 7 C | 7 C / 10 C | 9 C / 12 C | 13 C / 15 C | 17 C / 19 C | 21 C / 23 C | 24 C / 27 C | 28 C / 30 C |
| % per year | 100 % / 92 % | 83 % / 75 % | 75 % / 66 % | 75 % / 66 % | 66 % / 58 % | 58 % / 42 % | 42 % / 25 % | 50 % / 25 % | 100 % / 100 % |
| Heating | < Freezing / < Freezing | | | | | | | | |
| Cooling | | 25 % | 25 % / 16 % | 25 % / 16 % | 16 % / 25 % | 25 % / 33 % | 16 % / 42 % 42 % | 50 % / 75 % | |
| Neither | 8% | 16 % | 16 % | 16 % | 16 % | | | | |
| **Avg. Low Winter Temps** | **Zone 8** *Dec/Jan/Feb* **-6 F** (-21 C) | **Zone 7** *Dec/Jan/Feb* **2 F** (-17 C) | **Zone 6** *Dec/Jan/Feb* **9 F** (-12 C) | **Zone 5** *Dec/Jan/Feb* **17 F** (-8 C) | **Zone 4** *Dec/Jan/Feb* **26 F** (-3 C) | **Zone 3** *Dec/Jan/Feb* **35 F** (2 C) | **Zone 2** *Dec/Jan/Feb* **45 F** (7 C) | **Zone 1** *Dec/Jan/Feb* **61 F** (16 C) | **Acute** *Dec/Jan/Feb* **76 F** (24 C) |

Climate zone temperatures based 30-year averages published online (e.g., the National Centers for Environmental Information-NOAA) for a major city located within each climate zone. Zone classifications reflect ASHRAE (The American Society of Heating, Refrigerating and Air-Conditioning Engineers) standards 90.1 / 90.2. For additional information, visit www.ashrae.org.



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5.2.5 *Evaluation for design capacity*

Note—For estimating mitigation design needs, compare available test data (e.g., indoor air measurements and diagnostic testing) to:

a) the normal occupied operating condition for each unique sector of the building; and
b) the operating conditions that are most likely to emphasize a clear characterization of a radon hazard.

***Informative advisory***—It is recommended that a written evaluation of testing conditions as compared to significantly occupied conditions be available for proposals, planning, and subsequent to testing. This information will aid evaluation of existing test data relative to capacity needs when designing the mitigation system(s) and for planning post-mitigation testing.

5.2.6 *Investigative actions*

***Informative advisory***—The contractor should take investigative actions if, in the contractor's judgment, the visual inspection cannot sufficiently gauge the relative magnitude of forces that could enhance or inhibit the success of a mitigation system design, to include:

a) Exceptionally strong negative air pressure indoors relative to adjoining soil air, or
b) Severely inadequate ventilation.

Note—Characterization of pressure differences between indoors and outdoors or across rooms, building air exchange rates and airflow volume and pressures induced by air handlers can provide critical diagnostic information in high-rise buildings or buildings with large air handlers.

## 5.3 Diagnostic investigation

5.3.1 *All mitigation methods*

*Diagnostic analysis* shall be conducted prior to final design and installation of *mitigation* systems in multifamily, school, commercial or mixed-use buildings and where the purpose of mitigation includes chemical vapor intrusion.

Where such *mitigation* projects include multiple homes, buildings or portions of buildings that are like structures, provisions in Section 5.3.1.1 are permitted after completing *diagnostic analysis* for a representative sample of each like structure associated with the project.

5.3.1.1 *Like Structures*

Buildings or portions of a building that resemble each other in size, age, building materials, construction practices, surrounding soils and ventilation system design(s) shall be categorized as like structures. For like structures, information gained at one structure regarding the needed air volume rate, vacuum or pressure strength and other vital operational parameter are permitted to be applied to designs in other like structures.

To exercise this option, requirements in a) and b) of this Section 5.3.1.1 shall be met prior to release of the mitigation effort for post-mitigation testing of indoor or soil gas concentrations.

a) Jobsite logs shall include information that supports like conditions exist; and
b) Jobsite logs shall include the results of test procedures that validate like conditions exist, to include:
    1. For *ASD*, post-mitigation *PFE* performance testing in accordance with Section 9; and
    2. For non-*ASD* methods, testing procedures required in Section 12, as applicable to the *mitigation* method.



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5.3.2 *Targeted focus*

The initial target of design and any diagnostic investigations shall prioritize locations that would mitigate occupant exposure to the largest volume of soil gas that is susceptible to migrate into the building.

Exceptions: Where it has been determined that a foundation area is a source of disproportionately more concentrated volumes of radon, chemical vapors, or flammable gas; or where it has been determined that soil gas is not the source of the hazard.

5.3.2.1 Target Limits

It is not required that diagnostic procedures or *mitigation* methods be applied to all *ground-contact* portions of a building. The percentage of area targeted for *mitigation* compared to size the full building footprint shall be recorded in jobsite logs or identifiable in jobsite diagrams. *Diagnostic* characterizations shall not be reported as being homogenous across any other individual foundation or building area unless verified.

Initial diagnostic steps are often to prove or disprove assumptions regarding how the foundation was constructed and, as applicable, answering any other concerns observed during visual investigations.

*Informative advisory*—The contractor should take investigative actions if, in the contractor's judgment, the visual inspection cannot sufficiently gauge the relative magnitude of forces that could enhance or inhibit the success of a mitigation system design, to include:

a) Exceptionally strong negative air pressure indoors relative to adjoining soil air, or

b) Severely inadequate ventilation.

Note—Characterization of pressure differences between indoors and outdoors or across rooms, building air exchange rates and airflow volume and pressures induced by air handlers can provide critical diagnostic information in high-rise buildings or buildings with large air handlers.

5.3.3 *Diagnostic and performance test conditions* *(As replicated in ANSI/AARST SGM-SF)*

Jobsite log records shall include outdoor temperature and the status of heating, cooling, or mixed *HVAC* operating conditions, at the time when conducting diagnostic or performance test measurements. Jobsite logs shall also indicate whether testing was conducted, as is recommended:

a) with all exterior windows and doors, including garage doors, closed; and

b) with normal occupied indoor temperatures of between 65˚and 80˚ F (18˚ - 27˚ C).

5.3.4 *Non-ASD methods*

All non-ASD systems, methods and diagnostic procedures shall comply with Section 12.

5.3.5 *ASD diagnostic PFE analysis* *(As replicated in ANSI/AARST SGM-SF)*

*Diagnostic analysis* shall include evaluations required in a), b) and c) of this Section 5.3.5.

a. *PFE* Distance (Qualitative)

With vacuum applied at the chosen suction point, evidence shall be sought to characterize the distance PFE can be achieved across the targeted soil gas collection plenum(s). The pilot hole or test port locations shall be at locations that will best characterize:

1. The full expanse of the targeted soil gas collection plenum(s); or
2. As an alternative or supplement, other locations where evidence suggests that large volumes of soil gas are susceptible to being drawn into the building by air pressure differences between soil and indoor air.

Where *PFE* is not demonstrated across most of the targeted soil gas collection plenum(s), further investigation is required.



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b. *PFE* Vacuum (Quantitative)
Once goals for PFE distance are met, measurements shall be made to quantify air pressure differences under the slab or membrane relative to indoor air. Jobsite log records shall include the values measured in this effort to characterize vacuum strength needed for ASD design. The measurements shall be made with a micromanometer or equivalent differential pressure gauge that is capable of reading to 1/1000-inch water column (0.25 Pa).

c. Exhaust Air Volume (Quantitative)
Once goals for both PFE distance and vacuum strength are met, the volume of air exhausted to achieve desired PFE, as measured in cfm ($m^3$/min), shall be recorded in jobsite logs. Fans chosen and duct pipe configurations, in accordance with Section 6.3, shall be capable of transporting this volume of air.

5.3.5.1 Exception
Where *PFE* test locations or test ports cannot be created due to building materials that are virtually irreplaceable, such as for historical preservation properties, or due to denied access to locations of interest, a complete *PFE analysis* is not required. To exercise this exception, jobsite log records shall include the reason why and alternative locations or methods used for verifying design effectiveness.

## 5.4 Seasonal Compensation

Jobsite logs shall confirm that a comparison was made between:

a) diagnostic test conditions, as recorded for compliance with Section 5.3.3, and

b) the *normal occupied building operating condition* that prevails during the greatest amount of time each year for local buildings, as illustrated in Table 5.2.4.3 (Identifying Your Local Normal Occupied Operating Conditions).

5.4.1 Vapor intrusion
Because it is not possible to predict worst case conditions based on a single measurement or diagnostic event: Where assessments or indoor measurements indicate chemical vapors or other hazardous gas poses acute or subchronic risks, it shall be recommended to clients that designs address a means consistently monitor if the system is meeting mitigation goals.

## 5.5 Decisions *(informative)*

The following flowcharts illustrate sample procedures for determining the appropriate design choices.



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Figure 5.5-c Example Design Decision Flowchart— ASD

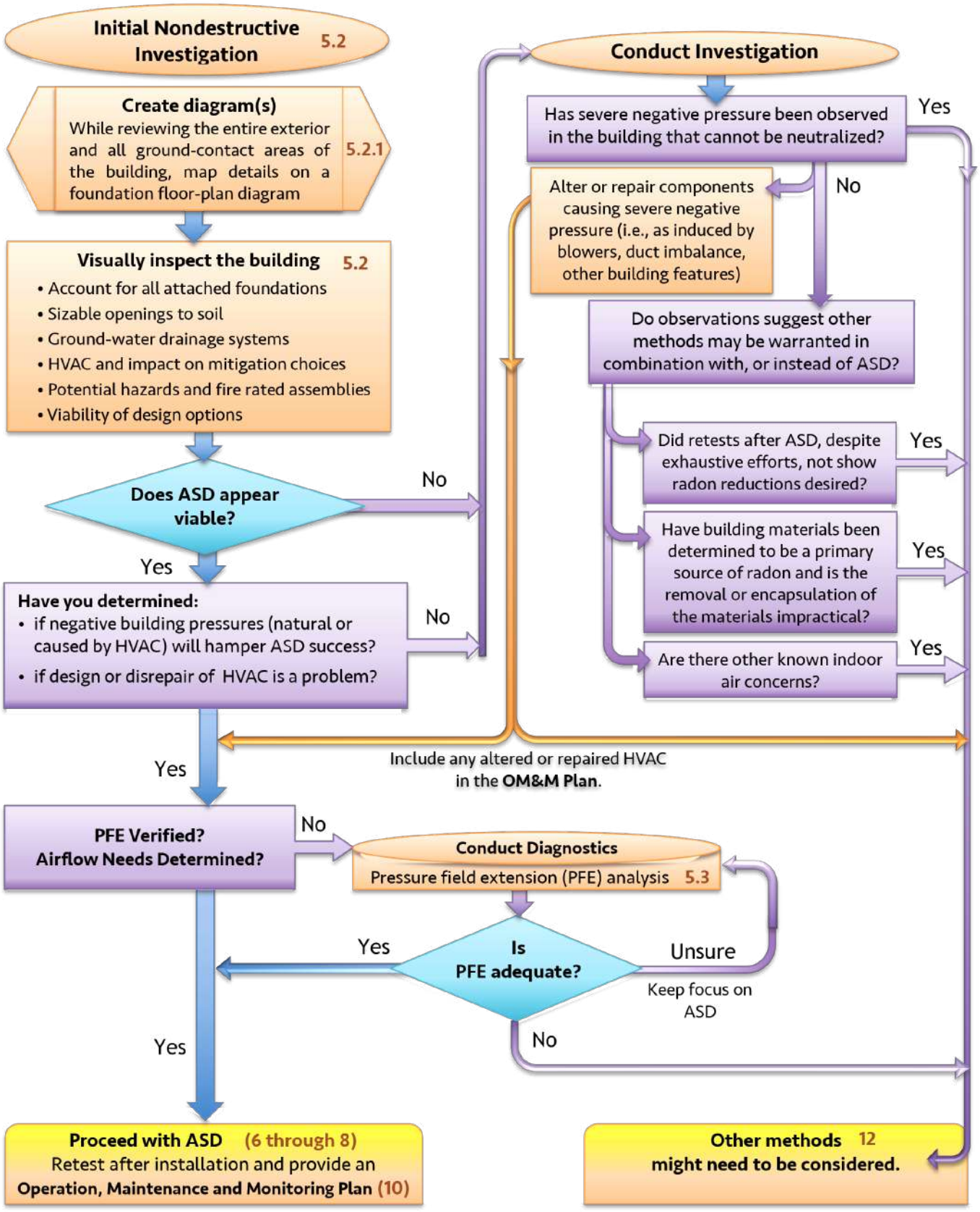




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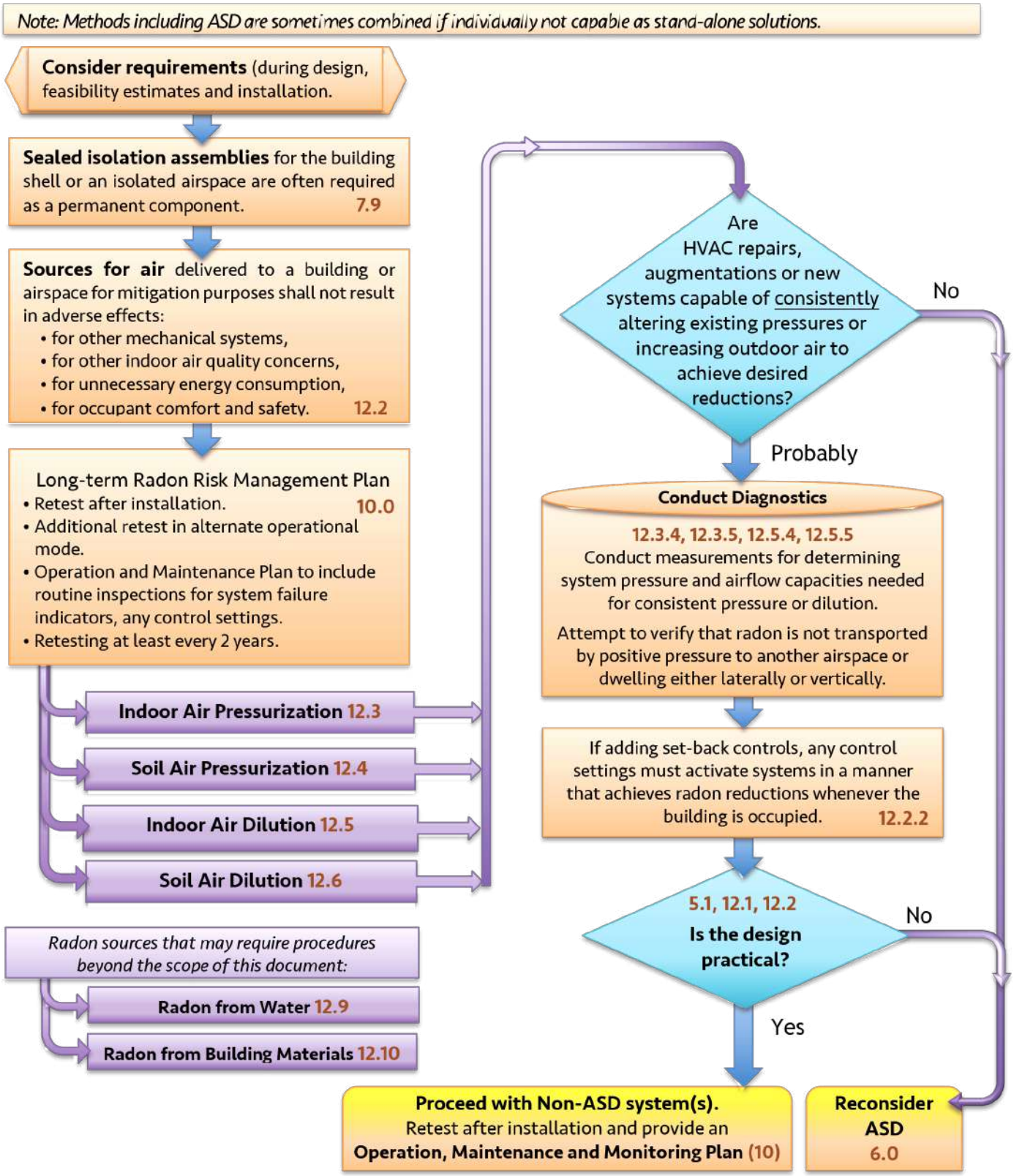
Figure 5.5-d Example Design Decision Flowchart— Non-ASD Methods



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## 6.0 ACTIVE SOIL DEPRESSURIZATION (ASD)

ASD systems shall comply with all requirements in Section 6 of ANSI/AARST SGM-SF and as additionally specified herein.

### 6.1 ASD Suction Points

6.1.1 *Suction pits*
6.1.2 *Sumps*
6.1.3 *Sub-membrane suction points*
6.1.4 *Non-habitable air spaces*
6.1.5 *Block walls*

### 6.2 ASD Piping

6.2.1 *Air and water-tight*
6.2.2 *Slope required*
6.2.3 *Positively-pressurized pipe*
6.2.4 *Labels required (duct piping)*
6.2.5 *ASD pipe materials*
6.2.6 *Flexible couplings*
6.2.7 *Secure duct piping*
6.2.8 *Provide access clearance*
6.2.9 *Protect ducts from the elements (insulation)*
6.2.10 *Observe codes*

### 6.3 ASD Pipe Sizing

6.3.1 *Minimum inside diameter*
6.3.2 *When larger air volume needs are indicated*
6.3.3 *When smaller air volume needs are verified*
6.3.4 *Equivalent cross-sectional area*
6.3.5 *Maintain whole-system air volume capacity*
6.3.6 *Multiple suction points*
6.3.7 *Sizing for gutter downspout duct materials*
6.3.8 *Air velocities (informative)*

### 6.4 ASD Exhaust Discharge

6.4.1 *General*
6.4.2 *Outdoors*
6.4.3 *Directional spread (restrictions)*
6.4.4 *Straight-line trajectory (restrictions)*
6.4.5 *Elevation above grade*
6.4.6 *Separation from operable openings*
6.4.7 *Separation from people*
6.4.8 *Equipment wells and parapet roofs*
6.4.9 *Angled trajectories*
6.4.10 *Roof*
6.4.11 *Below the roof*
6.4.12 *Horizontal trajectory*

---

6.4.13 *Increased distances for large capacity systems*

When the ASD system is designed for larger airflow capacities with duct piping larger than 4-inch (100-mm), distances shall be increased beyond what is required in Section 6.4 to comply with Table 6.4.13.

**Table 6.4.13**

| Pipe ID<br>*As in Section 6.4*<br>*3"- 4" Pipe (10 cm)* | Distance Away<br>*Directional spread*<br>*As in Section 6.4.3*<br>*10 ft (3 m)* | Distance Away<br>*Straight-line*<br>*As in Section 6.4.4*<br>*20 ft (6 m)* | Distance Above, Below or To Side<br>*Grade, Operable Openings and People*<br>*Sections 6.4.5, 6.4.6 , 6.4.7, 6.4.10, 6.4.11 and 6.12* |
|---|---|---|---|
| **For Larger Pipe ID** | **Increase to** | **Increase to** | **Increase distances by another:** |
| 6" (15 cm) | 12 ft (3.6 m) | 25 ft (7.6 m) | 2 ft (1.8 m) |
| 8" (20 cm) | 18 ft (5.5 m) | 30 ft (9 m) | 4 ft (2.4 m) |
| 10" (25 cm) | 20 ft (6 m) | 40 ft (12 m) | 6 ft (1.8 m) |
| For pipe larger than 10" (25 cm) | Shall be increased to meet or exceed ASHRAE 62.1, Appendix B (Separation of Exhaust Outlets and Outdoor Air Intakes) | | |

### 6.5 ASD Fan Installation

6.5.1 *Fan design*
6.5.2 *Safe locations required*
6.5.3 *Approved locations*
6.5.4 *Fan Installation*



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## 7.0 SEALING

Closure between soil air and indoor or outdoor air shall comply with all requirements in Section 7 of ANSI/AARST SGM-SF.

### 7.1 Background and Accessibility
7.1.1 *Accessibility to cracks and openings*

### 7.2 Sealant Materials
7.2.1 *Caulking cracks*
7.2.2 *For larger gaps*
7.2.3 *For larger openings*
7.2.4 *For heated pipes and flues*
7.2.5 *For sump lids and hatchway doors*
7.2.6 *Vapor Intrusion sealants*

### 7.3 Accessible Slab Cracks
7.3.1 *Perimeter channel drains*

### 7.4 Other Openings to Soil
7.4.1 *Block walls*
7.4.2 *Basement de-watering systems*

### 7.5 Sumps and Pits
7.5.1 *Sump cover specifications*
7.5.3 *Sump pump water discharge*
7.5.4 *Chemically contaminated water*
7.5.5 *Surface water relief (slabs)*

### 7.6 Membranes Over Exposed Soil
7.6.1 *Vapor intrusion (membranes general)*
7.6.2 *Seams (membranes general)*
7.6.3 *Repairs*
7.6.4 *Label membranes or access ports*
7.6.5 *Surface water relief (membranes)*

### 7.7 Sub-Membrane Depressurization (SMD)
7.7.1 *SMD—Seams*
7.7.2 *SMD—Pipe penetrations*
7.7.3 *SMD—Securing the membrane*
7.7.4 *SMD—Sealing the membrane perimeter*

### 7.8 Drains
7.8.1 *Drains to soil (Informative)*
7.8.2 *Utility drains to soil*
7.8.3 *Drains to daylight (informative)*

### 7.9 Sealed Isolation Assemblies
7.9.1 *Sealing (isolation assemblies)*
7.9.2 *Labeling required (isolation assemblies)*

## 8.0 FOR ALL SYSTEMS AND METHODS

All systems and methods shall comply with requirements in Section 8 of ANSI/AARST SGM-SF and as additionally specified herein.

### 8.1 Long-Term Plan for OM&M

### 8.2 System Monitors
8.2.1 *Viewable operating range monitors*
8.2.2 *Active notification monitors*
8.2.3 *Required for all system monitors*

### 8.3 Electrical
8.3.1 *Disconnect required*
8.3.2 *Labels required (disconnects)*
8.3.3 *Protection from shock*
8.3.4 *Not allowed*

### 8.4 Labeling
8.4.1 *Label materials and lettering*
8.4.2 *Primary labels*
8.4.2.1 Owner-Occupied Maintenance
8.4.2.2 Independent Maintenance
8.4.3 *System equipment*
8.4.4 *Label duct piping*
8.4.5 *Label electrical disconnects*
8.4.6 *Label sealed components*

### 8.5 Inspection for Compliance
8.5.1 *Limitations of professional obligations*
8.5.2 *Review with clients*

### 8.6 Retention of Records



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## 8.7 Intentional Collateral Mitigation

8.7.1 *Electrical (collateral mitigation)*

When a single mitigation system is intentionally designed to satisfy mitigation needs in more than one unit, dwelling or area within a shared building, power provided to the system shall be from a source that is electrically metered independent from individual units unless the meter is common to all units or dwellings.

**Exception:** In the absence of a common or independently metered power source for the system, requirements within one of the options a), b) or c) of this Section 8.7.1 shall be met.

a) For ASD or non-ASD methods that manipulate air pressures between soil air and ground-contact portions of the building, a stand-alone mitigation system shall be installed in each ground-contact unit or dwelling determined to require mitigation that is independently electrically metered; or

b) For non-ASD methods that are not dependent upon manipulating air pressures between soil air and ground-contact portions of the building, a stand-alone mitigation system shall be installed in each unit or dwelling determined to require mitigation that is independently electrically metered; or

c) Prior to installation the contractor shall:

1. Provide the client a written notice that includes the system's annual electrical costs (specifically calculated for each system based upon current local rates) and the following statement:

> "During future renovations, sales or vacancy of individual dwellings, the health and safety provided to occupants by the mitigation system may cease to exist without the occupant's knowledge. It is incumbent upon the client to inform the building owner(s) of their obligation in this regard for ensuring long-term operation and maintenance for the system and full disclosure of this possibility to future owners."; and

2. Receive written communications to be included with OM&M documentation that includes:
   a. A statement from the client that provides the client's justification for why it is truly not viable to achieve independent or common electrical metering or multiple stand-alone systems); and
   b. A statement from the owner of the dwelling(s) or unit(s) that indicates:
      (1) Acknowledgment of the electrical cost information provided by the contractor;
      (2) Acceptance of obligations for long-term operation and maintenance of the system(s);
      (3) Agreement with the client's justification; and
      (4) Permission to proceed with the installation.

8.7.2 System monitors (collateral mitigation)

In accordance with Section 8.2 for system monitoring, one of the following options is required:

a) Fan monitors are installed in each ground-contact area divided for separate occupancy use that is served by this system for ASD or non-ASD methods that manipulate air pressures between soil air and ground-contact portions of the building; or

b) Fan monitors are installed in each area divided for separate occupancy use that is served by this system for non-ASD methods that are not dependent upon manipulating air pressures between soil air and ground-contact portions of the building; or

c) A program is instituted for routine inspection onsite or by remote telemetric management system regardless of monitor locations and in accordance with Section 10.5 (OM&M Manuals); or

d) A fan monitor is installed in a location that is accessible and visible or audible for occupants of the building.



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# 9.0 POST-MITIGATION

Upon completion of the mitigation effort, as installed or augmented, the contractor shall comply with:

a) requirements in Sections 8.5 (Inspection for Compliance), 9.1.1, 9.1.2 and 9.1.3 of ANSI/AARST SGM-SF; and

b) as additionally specified herein.

## 9.1 Functional Evaluations

9.1.1 *General*

9.1.2 Non-*ASD mitigation methods*

9.1.3 *ASD systems*

9.1.4 *Vapor intrusion and ASD*

9.1.4.1 Vapor Intrusion Test Ports (SGM-MFLB)

For *ASD* systems intended to mitigate chemical vapor intrusion (VI), test ports for future *PFE* and soil gas sampling shall be created and configured to result in permanent test ports that are prominently documented in the *OM&M* manual. The test ports shall comply with a) and b) of this Section 9.1.4.1.

a) Physical properties

The test ports shall be:

1. accessible for future measurements without disassembly of building components or finishes;
2. installed to not present hazards such as tripping hazards to occupants;
3. installed after removing a portion of aggregate, packed fill or expansive soils that can often exist under a test port;
4. installed to retain functionality over time, such as by implementing hardware to allow easy access and closure of the test port in the future; and
5. sealed in a permanent, airtight manner at the opening between test port hardware and penetrations of a slab or soil gas retarder with a configuration that durably secures the test port in place.

b) Test port locations

Strategic locations of test ports shall include the following locations:

1. Test port locations remotely distant from the exhaust vent pipe transition to below the slab or soil gas retarder that are sufficient in number to:
   a. evaluate effectiveness of soil gas transport across the major expanse of the slab or membrane; and
   b. evaluate consistency of soil gas transport across soil gas collection plenums that are joined to a shared exhaust vent pipe.
2. Not less than one test port for each outer quadrant area of the building while also achieving one test port for each *ASD* or soil gas vent system and each soil gas collection plenum joined to a single *ASD* or soil gas vent system; and
3. For larger expanses, not less than one test port for each outer quadrant area of soil gas collection plenums that are 8,000 sq. ft. (744 $m^2$) or larger while also achieving one test port for each additional 8,000 sq. ft. (744 $m^2$) area.

Exception: Where there are no openings or utility penetrations through the slab or soil gas retarder, test ports are not required for plenum areas that are less than 64 square feet (6 $m^2$), or collectively represent less than 10% of any 4,500 square foot (418 $m^2$) area.



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## 9.2 Radon Test After Mitigation (SGM-MFLB)

For radon mitigation, post-mitigation testing shall comply with requirements in Sections 9.2.1 through 9.2.5 of this Section 9.2.

9.2.1 *Contractor obligations*

Where system maintenance and monitoring are the responsibility of someone other than the occupant, the *qualified mitigation professional* cannot be obligated to ensure that post-*mitigation* testing is conducted because the logistics are beyond their control.

9.2.2 *Testing protocol*

All testing shall be conducted in accordance with requirements of the state or equivalent local authority where the measurement is being performed and in accordance with the most current publication of the ANSI/AARST MA-MFLB (Protocol for Conducting Measurements of Radon and Radon Decay Products In Multifamily, School, Commercial and Mixed-Use Buildings).

9.2.3 *Additional tests*

As applicable when exhausts are located below the roof or when non-*ASD mitigation* methods include mechanically induced pressurization or dilution, testing specific locations for diagnostic purposes or no later than the initial retests after mitigation is required in accordance with:

a) Section 6.4.11 c (*ASD* exhaust—Below the roof), and
b) Section 12.3.5 (Non-*ASD*—Unintentional soil gas transport).

9.2.4 *Testing devices*

Radon test devices employed shall be listed as approved by a national authority, such as the National Radon Proficiency Program (NRPP), the National Radon Safety Board (NRSB) or a program that verifies compliance with the most current version of ANSI/AARST MS-PC; or as required by local statutes for jurisdictions that have a program for evaluating and approving devices.

Note—Identification of two existing certification bodies is not an endorsement of either program.

9.2.5 *Testing professionals*

Except where testing is conducted by owners of an individually owned and occupied dwelling or unit, testing shall be conducted by a Qualified Measurement Professional—Multifamily and Commercial as identified in Section 13.1.

## 9.3 Testing for *Chemicals of Concern*

Due to various considerations, *qualified soil gas mitigation professionals* are not required under this standard to ensure post-*mitigation* measurements of hazardous chemical vapors or other substances are conducted.



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# 10.0 DOCUMENTATION—ALL SYSTEMS AND METHODS

## 10.1 Long-Term Plan for OM&M Required

A long-term plan for OM&M is required for all mitigation systems and methods applied. The plan for OM&M shall be provided in an information packet, in accordance with Section 10.2, or in an OM&M manual, in accordance with Sections 10.5.

## 10.2 Owner-Occupied Maintenance

The contractor shall provide an information package that contains a plan for OM&M that includes essentials for ASD systems installed where the dwelling or unit is both individually owned and occupied by the person(s) responsible for OM&M. The means of providing the information package and its contents shall comply with requirements in Section 10.2 of the most current publication of ANSI/AARST SGM-SF.

## 10.3 Non-ASD Systems

Regardless of whether the owner or an independent party is responsible for maintenance, an *OM&M* manual compliant with Section 10.5 shall be provided where non-*ASD mitigation* designs are employed.

## 10.4 Independent Maintenance

Where maintenance and monitoring of *mitigation* components are the responsibility of someone other than the occupants, the *contractor* shall provide the client a written *OM&M* manual after mitigation that complies with all provisions of Section 10.5.

## 10.5 OM&M Manuals

OM&M manuals shall include all content required in Section 10.2 of ANSI/AARST SGM-SF for owner-occupied information packages. The OM&M manual shall also comply with all portions of this Section 10.5.

### 10.5.1 *Stewardship/Monitoring*

*OM&M* manuals shall recommend post-*mitigation* testing and provide instructions regarding long-term stewardship of *mitigation* systems, to include requirements in a), b), c) and d) of this Section 10.5.1.

a) Stewardship Statement

The *OM&M* manual shall prominently provide the following or equivalent message:

> *"Stewardship Required.*
> *It is incumbent upon property owners and managers to maintain and monitor system effectiveness for the life of the building. Current and future occupants or purchasers of the property should be able to verify by documentation that the minimum requirements of an operation, maintenance, and monitoring plan (OM&M) have been maintained. Essential requirements for long-term risk management are satisfied when building owners and managers comply with this OM&M manual."*

b) Ownership/Management Changes

The *OM&M* manual shall instruct that:

1. Whenever the party responsible for system maintenance and monitoring changes to another party who is not the owner-occupant of the property:
   a. The *OM&M* manual and logs are to be provided to the newly responsible party, and
   b. Newly *responsible parties* are to update contact information on system labels; and
2. Whenever the responsibility for mitigation maintenance and monitoring changes from an independent party to an owner-occupant, the system is to be relabeled to comply with Section 8.4.2.1 and an updated *OM&M* manual is to be provided to the owner(s).



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c) Radon Measurement/Inspections

Where a *radon mitigation* system is installed or found in a building at the property, *OM&M* procedures provided in the *OM&M* manual shall include all the following:

1. Quarterly inspection to verify operation of fans and other mechanical components;
2. Testing all buildings at the property at least every 5 years. All radon measurements shall be conducted in compliance with ANSI/AARST MALB-MF. The clearance test procedure required includes testing all ground-contact dwellings and non-residential rooms that are occupied or intended to be occupied; not less than 10% of dwellings and non-residential rooms on each upper floor; and any mitigated areas on upper floors.
3. After post-mitigation clearance testing and in between 5-year clearance test events, test all previously tested locations for mitigated areas at nominally 2-year intervals, to ensure continued effectiveness.

   It is permitted to suspend testing at 2-year intervals where the required effectiveness of a mitigation system has consistently demonstrated for a period of not less than eight years, and such systems are:

   a. inspected quarterly to verify fan operation,
   b. inspected biennially for mechanical equipment performance and integrity, and
   c. all buildings at the property and mitigated areas are retested every 5 years.
4. Each of these stewardship testing events to include mechanical inspections conducted by a qualified professional to verify continued performance of equipment.
5. The following or equivalent instructions:

   "Testing to verify continued effectiveness is to be conducted in conjunction with any sale of a building and after any of the following events occur:

   - ✓ New adjoining additions, structures or parking lots;
   - ✓ Building reconfiguration or rehabilitation;
   - ✓ A ground contact area not previously tested is occupied or a building is newly occupied;
   - ✓ Heating or cooling systems are altered with changes to air distribution or pressure relationships;
   - ✓ Ventilation is altered by extensive weatherization efforts;
   - ✓ Sizable openings to soil occur due to:
     - — groundwater or slab surface water control systems or sewer lines are added or altered (e.g., sumps, drain tiles, shower/tub retrofits, etc.) or
     - — natural settlement causing major cracks to develop;
   - ✓ Earthquakes, blasting, fracking, or formation of sink holes nearby; or
   - ✓ An installed mitigation system is altered.

d) Chemical Vapor or Gas Measurements

Where systems are known to mitigate hazardous concentrations of chemical vapor or other hazardous soil gas, the *OM&M* manual shall instruct that stewardship obligations require a routine schedule of ongoing chemical vapor or gas measurements. While guidance is to be provided in the contractor's *OM&M* manual, a client's overseeing team will normally review, amend and integrate opinions of qualified environmental professionals into a final plan for *OM&M*.



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10.5.2 *Historical information*

The OM&M manual shall include a summary of the pre-and post-mitigation investigation(s) and if available, pre-, and post-mitigation test data.

10.5.3 *System components*

The *OM&M* manual shall provide detailed operating instructions and information on essential *mitigation* equipment and components, to include:

a) Manufacturer model numbers for fans and essential equipment;

b) Instructions on equipment and manufacturer instructions where applicable to operation and maintenance;

c Locations of fans, fan monitors, electronic telemetry/monitoring equipment, permanent test ports, electrical disconnects and other components unique to the system;

d) Descriptions on how to interpret labels and annotations relative to control settings and other designed operating parameters for the equipment; and

e) A list of common maintenance and repair tasks associated with the system, such as:

1. Fan and fan monitor replacement or repair;
2. Duct pipe connections; and
3. Sealing and closure of openings between soil and indoor air.

10.5.4 *Maintenance inspection checklists*

OM&M manuals shall provide instructions regarding maintenance inspections, in accordance with requirements a), b) and c) of this Section 10.5.4.

a) Visual Operational Inspection Checklist

The OM&M manual shall define a list of items that are to be visually inspected on a frequent basis to verify continued operation of fans and other mechanical components, such as system monitors, controls, labels, vents, and filters.

b) Mechanical Inspection Checklist

The *OM&M* manual shall define a list of equipment to inspect when conducting mechanical performance inspections that include:

1. Performance indicators, labels and fan operation;
2. Seals, straps, fasteners, fan boots, pipe connections, and any permanent PFE test ports;
3. Electrical components (including switch, GFCI or disconnect operation); and
4. Other related building systems, as applicable, such as sump pumps and combustion appliances.

c) Vapor Intrusion

Where the mitigation purpose includes mitigation of chemical vapor intrusion, the mechanical inspection shall additionally include recorded measurements of pressure field extension and, as measured within main trunk duct piping, whole system vacuum strength and air volume exhausted.

10.5.5 *Repairs*

The *OM&M* manual shall include instructions that stewardship obligations require correction and repair of any conditions that are found to indicate component failure or inconsistencies in operating parameters.

10.5.6 *Retention of OM&M records*

The *OM&M* manual shall include instructions that all maintenance logs, records of repairs and measurement reports for radon and soil gas concentrations be retained and assimilated into the OM&M manual.



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## 10.6 Inadvertent Collateral Mitigation

*(As replicated in ANSI/AARST SGM-SF)*

Where mitigation is not conducted in all attached units or dwellings in a shared building, both the following, or equivalent, statement and example notice in Figure 10.6 shall be prominently included with information packets and *OM&M* manuals to inform the client of inherent obligations to neighboring occupants:

> *"There are inherent obligations to occupants of adjoining dwellings regarding disclosure of elevated radon concentrations found and potential effects on adjoining dwellings as a result of the mitigation system.*
>
> *In accordance with the ANSI/AARST standards, mitigation firms are obligated to advise the client of inherent obligations to neighboring occupants.*
>
> *It is strongly recommended to distribute the following message in writing to occupants of adjoining dwellings and, if applicable, to the homeowner's association or management firm that provides stewardship for neighboring properties."*

Figure 10.6 Example Notice to Neighboring Property Owners and Occupants

From: _____

Elevated radon concentrations were found at (addresses): _____

A mitigation system [ ] has been installed, or [ ] is planned to be installed.

In the interest of health protection, we have been advised to provide you the following messages:

1) Test for radon — it's easy and inexpensive. Any building on any parcel of land can have a radon problem.
2) The radon reduction system installed or planned for installation in our unit can inadvertently move air and extend a vacuum under some adjoining units or dwellings with the intent to stop radon entry into your dwelling. It is recommended that occupants of adjoining units:
   a) Seek to maximize radon reductions and energy conservation by closing openings to soil (e.g., closed covers over sumps and large holes).
   b) Check for any adverse impacts such as flue gas spillage from combustion appliances.
3) We cannot warrant any degree of radon reductions, nor can we be responsible for maintaining radon reductions, maximizing energy conservation, or checking for unlikely yet possible environmental impacts for adjoining units. For additional guidance, it is recommended to contact the state or local radon office. Sources in the U.S. include the national radon hotline at 1-800-SOS-RADON (1-800-767-7236) and state radon offices that can be found at: https://www.epa.gov/radon/epa-map-radon-zones-and-supplemental-information#datainfo



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## 11.0 HEALTH AND SAFETY

The *contractor* shall establish, maintain, and follow a written safety management program. The program shall comply with requirements in Section 11 of ANSI/AARST SGM-SF.

### 11.1 Safety Management Program

11.1.1 *Resources*

### 11.2 Safety Training

11.2.1 *Worker training*

11.2.2 *Oversight training*

### 11.3 Hazardous Building Conditions

11.3.1 *Asbestos*

11.3.2 *Lead-based paint*

11.3.3 *Flue gas spillage*

11.3.4 *General hazards*

*Informative advisory*—As more applicable prior to conducting work in large buildings, request that the client provide information regarding all known safety hazards for the building and adjacent or nearby buildings that might be related to design and installation of the mitigation systems.

*Note—Section headings are provided to help inform or remind that these provisions in SGM-SF contain requirements that apply to this standard.*

### 11.4 Radon Mitigation

11.4.1 *Jobsite worker exposure to radon*

11.4.2 *Radon exposure limits*

### 11.5 Chemical Vapor Mitigation

11.5.1 *Chemical vapor Intrusion (VI)*

11.5.3 *Safety oversight*

11.5.3.1 Jobsite hazards

11.5.3.2 OSHA Requirements



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# 12.0 NON-*ASD* MITIGATION METHODS

## 12.1 General

12.1.1 *Design and documentation*

Non-destructive and diagnostic investigations shall be conducted prior to installation, in accordance with Sections 5.2 (Nondestructive Investigations), 5.3 (Diagnostic investigations) and as required in this Section 12. Each method applied shall conform with all requirements of Section 8 (All Systems) and Section 10 (Documentation).

12.1.2 *Combination of methods/systems*

Where multiple methods are employed or inadvertently result from installation, the OM&M manual required in Section 10.5 shall provide a plan for OM&M regarding each resulting mitigation method.

> Note—Examples include *ASD* plus indoor air dilution or pressurization; or soil gas dilution induced by an *ASD* fan due to sizable crawl space openings to outdoors or sizable unsealed edges of a *SMD* membrane.

12.1.3 *HVAC repairs or modifications*

Where an incidental failure or condition of an HVAC component is suspected of causing radon or soil gas entry and it can be repaired in a permanent fashion, diagnostic performance testing or indoor radon or soil gas concentrations after the repair are required for verifying of mitigation effectiveness. Where mitigation resulted from a repair, an OM&M manual in accordance with Section 10.5 is required.

12.1.4 *Proposals*

Prior to installation, the client shall be provided an estimate of total ownership costs for: Indoor Air Pressurization (Section 12.3), Indoor Air Dilution (Section 12.5) and Soil Air Dilution (Section 12.6) mitigation systems. Total ownership costs shall include installation costs and the annual operating costs with observance that costs for energy, replacement and repair items, labor, and testing may change in the future.

12.1.5 *Plans for OM&M*

Where the mitigation method includes filters, exterior intake and exhaust vents, duct balance, controls, or other items that need to be monitored to maintain mitigation goals, the plan for OM&M shall prominently list them and provide instructions for routine inspections and maintenance.

12.1.6 *Verifying effectiveness*

Where mitigation methods are based on mechanical dilution or pressurization of indoor air, or rely on passive methods, two post-mitigation clearance tests are required to verify seasonal effectiveness. Where the option to conduct seasonal testing is beyond the control of the contractor, the plan for OM&M shall identify the mitigation method and related requirements that include:

a. One clearance test conducted under conditions that are representative of the predominant normal occupied building operating condition, such as heating season conditions, and
b. Another clearance test conducted under cooling season conditions, or the alternate seasonal condition of longest annual duration.

## 12.2 Sources for Air Delivered to a Building

When air is actively or passively used to pressurize an airspace or dilute hazardous concentrations within an airspace, the source of air and design configurations shall comply with all requirements of this Section 12.2.

12.2.1 ***Capacity** (sources of air)*

System installations shall result in a configuration with capacity to continuously provide no less than 10% more than the minimum rate of air volume, measured in cfm ($m^3$/min), needed to achieve mitigation goals.



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12.2.2 *Controls for variable activation*

Controls for mechanical equipment that pressurize or dilute indoor or soil air shall be configured and verified to achieve mitigation goals whenever each portion of the building is occupied.

12.2.3 *Air intake and distribution vents*

Air intake and distribution vents shall comply with requirements a), b) and c) of this Section 12.2.3.

a) Vent Blockage
Vents shall be in locations unlikely to be inadvertently blocked by stored or standing items and natural obstructions such as snow or foliage.

b) Vent Protection
Vents shall be protected at both internal and external locations with vent covers, wire mesh or screening to prevent blockage from debris, entry of animals or injury to occupants.

c) Duct Balance
Contractors shall verify that the balance of incoming and outgoing airflow does not increase negative pressure within portions of the building targeted for mitigation that are in contact with the soil.

12.2.4 *Adverse effects*

Sources for air delivered to an airspace shall comply with requirements in a) and b) of this Section 12.2.4.

a) For indoor air sources
Intake vent locations within a building shall not result in adversely affecting other building systems and occupant safety, such as the inducement of flue gas spillage from atmospherically vented combustion appliances or distribution of known airborne contaminants.

b) For outdoor air sources
System design shall not result in adverse effects on occupant comfort relative to temperature and humidity, and adverse effects on building components, such as formation of condensation on indoor wall, floor and ceiling surfaces or ice on exterior building components. Intake vents shall be in locations where airborne pollutants, such as from vehicle emissions, trash containers and combustion appliances, are distant enough from the intake to not enter the building.

12.2.4.1 Unnecessary Energy Consumption

The volume of outside air delivered into a building shall be compared to current energy codes to evaluate the practicality of the mitigation method.

Note—Current energy codes for new construction[4] seek to limit the air change rate per hour (ACH) to:

a) For residential buildings, ≤ 5 ACH in climate zones 0, 1 and 2, and ≤ 3 ACH in climate zones 3 through 8, as measured at a pressure differential of 0.2-inch water gauge (50 Pa)[5], or 0.30 cfm/ft$^2$ (1.5 L/s m$^2$).

b) For non-residential buildings, 0.40 cfm/ft$^2$ (2.0 L/s m$^2$) of the building thermal envelope area as measured at a pressure differential of 0.3-inch water gauge (75 Pa)[6].

12.2.5 *Outdoor air ventilation systems*

Systems that introduce outdoor air into a building shall meet requirements in a) and b) of this Section 12.2.5.

[4] The International Energy Conservation Code (as published by the International Code Council)

[5] Testing conducted in accordance with ANSI/RESNET/ICC 380, ASTM E779 or ASTM E1827

[6] Testing conducted in accordance with ASTM E2357, ASTM E1677, ASTM D8052 or ASTM E283



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Note—Any of these systems may require control adjustments or modification to always deliver a minimum degree of outside air into a building.

- Economizer systems typically deliver untempered outdoor air into a building to reduce the cost of cooling a building. Controls are often set to automatically activate dampers to adjusting incoming volumes of outdoor air when outdoor air is cooler than indoor air.
- HRV units use the heat of indoor air exhausted to consistently preheat incoming outdoor air.
- ERV units, similar to HRV, have sensors and controls to automatically activate dampers.

a) Exhaust and Supply Ports
For heat recovery ventilator (HRV) and energy recovery ventilator (ERV) installations, distances specified indoor in Table 12.2.5 are required between indoor supply and inlet vents and outdoor exhaust compared to both active intake vents and passive ventilation openings into the building, such as operable windows.

Table 12.2.5 Exhaust and Supply Port Minimum Distances*

| Air volume rate of discharge from indoor supply or outdoor exhaust vents | Directional spread ** distance away from intake | Straight-line trajectory *** distance away from intake | Physical port distance between: 1) indoor supply and inlet vents, and 2) outdoor exhaust compared to inlet vents and other ventilation openings into indoor air | |
|---|---|---|---|---|
| ≤ 150 cfm (4 $m^3$/min) | 8 ft (3 m) | 12 ft (3 m) | ≥ 6 ft (3 m) for ≤ 6 inch (15 cm) diameter ducted systems | Indoor supply and inlet vents are permitted to be closer where, relative to room size(s), dilution goals are met. Exterior exhaust and inlet vents are permitted to be closer where designs preclude cross-contamination of air. |
| ≤ 250 cfm (7 $m^3$/min) | 10 ft (3 m) | 15 ft (4.5 m) | | |
| ≤ 350 cfm (10 $m^3$/min) | 12 ft (3.6 m) | 20 ft (6 m) | | |
| ≤ 450 cfm (13 $m^3$/min) | 14 ft (4.3 m) | 24 ft (7.6 m) | | |
| ≤ 500 cfm (24 $m^3$/min) | 14 ft (4.3 m) | 27 ft (8.2 m) | | |

* Applicable to ≤ 6-inch (15 cm) diameter duct systems. Larger duct systems require greater distances per ASHRAE 62.1, Appx. B, Separation of Exhaust Outlets and Outdoor Air Intakes.

* The exhaust trajectory with an exhaust spread radius of 45˚as defined in Section 6.4.1.

** The straight-line exhaust trajectory with an exhaust spread radius of 11˚as defined in Section 6.4.1.

b) Condensate Drainage
A drainage system with capacity to dispose of the condensate water created by the HRV or ERV system shall exist or be provided and comply with Section 7.8 (Drains).

12.2.6 *Passive vent openings*

Where mitigation relies on passive vent openings to passively or as induced by exhausted air, actively provide dilution air to interior or non-habitable air spaces, the configuration shall meet requirements in a) and b) of this Section 12.2.6.

a) Vent openings shall be non-closeable when used, installed, or altered for mitigation purposes to maintain ventilation of an interior space, a crawlspace or other non-habitable air space.

b) Protection of building systems shall be provided where passive vents are open to subfreezing conditions, such as insulating, isolating, or applying heat-tape to exposed water supply and distribution pipes.



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## 12.3 Indoor Air Pressurization

Where the method of mechanically driving air into enclosed portions of a building is used or considered for mitigating the volume of radon or soil gas entering habitable spaces, the configuration, design process and post-mitigation verification shall comply with all requirements of this Section 12.3.

12.3.1 *Applicability*

Requirements of this Section 12.3 shall apply where the target of indoor air pressurization is ground-contact rooms, or as applicable, whole buildings or non-habitable airspaces, such as crawl spaces, utility tunnels, under raised flooring, behind partitioned walls or in hollow voids within CMU block walls.

12.3.2 *Sources for air*

Sources of air delivered to the airspace being pressurized shall comply with Section 12.2.

12.3.3 *Sealing*

The airspace(s) pressurized shall be augmented, as needed, to resist air movement between the targeted airspace and surrounding indoor and outdoor air, in accordance with Section 7.9 (Sealed isolation assembly).

12.3.4 *Design capacity*

Mechanical components, newly installed or augmented, shall result in capacity to constantly deliver not less than 10% more than the minimum rate of air volume, measured in cfm ($m^3$/min), that is needed to establish positive pressure in the targeted airspace relative to soil that adjoins the foundation.

12.3.4.1 Pressurization Combined with *ASD*

Where applying both *ASD* and increased air pressure within ground-contact spaces, the configuration shall result in positive pressure in the targeted airspace relative to soil that adjoins the outer foundation.

12.3.5 *Unintended soil gas transport*

For systems that pressurize an airspace, requirements in a) and b) of this Section 12.3.5 shall be met.

a) An evaluation shall be conducted to itemize suspected air pathways where radon or soil gas could inadvertently be driven laterally under the building or vertically through partitions into another portion of the building. The evaluation shall be recorded in jobsite logs.

b) Airspaces adjoining the pressurized airspace laterally and vertically shall be tested for indoor radon or soil gas concentrations once the system is completed and active.

Exception: Where evaluations do not support the existence of pathways for sizable volumes of soil gas to be inadvertently driven laterally or vertically into other indoor air locations.

12.3.6 *Prior to system installation or augmentation (indoor air pressurization)*

Prior to system installation or augmentation, requirements in a) and b) of this Section 12.3.6 shall be met.

a) Non-destructive investigations shall be conducted in accordance with Section 5.2 and additionally include evaluation of viability for meeting requirements in: Section 7.9 (Sealed isolation assemblies); Section 12.2 (Sources of air); and Section 12.3.5 a) (Unintentional soil gas transport).

b) Diagnostic investigations shall be conducted in accordance with Section 5.3 to design a system that meets requirements in Section 12.3.4 (Design capacity). The following shall be recorded in jobsite logs: pressure and airflow measurements that coincide with the juncture when the airspace is positively pressured, relative adjoining soils or airspaces containing open soil.

12.3.7 *Post-mitigation (indoor air pressurization)*

Functional evaluations after completing the system shall comply with Section 9.1 and include pressure and airflow measurements to verify that the installed system is compliant with requirements in Section 12.3.3 (Design capacity). These measurements and confirmation of compliance with Section 5.1 (Appropriate systems), Section 12.2 (Sources for air) and Section 12.3.3 (Sealing) shall be recorded in jobsite logs.



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12.3.8 *Documentation (indoor air pressurization)*

An OM&M manual that complies with Section 10.5 shall be provided to the client, to additionally include:

a) System operating parameters for the juncture when the airspace is positively pressured, relative adjoining soils or soil airspaces, including:

1. System totals for both inlet and outlet airflow volumes, as measured in cfm ($m^3$/min);
2. Conditions when these measurements were taken, in accordance with Section 5.3.4; and
3. Guidance, in accordance with Section 12.1.6, for verifying seasonal effectiveness; and

b) Descriptions of investigations required in Section 12.3.5 regarding the potential for air pressures to result in unacceptable concentrations of radon or soil gas within other habitable airspaces.

## 12.4 Soil Air Pressurization

12.4.1 *Applicability*

Where the method of mechanically increasing air pressure within soil that adjoins the outer foundation is used or considered for mitigating radon or soil gas entry into habitable spaces, the configuration, design process and post-mitigation verification shall comply with all requirements of this Section 12.4.

12.4.2 *Sources for air*

Sources for air delivered to the airspace being pressurized shall comply with Section 12.2.

12.4.3 *Sealing and ducting*

Soil air pressurization systems shall comply with Section 7 (Sealing) and with Section 6 (ASD), with the following exceptions: Section 6.2.3 (Positively pressured pipe); Section 6.4 (ASD Exhaust Discharge); Fan locations Sections 6.5.2 and 6.5.3; and Section 6.2.5 (Pipe materials) where configured using traditional *HVAC* duct materials.

Requirements in Sections 6.1.1 (Suction pits) and 6.1.2 (Sumps) shall be met even though locations described as suction points will be used to pressurize rather than depressurize soil air.

12.4.4 *Prior to installation (soil air pressurization)*

Prior to system installation or augmentation, requirements in a) and b) of this Section 12.4.4 shall be met.

a) Non-destructive investigations shall be conducted in accordance with Section 5.2 to additionally include evaluation of viability for complying with Section 12.2 (Sources of air) and Section 12.3.5 a (Unintentional soil gas transport).

b) Diagnostic investigations shall be conducted in accordance with Section 5.3 to evaluate *PFE* for positively pressured soils or airspaces containing open soil, relative to indoor air. Pressure measurements that coincide with the juncture when the targeted adjoining soils or airspaces containing open soil are positively pressured, relative indoor air, shall be recorded in jobsite logs.

12.4.5 *Post mitigation (soil air pressurization)*

Functional evaluations after completing the system shall include pressure and airflow measurements to verify that soil air is positively pressured relative to indoor air. These measurements and visual confirmation of compliance with Section 5.1 (Appropriate systems), Section 12.2 (Sources for air) and Section 7 (Sealing) shall be recorded in jobsite logs.

12.4.6 *Documentation (soil air pressurization)*

Plans for OM&M shall be provided to the client in either an information package, in accordance with Section 10.2, or an OM&M manual, as required in Section 10.5. Plans for OM&M shall include descriptions of investigations required in Section 12.3.5 (Unintentional soil gas transport).



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## 12.5 Indoor Air Dilution

Where the method of mechanically driving dilution air into portions of a building is used or considered as a method to dilute radon or soil gas concentrations after soil gas enters the building, the configuration, design process and post-mitigation verification shall comply with all requirements of this Section 12.5.

12.5.1 *Applicability*

Requirements of this Section 12.5 shall apply where the target of indoor air dilution is ground-contact rooms, or as applicable, whole buildings or non-habitable airspaces, such as crawl spaces, utility tunnels, under raised flooring, behind partitioned walls or in hollow voids within CMU block walls.

12.5.2 *Sources for air*

Sources for outdoor or indoor dilution air delivered to the targeted airspace shall comply with Section 12.2.

12.5.3 *Sealing*

Where dilution air is provided, sealing in accordance with Section 7 (Sealing) shall be conducted to result in a continuous air barrier, to the extent practicable, that resists air movement between soil and indoor air.

12.5.4 *Design capacity*

Mechanical or passive components that are newly installed or augmented shall result in a configuration with capacity to continually deliver not less than 10% more than the minimum rate of air volume, measured in cfm ($m^3$/min), needed to achieve dilution goals.

12.5.5 ***Prior to installation*** *(indoor air dilution)*

Prior to installation or augmentation of a mechanical ventilation system for mitigation purposes, requirements in a), b) and c) of this Section 12.5.5 shall be met.

a) Non-destructive investigations shall be conducted in accordance with Section 5.2 and additionally include evaluation of viability for meeting requirements in Section 12.2 (Sources of air).

b) One of the following diagnostic investigations shall be conducted in accordance with Section 5.3 to evaluate system capacity needs for meeting dilution goals.

1. Prescriptive option:
   Blower door measurements or other procedures for evaluating the existing natural air exchange rate per hour (ACH) of the targeted airspace are conducted. The calculation for determining the additional rate of air volume, measured in cfm ($m^3$/min), needed to meet dilution goals shall be:

$$\text{Final ACH} = \text{Initial ACH} \times \frac{\text{Initial Concentration}}{\text{Final Desired Concentration}}$$

2. Performance option:
   Relative to the formula provided in the prescriptive option, an estimated rate of air volume, as measured in cfm ($m^3$/min), is delivered to targeted airspace(s). For this option, indoor measurements of radon or soil gas concentrations shall be conducted to diagnostically determine if system capacity requirements in Section 12.5.4 have been met.

The resulting total ACH being considered to achieve mitigation goals and a comparison with to energy conservation codes cited in Section 12.2.4.1 shall be recorded in jobsite logs.

c) Inadvertent pressurization
Pressure measurements shall be conducted to determine if the airspace is now inadvertently pressurized relative to adjoining soil. If so, investigations shall be conducted in accordance with Section 12.3.4 Unintended soil gas transport.



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12.5.6 *Post-mitigation (indoor air dilution)*

Functional evaluations after completing the system shall include visual confirmation of compliance with Section 5.1 (Appropriate Systems), Section 12.5.1 and 12.5.2 shall be recorded in jobsite logs.

Performance evaluations after completing the system shall include a measurement of radon or soil gas concentrations in habitable airspace(s) to verify mitigation effectiveness.

12.5.7 *Documentation (indoor air dilution)*

An OM&M manual that complies with Section 10.5 shall be provided to the client. It shall also include:

a) Measurement results of indoor radon or soil gas concentrations conducted and system operating parameters for the juncture when those measurements have verified achieving system capacity requirements, including:
   1. The system totals for both inlet and outlet airflow volumes, as measured in cfm ($m^3$/min), and
   2. Conditions when these measurements were taken, in accordance with Section 5.3.4; and
   3. Guidance, in accordance with Section 12.1.6, for verifying seasonal effectiveness; and

b) Descriptions of investigations required in Section 12.3.5 regarding the potential for system air pressures to result in unacceptable concentrations of radon or soil gas within habitable airspaces.

## 12.6 Soil Air Dilution

Where the mitigation method entails passive ventilation or a mechanical system that delivers air or exhausts air to cause the entry of dilution air into soil or non-habitable airspaces, the configuration and post-mitigation verification shall comply with all requirements of this Section 12.6.

12.6.1 *Sources for air*

Sources of air induced into the soil or targeted airspace shall comply with Section 12.2, to include vent configurations required in Section 12.2.6.

12.6.2 *Sealing and other specifications*

Openings between indoor air and soil or non-habitable airspaces shall be closed, in accordance with Section 7 (Sealing).

12.6.3 *Design specifications (soil air dilution)*

Mechanical exhaust systems shall comply with Sections 6 (ASD).

Exception: Where mechanical system exhaust configurations comply with distances from passive vent intakes required in Section 12.2.5 (Outdoor air ventilation systems), Table 12.2.5.

12.6.4 *Design capacity (soil air dilution)*

Where mechanical exhaust systems induce ventilation within non-habitable air spaces, the configuration shall result in capacity to continually induce cross-ventilation of the non-habitable airspace. Where the mitigation method is passive rather than mechanical ventilation, vent locations shall be configured to result in wind driven cross-ventilation of the non-habitable airspace.

12.5.5 *Prior to installation (soil air dilution)*

Non-destructive investigations in accordance with Section 5.2 shall be conducted and recorded to include evaluation for complying with Section 5.1 (Appropriate systems), Section 12.2 (Sources of air) and Section 12.2.6 (Passive vents). Where mechanical systems are employed, the system airflow volume shall be measured, recorded, and compared with energy conservation codes described in Section 12.2.4.1.

12.5.6 *Post-mitigation (soil air dilution)*

Functional evaluations after completing the system shall include visual confirmation of compliance with Section 5.1, Section 12.3.1 and Section 7 shall be recorded in jobsite logs. Performance evaluations after



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completing the system shall include a measurement of radon or soil gas concentrations in habitable airspace(s) to verify mitigation effectiveness.

12.4.7 *Documentation (soil air dilution)*

An OM&M manual that complies with Section 10.5 shall be provided to the client that includes system operating parameters that existed at the time when mitigation goals were met, to include:

1. The system exhaust airflow volume, as measured in cfm ($m^3$/min);
2. Conditions when these measurements were taken, in accordance with Section 5.3.4; and
3. Guidance, in accordance with Section 12.1.6, for verifying seasonal effectiveness.

## 12.7 Passive Methods and Systems

When passive mitigation systems or methods are employed, the design and configurations shall comply with all requirements that are applicable in this Section 12.7.

12.7.1 *Verifying effectiveness*

Verification of effective passive mitigation requires testing indoor radon or soil gas concentrations to include requirements in Section 12.1.6 for verifying seasonal effectiveness.

> Note—Under specific circumstances, passive technologies for reducing soil gas entry can be effective to the degree to which the connection between soil air and living spaces can be broken and natural forces that drive soil gas into a building can be minimalized or neutralized. However:
>
> a) Achieving a complete between soil air and indoor air is not truly possible or sustainable; and
>
> b) efforts to counter natural forces that drive soil gas entry using passive means are often unreliable or unsustainable.

12.7.2 *Sealing openings to soil*

Sealing of gaps and openings between soil and indoor air is not to be regarded as a permanent, stand-alone mitigation method. Efforts to resist air movement between soil and indoor air, which are required for most mitigation methods, shall comply with Section 7 (Sealing).

> Note—While studies have indicated as much as a 50% reduction in indoor concentrations can be witnessed, field experience in the lack of reliable or sustainable effectiveness resulted in the following position statement: "EPA does not recommend the use of sealing alone to reduce radon because, by itself, sealing has not been shown to lower radon levels significantly or consistently." [7]

12.7.3 *Passive Soil Ventilation*

Techniques for passive soil ventilation, typically employed during new construction of buildings, shall comply with standards cited and a) and b) of this Section 12.7.3.

a) For single-family homes, ANSI/AARST CCAH (Reducing Radon in New Construction of One & Two Family Dwellings and Townhouses).

b) For multifamily, school or other large buildings, ANSI/AARST CC-1000 (Soil Gas Control Systems in New Construction of Multifamily, School, Commercial and Mixed-Use Buildings).

[7] The EPA "Consumer's Guide to Radon Reduction" 402-K92-003, August 1992 and 402/K-10/005, December 2016



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12.7.4 *Passive vents*

Vent openings shall be non-closeable and comply with Section 12.2.5 when installed or altered to increase ventilation of an interior space, a crawlspace or other non-habitable air space for mitigation purposes.

12.7.5 *Passively energized mechanical systems*

Note—Such methods have included wind-driven turbines, solar-powered fans and piping configurations that seek to enhance the effect of heat or wind for generating negative pressure within ASD piping.

Informative advisory—A wide variety of mechanisms or configurations have been tried and studied for countering the natural energy forces that drive soil gas into a building. Such technologies have not yet demonstrated reliability for consistent and sustainable mitigation.

## 12.8 Air Cleaning

12.8.1 *Radon (air cleaning)*

Post-mitigation verification of effectiveness requires testing indoor radon decay products, in accordance with procedures required in ANSI/AARST MAH "Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes," to include for requirements in Section 12.1.4 for verifying seasonal effectiveness,

Note—Consistent with EPA technical guidance[8], air cleaning as a means of reducing the risk from radon is not recommended as a mitigation method. Published peer reviewed science does not support that, with current technologies, the amount of risk reduction sought can be quantified or verified for consistency.

Radon gas itself cannot be cleaned or filtered from indoor air. Radon's decay products that do represent the substantial risk from radon exposure are partially cleaned from the air as solid particles. However, challenges of using air cleaning as a mitigation method that are beyond current technology include:

a) The degree to which radon decay products and their associated risks can be verified to have been truly removed from the air;

b) System designs to ensure consistency of air cleaning along with mechanisms to warn occupants when filters or systems degrade in performance; and

c) System design specifications and standards that can ensure all radon decay products, including those not attached to solid particles and those that constantly form downstream from any air handler system, are removed from the air throughout multiple effected airspaces.

12.8.1 *Chemical vapors (air cleaning)*

Note—Filtration systems can be useful for aiding other systems or for temporary risk reduction. However, filtration systems require rigorous maintenance to retain reductions in exposures to occupants. Such methods, including how filtration might apply to vapors exhausted from a mitigation system, are currently beyond the scope of this document.

## 12.9 Water

12.9.1 Radon from water

Post-mitigation verification of effectiveness requires testing water indoor radon decay products, to include requirements in Section 12.1.4 for verifying seasonal effectiveness, in accordance with procedures required in ANSI/AARST MW-RN "Protocol for the Collection, Transfer and Measurement of Radon in Water."

[8] EPA/625/8-87/019 January 1988 "Radon Reduction Techniques for Detached Houses (Second Edition)" (Section seven, third paragraph) and EPA/626/6-88/024 August 1988 "Application of Radon Reduction Methods" (Section 10.6, third paragraph).



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Note—Methods for mitigating radon in water are currently beyond the scope of this document. Where it has been determined that radon from a water supply is a primary source of elevated radon concentrations in air, aeration and activated charcoal filtration are common methods employed to achieve radon reductions.

### 12.9.2 Chemical Vapors from water

Note—Chemicals in groundwater are a common source for chemical vapors that enter a building. Methods for handling and disposal of contaminated water are currently beyond the scope of this document.

## 12.10 Building Materials

Note—Where it has been determined that building materials are a primary source of elevated radon concentrations, Indoor Air Dilution, in accordance with Section 12.5, can be considered. Other methods beyond the scope of this document could include encapsulation, isolation or removal of building materials.

## 12.11 Source Removal

Note—Methods and practices for removal of source material are beyond the scope of this document.



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# 13.0 NORMATIVE APPENDICES AND REFERENCES

## 13.1 National Certification/Listing Programs

For private sector certifications and listings, this standard requires a national program that evaluates and lists qualified individuals, training courses and other products or services, such as laboratory services, integral to achieving public health goals intended by this standard. Programs meeting the purpose, need and requirements of this standard are those with policies as established in a), b) and c) of this Section 13.1.

a) Programs with published policies that:
   1. require persons to undergo education and an impartial examination process prior to granting personal certification or certificates of educational achievement; and
   2. require surveillance of continued competence, not less than as demonstrated by continuing education on standards updates, compliance and other related technical knowledge and skills, prior to granting recertification or renewed certificates or listings; and
   3. require, for the certification of radon measurement laboratories, initial demonstration and scheduled ongoing surveillance of compliance with ANSI/AARST MS-QA (Radon Measurement Systems Quality Assurance).

b) Programs that:
   1. have a written policy and means for receiving and adjudicating complaints against individuals or companies who have been granted a credential; and
   2. have publicly published educational and examination requirements for each credential or listing available online where readily accessible for consumers of credentialed services.

c) Programs that include educational prerequisites as follow:
   1. Qualified Mitigation Professionals—Multifamily and Commercial
      Listing or certification credentials granted that qualify individuals as proficient in designing radon or soil gas mitigation systems in existing multifamily, school, commercial and mixed-use buildings are to include:
      a. current certification as a qualified radon or soil gas mitigation professional in homes; and
      b. additional education and processes approved by the program relative to tasks required in the most current version of this standard, ANSI/AARST SGM-MFLB (Soil Gas Mitigation Standards for Existing Multifamily, School, Commercial and Mixed-Use Buildings) prior to granting this advanced level certification or listing and recertifications or relisting.
   2. Qualified Radon Measurement Professional—Multifamily and Commercial
      Listing or certification credentials granted that qualify individuals as proficient in placement, retrieval, and analysis (as applicable) of *radon* detectors and to design, plan, and implement quality procedures when conducting *radon* measurements in multifamily, school, commercial and mixed-use buildings are to include:
      a. current certification as a qualified radon measurement professional in homes; and
      b. additional education and processes approved by the program relative to tasks required in the most current version of ANSI/AARST MA-MFLB (Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily, School, Commercial and Multi-Use Buildings) prior to granting this advanced level certification or listing and recertifications or relisting.



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3. Qualified Mitigation Professionals—Homes

   Certifications granted that qualify individuals as proficient in designing radon or soil gas *mitigation* systems in existing homes are to include:

   a. no less than 32 hours education prior to granting certification that focuses on tasks required in this standard, ANSI/AARST SGM-SF (Soil Gas Mitigation Standards for Existing Homes); and

   b. biennial recertifications after completing continuing education requirements and any other program surveillance activities.

4. Qualified Radon Measurement Professional—Homes

   Certifications granted that qualify individuals as proficient in conducting radon measurements in existing homes are to include:

   a. no less than 16 hours education prior to granting certification that focuses on tasks required in ANSI/AARST MAH (Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes); and

   b. biennial recertifications after completing continuing education requirements and any other program surveillance activities.

Informative Note 1—The National Radon Proficiency Program (NRPP), the National Radon Safety Board (NRSB), or equivalent programs that also meet requirements of a), b) and c) of this Section 13.1 meet the requirements of this standard.

Note that identification of existing certification bodies is not an endorsement of their programs.

Informative Note 2—The purpose of requirements in this Section 13.1 is to ensure contractors have an appropriate degree of technical, engineering, and scientific knowledge to protect occupants by successfully reducing hazards associated with *radon gas*, chemical vapors or other soil gases that are present in indoor air.



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## 13.2 Temporary Systems/ Rapid Response

13.2.1 *Temporary systems limits*

All contractor correspondence shall indicate that use of a mitigation system that is not fully installed or not designed as an integral, permanent addition to the building is limited to no longer than 30 days for occupied buildings except with the following requirements for specific cases:

a) The use of such temporary system is limited to no longer than 90 days when diagnostics for optimizing final design can be justified to necessitate delay in the installation of a permanent system; or

b) The use of such temporary system is limited to no longer than 90 days after to completion of major renovation, change in building use, or building permit requirements that necessitate delay in the installation of a permanent mitigation system; or

c) The use of such temporary mitigation system shall be extended only to a point that is necessary to allow multiple parties or jurisdictions of authority to individually and collectively design, fund and approve the installation plan and the logistics of such approval process thereby necessitates a delay in the installation of a permanent mitigation system.

Where the purpose of mitigation is chemical vapor intrusion, non-ASD mitigation methods that are not integral, permanent additions to the building but are maintained by an independent party under a plan for OM&M are considered permanent up until OM&M monitoring ends.

13.2.2 *Label Temporary Systems*

The contractor shall place label(s) in a conspicuous location on the system or system components stating the words "Temporary Soil Gas Mitigation System" and the date of implementation. The label(s) shall also include a description of the temporary system and an estimated date for completion of a permanent system that shall not exceed the time limits in this Section 13.2.1. The label, such as provided for example in Exhibit D, shall include the responsible party or representative, phone number, and applicable certification number and certifying agency.

13.2.3 *Risk Communication (Temporary Systems)*

The contractor shall notify the client in writing of labeling requirements and its content upon implementation of the temporary system.

13.2.3.1 Radon

When the purpose of the mitigation includes radon, the contractor shall provide the client in writing with risk information relative to concentrations measured in the dwelling(s), such as portrayed in EPA's publication "Citizens Guide to Radon" or similar current literature published by the federal, provincial, tribal, or state authority.

> Note—The contractor should inform the client in writing that the standard of care requires action for timely completion of a permanent mitigation system and that the client is responsible for the health and safety of occupants. Where measured concentrations exceed those rendered in EPA's "Citizens Guide to Radon" (e.g., > 20 pCi/L [740 Bq/m$^3$]), an extrapolation of the risk indicated, as provided in Exhibit C, should be included.

13.2.4 *Request Notification to Occupants*

The contractor shall request in writing that the client assign a designated party to make all appropriate notifications to occupants and facilitating staff about the temporary nature of the system and related health risk.



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Note—It is recommended that the contractor obtain signed acknowledgment from the client that the request for notification to occupants was received.

13.2.5 *Rapid response (informative)*

For the purposes of this document, "Rapid Response" denotes situations where action is required quickly or immediately due to hazards present. Subchronic or acute risk exposures to chemical vapors are examples of situations where excessively hazardous conditions can warrant immediate action. Options that may be considered can include:

a) Vacating the Property
Where acute safety concerns are present and cannot be immediately mitigated, occupants and workers should be evacuated from the building until safe conditions can be established;

b) Enhanced Ventilation
Ventilation with outside air is normally the first consideration as a temporary means to enhance safety. However, care must be exercised for any temporary effort. The amount of ventilation immediately achieved may not be adequate to achieve safe conditions. In addition, ventilation with outside air is seldom viable as a permanent solution;

c) Mechanical Solutions
A variety of mechanical systems can often be temporarily augmented or installed to enhance safety. Care must be exercised for all temporary efforts since the amount of reduced hazard achieved may not be adequate for achieving safety. Rapid response options include:

1. A temporary ASD system not necessarily conforming with all requirements of Section 6; or
2. Enhanced Mechanical Ventilation: The addition of temporary blowers and/or manipulation of HVAC air handler controls; or

d) Other methods might be applicable such as carbon filtration of indoor air or methods with less certainty of protection, such as sealing large openings to soil.



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## 13.3 Normative References

Published by the AARST Consortium on National Standards
For the latest versions of AARST/ANSI documents, see: www.standards.aarst.org

ANSI/AARST SGM-SF (Soil Gas Mitigation Standards for Existing Homes)

ANSI/AARST MA-MFLB (Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily, School, Commercial and Mixed-Use Buildings)
*Note—Previously published as ANSI/AARST MAMF and MALB and now harmonized and consolidated into a single standard.*

Published by the ASHREA
For the latest versions of ASHRAE documents see: www.ashrae.org

- 62.1 Ventilation for Acceptable Indoor Air Quality for buildings that are more than three stories tall (Appendix B—Separation of Exhaust Outlets and Outdoor Air Intakes)

Published by ASTM International
For the latest versions of ASTM documents see: www.astm.org

- C33 Standard Specification for Concrete Aggregates
- C920 Elastomeric Joint Sealants
- C1173 Flexible Transition Couplings for Underground Piping Systems
- D1785 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- D2564 Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
- D2665 Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
- D5926 Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
- E1745 Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- F656 Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- F891 Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core
- F1488 Coextruded Composite Pipe
- D2787 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Published by the International Code Council, Inc.
For the latest versions of ICC documents see: www.iccsafe.org

- The International Residential Code® (IRC)
- The International Building Code® (IBC)
- The International Mechanical Code® (IMC)
- The International Plumbing Code® (IPC)
- The International Energy Conservation Code (IECC)



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## 14.0 DESCRIPTION OF TERMS

Terms not defined herein have their ordinary meaning within the context of their use as defined in "Webster's Collegiate Dictionary."

**Accessible:** Capable of being reached for operation, repair, and inspection.

**Accessible, Readily (Readily Accessible):** Capable of being reached quickly for operation, repair, or inspections without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth.

**Active soil depressurization (ASD):** A family of radon mitigation systems involving mechanically driven soil depressurization, including sub-slab depressurization (SSD), sub-membrane depressurization (SMD), block wall depressurization (BWD) and *crawl space* depressurization (CSD).

**Backer rod:** A semi-rigid closed-cell foam material resembling a rope (available in various diameters) that is used to fill around pipes, large cracks, etc. to assist in making a sealed penetration.

**Becquerel per cubic meter (Bq/m³):** A unit of measure for radioactivity in one cubic meter of air. CONVERSION: 1 Bq/$m^3$ equals 0.027 picocuries per liter (*pCi/L*).

**Chemicals of Concern (COC):** Chemicals in vapor, liquids or soil that have been identified at a site location to potentially pose health and safety hazards.

**Client:** The person(s), or company that contracts with a *contractor* to install a mitigation system in a building.

**Collateral mitigation:** The ability to mitigate more than one occupied *dwelling* or unit with a single mitigation system.

**Continuous Duty:** A motor may be rated as either continuous duty or intermittent duty. Continuous duty rated motors are rated to be run continuously without any damage or reduction in life of the motor while intermittent duty motors must be allowed to stop and cool before restarting.

**Contractor:** Any person(s) or contracting firm regardless of organizational structure who installs a mitigation system. See Section 3 for descriptions of Qualified Mitigation Professionals.

**Crawl space:** A foundation type with an open area beneath the livable space of a *dwelling* that typically has either a concrete slab or earthen floor.

**Cubic feet per minute (cfm):** A measure of the flow rate of a fluid, such as air. CONVERSION: 1 cfm = 1.699 cubic meters/hour ($m^3$/hr).

**Depressurization:** A negative pressure induced in one area relative to another.

**Diagnostic procedures:** One or multiple procedures for identifying or characterizing conditions under, beside and within buildings to project the effects of various system designs. Diagnostic procedures can include sub-slab pressure field extension tests or analysis; visual observations; characterization of pressure or air exchange rates between indoors and outdoors and also between floors or adjoining air spaces; and *diagnostic radon measurements* at locations of interest (e.g., common areas, mechanical spaces and spaces not in ground contact).

**Diagnostic radon measurements:** Diagnostic Radon Measurements are intended to confirm specific conditions or effects of mitigation activities. Test locations are identified by their relationship to the specific information being sought. Diagnostic Radon Measurements are not a substitute for testing in accordance with ANSI/AARST measurement protocols.

**Dwelling:** A building or portion of a building that is used, intended, or designed to be built, used, rented, leased, let or hired out to be occupied or that are occupied for living purposes.

**Feet per minute (fpm):** A measure of the velocity rate of a fluid, such as air. CONVERSION: 1 fpm = 0.3048 meters per minute (0.3m/min).

**Flue gas spillage:** A condition in which the normal movement of combustion products up a flue (due to the buoyancy of the hot flue gases) is reversed, resulting in the combustion products entering the building. Flue gas spillage of combustion appliances (such as fireplaces and furnaces) can occur when *depressurization* in the house overwhelms the buoyant force of the hot gases. Flue gas spillage can also be caused by a blockage in the chimney or flue termination.



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**High-rise building:** A building that is 75 feet (23 m) or higher.

**HAC system:** Heating and cooling (air conditioning) systems that are not designed to also supply outdoor air ventilation. HAC systems are common to single-family residences.

**HVAC setback:** HVAC "setback" is normally the automated or manual operation of system controls to cause different activity for heating, cooling and ventilation systems during occupied periods compared to unoccupied periods.

**HVAC system:** Heating and cooling (air conditioning) systems that are additionally capable of supplying outdoor air ventilation. If they do not supply outdoor air ventilation, they are more technically referred to as HAC systems.

**Informative:** Informational content or guidance that is not considered mandatory by this document.

**Intentional collateral mitigation:** *ASD* system(s) intentionally designed to reduce radon/soil gas concentrations in multiple *dwellings* that have each been identified by testing to indicate radon/soil gas concentrations that exceed acceptable limits.

**Jurisdictional authorities:** Governing authorities that regulate specific installation requirements or manner of activities will normally include a combination of authoritative bodies because of laws or other requirements adopted at a local municipality, county, province, or state. In addition, national jurisdiction will apply for a variety of activities that are regulated as a result of federal statutes. In some cases, tribal or international laws or treaties result in an authority that holds jurisdiction over certain activities.

**Mechanically fastened:** A means of connection such as for duct joints or electrical connections that entails more than a pressure fit, glued or twist connection (i.e., mechanical screws employed to secure connection of wiring or ducting).

**Mitigation:** System or steps to reduce radon concentrations or other pollutants in the indoor air of a building.

**Mitigation Installer:** A staff member or sub-contractor who participates in installation of the mitigation system(s) and therefore, regardless of qualifications or other obligations herein, is included in considerations for worker health and safety.

**Nontransient:** Occupancy of more than 31 days.

**Normal occupied operating conditions:** The operational condition for the building or unique sector of the building that exists during the greatest amount of significantly occupied time.

**Normative:** Provisions or referenced documents that state practices considered mandatory and required by this document.

**Occupied:** Any area of the building that is occupied on a regular basis for more than 4 hours a day. See "Significantly occupied" and "Occupied work or school weeks"

**Occupied work or school weeks:** Those weeks that do not include vacation days such as national or religious holidays, winter breaks or similar weeks where test conditions do not represent normal occupied operating conditions for the building. See "Normal Occupied Operating Condition", "Occupied" and "Significantly occupied".

**Operation, Maintenance and Monitoring plan (OM&M):** A document that includes information on the operation and maintenance of installed system(s) and guidance for monitoring the effectiveness of the system in the future.

**Operations Manual:** A document that is normally compiled by the mitigator to provide requirements and guidance for operation and maintenance of the mitigation system(s). This manual is a component of an Operation, Maintenance and Monitoring Plan (*OM&M*) that additionally includes information on monitoring effectiveness of the system.

**Overseeing Professional:** An individual or firm that aids to assemble and coordinate a qualified team of professionals of diverse skill sets.

**Overseeing Team:** Those individuals associate with project commissioning for vapor intrusion projects that normally include: Responsible Parties; Regulatory Authorities when compliance with local, state or federal regulatory standards is required; and An Overseeing Professional to assemble and coordinate a qualified team of professionals of diverse skill sets.

**Picocurie per liter (pCi/L):** A unit of concentration radioactivity corresponding to 0.037 decays per second or 2.22 decays per minute in a liter of air or water. 1 pCi/L = 37 becquerels per cubic meter ($Bq/m^3$).

**Pressure field Extension (PFE):** The distance that a pressure change, created by drawing soil-gas through a suction point, extends outward in a sub-slab gas permeable layer, under a membrane, behind a solid wall or in a hollow wall.

**Pressure field Extension Test:** A *diagnostic* procedure to evaluate the potential effectiveness of an ASD system by using a shop vacuum or other fan or vacuum device to draw air from the space below a slab or from the cavities inside a block wall.



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Measuring the change in pressure at various small test holes through the slab or the block wall using a micro-manometer or heatless smoke can provide evidence of the potential effectiveness of an *ASD* system.

**Pressure Field Extension (PFE) Analysis:** For *ASD* design and optimization, an analysis of 1) qualitative evidence for the distance potential of Pressure Field Extension, and 2) quantitative measurements employed for determining vacuum pressure and air flow volume rates required to achieve a consistent vacuum across the area observed.

**Pressurization:** A positive pressure induced in one area relative to another.

**Quality Control:** For mitigation professionals, actions to retain evidence of actual operational and installation quality that is compared to intended goals for quality. The comparison is systematically used to control quality with corrective actions as needed on a jobsite or for improvements to operational procedures.

**Quality Management System (QMS):** A documented plan of action, often described as a QA plan, which includes Quality Control Procedures for tracking the difference between planned actions and the actual resulting installation or product with systematic review for managing and improving quality.

**Radon (Rn):** A colorless, odorless, naturally occurring, radioactive, inert gaseous element formed by radioactive decay of radium-226 (Ra-226) atoms. The atomic number is 86. Although other isotopes of radon occur in nature, in this document, radon refers to the gas Rn-222. Rn-222 is measured in picocuries per liter (*pCi/L*) or in becquerels per cubic meter ($Bq/m^3$).

**Re-entrainment:** The unintended re-entry into a building of radon or soil gas that is being exhausted by a mitigation system.

**Responsible Party (RP):** Can be the property owner(s) or extend to include private businesses and/or governmental agencies

**Sealed isolation assemblies:** The surrounding physical components to an airspace that might include the entire building shell or an isolated airspace within a building that has been sealed to resist air movement between the isolated airspace and both indoor air and outdoor air.

**Setback:** See HVAC Setback.

**Significantly occupied:** The time period when the building is typically occupied by the majority of the workers or students. See "Normal Occupied Operating Condition", "Occupied", "Significantly occupied" and "Occupied work or school weeks".

**Soil gas collection plenum:** A 3-dimensional enclosure for collecting radon and other soil gases from under slabs, soil gas retarders or from behind walls that surrounds a void or gas permeable layer. There are at least six sides to this enclosed airspace, and none are perfectly sealed, especially at the side facing soil.

**Suction pit:** Space that exists or is created below the suction pipe.

**Suction point:** Location at which suction piping is routed through the slab, foundation, membrane, drain tile or sump cover.

Sump (Sump pit): A pit below the subsurface grade of a building, which is commonly intended as a component of a ground water control system. Sump pumps and drainage piping are often additional components of such ground water control systems.

**Townhouse:** A single family *dwelling* (also referred to as a townhome) that is constructed in a group of three or more attached units where each unit extends from the foundation to the roof and has a yard or public way on at least two sides.

**Unique sector of a building:** Portions of a common building that are individually classified by the general design and the intended design of each active heating, cooling, and ventilation system (HVAC).

**Unit:** A building or portion of a building that is used, intended, or designed to be built, used, rented, leased, let, or hired out to be occupied or that is occupied for commercial, residential or public purposes.

**Working level (WL):** Any combination of short-lived radon decay products in one liter of air that will result in the ultimate emission of 1.3 x 105 MeV of potential alpha energy. This number was chosen because it is approximately the alpha energy released from the decay products in equilibrium with 100 pCi of Ra-222. Exposures are measured in working level months (WLM).

**Working Level Month (WLM):** A unit of concentration radioactivity corresponding to 1 working level (WL) for 170 hours per month. Although this unit of measurement came from assuming 40-hour work week exposures, it is commonly used to set limits for annual exposure to radon decay product alpha energy.



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## Exhibit A-1
## Sample Notice: "CONTRACTOR TO CLIENT"
## Intention to Enter Dwellings

To: Property Management, Corp.
2013 Industrial University Avenue
Anytown, USA

Radon Company
Anytown, USA 800-000-0000

Dear Management and Supervising Staff,
We request that notice of the intention to enter the building be provided to occupant(s) and other impacted residents a minimum of 24 hours before we enter the building area(s) designated below and in a manner that meets any applicable laws.

In addition, we request that notices be provided to occupants and other impacted residents that include instructions, warnings, or guidance for specific disruptive or hazardous situations that may include noise, sealant vapors or other disruptions.

**Access is required to for:** [ ] Building Investigation [ ] System Installation [ ] Maintenance

**Building Address:** _____

**Building Area(s):** _____

**Scheduled** Date_____ Day _____ Time_____
_____

**Procedures are expected to include:**
[ ] _____
_____

[ ] **Drilling into concrete floors**

[ ] **Application of sealants.** 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. *Material Safety Data Sheets (MSDS) are available upon request.*
**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.
**If symptoms are observed**: Leave the area immediately to breathe fresh air. Avoid further exposure. If symptoms persist, get medical attention.

We thank you for your cooperation in helping to ensure safe and healthy homes.

Sincerely,
Radon Company, Anytown, USA



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## Exhibit A-2
## Sample Notice : "MANAGEMENT TO FACILITATING STAFF"
## Intention to Enter Dwellings

Property Management Company
Anytown, USA 800-000-0000

Dear Custodial, Maintenance and Educational Staff,

Important steps are being taken to lower the risk to occupants in this building from soil gas pollutants. In particular, radon gas is the second leading cause of lung cancer and the leading cause of lung cancer in nonsmokers in the U.S.

Your staff member contacts:

Staff authorized for responding to public inquiries: _____ Phn#_____

For logistics of onsite activities, contact: _____ Phn#_____

**Access is needed and scheduled for:**

**Building:** _____

**Building Area(s):** _____

**Scheduled Date**_____ **Day** _____ **Time**_____

**Access is required to for:** [ ] Building Investigations [ ] System Installation [ ] Maintenance

**Procedures are expected to entail:**

[ ] _____

_____

[ ] **Drilling into concrete floors**

[ ] **Application of sealants.** 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. *Material Safety Data Sheets (MSDS) are available upon request.*

**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.

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

We thank you for your cooperation in helping to ensure safe and healthy homes.

Sincerely,

Management or Radon Company, Anytown, USA



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## Exhibit A-3
## Sample Notice: "MANAGEMENT TO OCCUPANTS"
## Intention to Enter Dwellings

Property Management Company
Anytown, USA 800-000-0000

Dear Building Occupants,

Important steps are being taken to lower the risk to residents in this building from soil gas pollutants. In particular, radon gas is the second leading cause of lung cancer and the leading cause of lung cancer in nonsmokers in the U.S. Radon is a naturally-occurring radioactive gas that can be present in some buildings at concentrations that are dangerous to you, your family and pets. Copies of EPA's *A Citizen's Guide to Radon* are available upon request or you can contact your State Radon Office (http://www.epa.gov/radon/whereyoulive.html) or EPA regional office for additional information on radon.

Staff authorized for responding to public inquiries: _____ Phn#_____
For logistics of onsite activities, contact: _____ Phn#_____

**Access is needed and scheduled for:**

**Building:** _____

**Building Area(s):** _____

**Scheduled Date**_____ **Day** _____ **Time**_____

**Access is required to for:** [ ] Building Investigations [ ] System Installation [ ] Maintenance

**Procedures are expected to entail:**

[ ] _____
_____

[ ] **Drilling into concrete floors**

[ ] **Application of sealants.** 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. *Material Safety Data Sheets (MSDS) are available upon request.*

**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.

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

We thank you for your cooperation in helping to ensure safe and healthy homes.
Sincerely,
Management or Radon Company, Anytown, USA



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## Exhibit B
## Sample Posted Notice: "CONTRACTOR TO OCCUPANTS"
## Sealant Warning

Radon Company
Anytown, USA 800-000-0000

Dear Building Occupants,
Important steps are being taken to lower the risk to residents in this building.

The work has required **application of sealants.**

[✓] **Wet Caulk/Sealants**. Take care to not step in or touch sealants until they are dry.

[✓] **Vapor from sealants:** 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 air-tight 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. **If symptoms are observed:** Leave the area immediately to breathe fresh air. Avoid further exposure. If symptoms persist, get medical attention.

We thank you for your cooperation in helping to ensure safe and healthy homes.

Sincerely,
Mitigation Company, Anytown, USA

*Informative advisory*—For all jobsites, including owner-occupied properties, it is recommended that the *contractor* post or leave similar notices for affected occupants when using sealants.



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## EXHIBIT C

## TEMPORARY SYSTEMS

Figure C-1:
SAMPLE LABEL
WHEN INSTALLING
TEMPORARY SYSTEMS

| Temporary Radon Reduction System | |
|---|---|
| Date Installed: | |
| Description of system: | |
| Estimated date for completion of a permanent system: | [ ] Within 30 days. |
| | [ ] Within 90 days due to ongoing diagnostics. |
| | [ ] Within 90 days after renovations. |
| | [ ] Subject to the approval processes |
| John Smith Radon Reductions, 866-041-0412, Anywhere America, Cert# 109492 State Proficiency Board | |

Figure C-2:
SAMPLE RISK TABLE
FOR RADON
CONCENTRATIONS THAT
ARE HIGHER THAN 20 PCI/L

| RADON RISK IF YOU HAVE NEVER SMOKED | | |
|---|---|---|
| ***Radon Level*** | ***If 1,000 people who never smoked were exposed to this level over a lifetime*** * | |
| ***150 pCi/L*** | ***About 270 people could get lung cancer*** | ***Estimated*** *for concentrations higher than provided in EPA's Citizen Guide to Radon* |
| ***100 pCi/L*** | ***About 180 people could get lung cancer*** | |
| ***50 pCi/L*** | ***About 90 people could get lung cancer*** | |
| *20 pCi/L* | *About 36 people could get lung cancer* | *As shown in EPA's Citizen Guide to Radon* |
| *10 pCi/L* | *About 18 people could get lung cancer* | |
| *8 pCi/L* | *About 15 people could get lung cancer* | |
| *4 pCi/L* | *About 7 people could get lung cancer* | |
| *2 pCi/L* | *About 4 people could get lung cancer* | |
| *1.3 pCi/L* | *About 2 people could get lung cancer* | |
| * Lifetime risk of lung cancer deaths from EPA's *Assessment of Risks from Radon in Homes* (EPA 402-R-03-003) | | |



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## CONSENSUS BODY MEMBERS

**Sincere appreciation is both expressed and deserved for years of contributions in time and wisdom provided by all the following consensus body members and staff.**

### Mitigation Standards—Consensus Body 2019-2022

Chair: Steve Tucker (OR) Assistance Team: Gary Hodgden (KS)

| Stakeholder Group | Delegate | Affiliation |
|---|---|---|
| (Educators Rn) | Bill Angell (MN) | University of Minnesota |
| | Chad Robinson (KS) *Alternate* | Midwest University Radon Consortium (MURC) |
| (Regulated States Rn) | Josh Kerber (MN) | Minnesota Department of Health |
| | Patrick Daniels (IL) *Alternate* | Illinois Emergency Mgmt. Radon Program |
| (Federal EPA Rn) | Tommy Bowles (DC) | U.S. Environmental Protection Agency (EPA) |
| (Federal OHH) | Warren Friedman (DC) | HUD Office of Healthy Homes |
| (Proficiency Program) | Bruce Snead (KS) | AARST-NRPP (Policy Advisory Board) |
| | Kyle Hoylman (KY) *Alternate* | AARST-NRPP (Credentialing Committee) |
| (Measurement Prof. Rn) | Nate Burden (PA) | Professional Measurement Service Provider |
| | James Fraley (GA) *Alternate* | Professional Measurement Service Provider |
| (Home Mitigation Prof.) | Bill Brodhead (PA) | Professional Service Provider |
| | Aaron Fisher (PA) *Alternate* | Professional Service Provider |
| (Large Bldg. Mitigation) | Tony McDonald (OH) | Professional Service Provider |
| | Fred Elrott (CA) *Alternate* | Professional Service Provider |
| (VI Mitigation Prof.) | Tom Hatton (NJ) | Professional Service Provider |
| | Rachel Saari (MI) *Alternate* | Professional Service Provider |
| (Building Scientist) | Todd McAlary (CN) | Professional Service Provider |
| | Chris Ferguson (IN) *Alternate* | Professional Service Provider |
| (Site Assessment VI) | Chris Lutes (NC) | Professional Measurement Service Provider |
| | Chris Bonniwell (WI) *Alternate* | Professional Measurement Service Provider |
| (VI Stewardship VI) | David Gillay (IN) | Professional Legal Services |
| (Fan Manufacturers) | Dave Hill (MA) | Spruce |
| | Paul Owen (MA) *Alternate* | *Spruce* |
| (Ventilation Manufacturers) | Hamid Massali (KS) | Fantech |
| | Michelle Festa (PA) *Alternate* | Festa |

Assist Team: Joanna Mandecki, Nanci Hermberger, Lindsey Beal, Denise Bleiler, Wensday Worth and Marilyn Patrick

### SGM-SF Consensus Body 2014-2017

Chair: Dave Kapturowski (MA) Assistance Team: Gary Hodgden (KS)

| Stakeholder Group | Delegate | Affiliation |
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| (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) |
| (Proficiency Program) | Bruce Snead (KS) *Alternate* | AARST-NRPP (Policy Advisory Board) |
| (Mitigation Prof. Rn) | David Grammer (NJ) | Professional Service Provider |
| | Keith Volsted (IL) *Alternate* | Professional Service Provider |
| (Measurement Prof. Rn) | David Wilson (TN) | Oak Ridge National Laboratory |



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| | | |
|---|---|---|
| (Building Inspectors) | Nate Burden (PA) | Professional Service Provider |
| (Federal OHH) | Warren Friedman (DC) | HUD Office of Healthy Homes |
| | Eugene Pinzer (DC) *Alternate* | HUD Office of Healthy Homes |
| (Regional HUD) | Paul Mohr (MO) | HUD Field Representatives |
| | Sam Gieryn (MO) *Alternate* | HUD Field Representatives |
| (Federal HUD) | Nelson Rivera (DC) | HUD Community Planning and Development |
| | Danielle Schopp (DC) *Alternate* | HUD Community Planning and Development |
| (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 |
| | Pat Troth (IN) *Alternate* | Indiana Dept. of Environmental Management |
| (Federal EPA VI) | Henry Schuver (DC) | EPA Office of Emergency Response (OSWER) |
| | Rich Kapuscinski (DC) *Alternate* | EPA Office of Emergency Response (OSWER) |
| (Mitigation Prof. VI) | Tony McDonald (OH) | Professional Service Provider |
| | Tom Hatton (NJ) *Alternate* | Professional Service Provider |
| (Building Scientist VI) | Rachel Saari (MI) | Professional Service Provider |
| | Robert Truesdale (NC*) Alternate* | RTI (Research Triangle Institute) |
| (Site Assessment VI) | Chris Lutes (NC) | Professional Service Provider |
| | Eric Lovenduski (NY) *Alternate* | Professional Service Provider |
| (Stewardship VI) | David Gillay (IN) | Professional Service Provider |
| | Chris Bonniwell (WI) *Alternate* | Professional Service Provider |
| (Regional EPA) | Michael Murphy (IL) | USEPA Region 5 (North-Central Region) |
| | Alana Lee (CA) *Alternate* | *USEPA Region 9 (Pacific-Southwest Region)* |
| (Public Health NGO VI) | Lenny Siegel (CA) | Center for Public Environmental Oversight |

## RMS-MF Subcommittee 2012-2015

Chair: John Mallon (PA) Assistance Team: Gary Hodgden (KS)

| Stakeholder Group | Delegate | Affiliation |
|---|---|---|
| (Educators) | Bill Angell (MN) | Midwest University Radon Consortium (MURC) |
| (Regulated States) | Patrick Daniels (IL) | Illinois Radon Program Manager (IEMA) |
| (Proficiency Program) | David Wilson (TN) | Technical and Science Committee (AARST-NRPP) |
| (Proficiency Program) | Shawn Price (NC) *Alternate* | National Radon Proficiency Program (NRPP) |
| (Realtors) | Russell Riggs (DC) | National Association of Realtors (NAR) |
| (Consumer Advocacy) | Dave Jacobs (DC) | National Center for Healthy Housing (NCHH) |
| (Mitigation) | Thomas Hatton (NJ) | Professional Service Provider |
| (Measurement) | Tony Davenport (FL) | Professional Service Provider |
| (Measurement) | David Grammer (NJ) *Alternate* | Professional Service Provider |
| (Home Inspectors) | Bruce Thomas (PA) | Professional Service Provider |
| (Home Inspectors) | Nate Burden (PA) *Alternate* | Professional Service Provider |
| (Federal EPA) | Jani Palmer (DC) | U.S. Environmental Protection Agency (EPA) |
| (Federal HUD) | Warren Friedman (DC) | Office of Lead Hazard Control and Healthy Homes |
| (Federal HUD) | Hilary Atkin (DC) *Alternate* | Housing and Urban Development (HUD) |
| | Previous committee members deserving appreciation | |
| (Non-regulated States) | Joshua Miller (MN) | Minnesota Department of Health - Indoor Air Unit |
| (Public Health NGO) | Eileen Lowery (RHA) (IL) | Respiratory Health Association (NHA) |
| (Consumer Advocacy) | Jane Malone (DC) | National Center for Healthy Housing (NCHH) |
| (Federal HUD) | Chris B. Trent (DC) | Housing and Urban Development (HUD) |



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## Concurrent RMS-LB Consensus Body **2012-2015**

Acting Chair: Gary Hodgden (KS)

| Stakeholder Group | Delegate | Affiliation |
|---|---|---|
| (Educators) | Bill Angell (MN) | Midwest University Radon Consortium (MURC) |
| Proficiency Program) | David Wilson (TN) | Technical and Science Committee (AARST-NRPP) |
| (Federal EPA) | Jani Palmer (DC) | U.S. Environmental Protection Agency (EPA) |
| (Mitigation prof.) | John Mallon (PA) | Professional Service Provider |
| (Home Inspectors) | Nate Burden (PA) | Professional Services |
| (Home Builders) | Steve Tucker (OR) | Specialty Services |
| (Vapor Intrusion) | Thomas Hatton (NJ) | Specialty Services |
| (Manufacturers) | Dave Hill (MA) | Manufacturer (Spruce) |
| | Previous committee members deserving appreciation | |
| (Non-regulated States) | Joshua Miller (MN) | Minnesota Department of Health - Indoor Air Unit |
| (Regulated States) | Matt Shields (PA) | Pennsylvania Department of Environmental Health |
| (Mitigation prof.) | David Grammer (NJ) | Professional Service Provider |
| (Measurement prof.) | Charlie Lamb (NY) | Professional Service Provider |



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SGM-MFLB 2023

AARST CONSORTIUM

# Companion Guidance

Advisory—The information contained in this guidance document is not part of this ANSI/AARST American National Standard (ANS) and does not contain requirements necessary for conformance to this standard. The information contained in this guidance document has not been processed in accordance with ANSI's requirements for an ANS. As such, this guidance document may contain material that has not been subjected to public review or a consensus process.


| | | |
|---|---|---|
| CG Section A | **Guidance To Property Owners** | CG 1-2 |
| CG Section B | **HVAC Group Descriptions** | CG 3-4 |
| CG Section C | **Calculating Average Annual Operating Conditions** | CG 5-6 |
| CG Section D | **Example ASD Maintenance Schedule/Log** | CG 7 |
| CG Section E | **Example HVAC Maintenance Schedule/Log** | CG 8 |
| CG Section F | **Example HVAC Inspection Checklist** | CG 9 |
| CG Section G | **Comprehensive HVAC Diagnostic/Repair Checklist** | CG 10-11 |

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| Facilitating Contractor Needs<br>*These steps can often reduce costs while also achieving reliable proposals* | |
|---|---|
| Existing Radon Measurements<br><br>Floor Plan Diagrams | ***Prepare to provide:*** All test reports and at least one floor plan diagram that is annotated with the location and results of all available radon measurements for the common building structure(s) or portion of the building(s) to be mitigated.<br>The floor plan diagram or series of diagrams should illustrate the building foundation including slab-on-grade, basement, and crawlspace areas |
| Building Specifications | ***Prepare to provide:*** Any available information on the building (e.g., construction specifications) that might be of value in determining the mitigation strategy |
| Known Hazards | ***Prepare to provide:*** All information regarding known safety hazards for the building and adjacent or nearby buildings that might be related to design and installation of the mitigation systems. Information of concern, among others, includes for programs and regulations related to asbestos, lead paint or other hazards. |
| Visual inspection | ***Prepare to provide:*** Access for visual inspections. |
| Diagnostic Investigation | ***Prepare to provide:*** Access and funding for diagnostic procedures, as appropriate for effective system design. Procedures recommended or chosen will depend upon the level of complexity for identifying or characterizing conditions under, beside and within buildings to adequately project the effects of various system designs. |
| Communication Plan – Coordination<br><br>Access Notices Required | ***Prepare to provide:*** Coordination with Contractor and staff members (i.e. senior staff, appropriate communications staff and maintenance staff) to develop the communication plan<br>• Develop notices (with instructions, general information, health advisories and who to contact for inquiries) that may be specific for each affected audience, including facilitating staff such as maintenance managers and supervisors, and occupants.<br>• Develop timetables and means for distribution of notices.<br>• Specify which management staff member is responsible for on-site activities.<br>• Specify the structure of additional communication paths between senior staff, facilitating staff, maintenance staff and the professional radon service provider(s).<br>• Identify who is granted permission to respond to public inquiries and their contact information |



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## *Guidance When Considering Non-ASD Methods*

Keep in mind:

- **Teams**
  When elevated radon concentrations are found, assemble a team of qualified professionals that includes an experienced mitigation professional.

- **Source control**
  Aggressive source control for contaminants is a critical component in managing indoor air quality as in the examples of hazardous chemicals or microbial and bacterial contamination.

  ASD is a source control method for radon and other soil air contaminants. Therefore, compared to other mitigation methods, ASD will typically demonstrate far greater effectiveness in reducing indoor radon concentrations and of other soil gas contaminants. Additionally, ASD provides significant benefits compared to other mitigation methods that include energy conservation and ease of maintenance so critical in maintaining a Long-Term Operation, Maintenance and Monitoring Plan.

- **Limitations of Non-ASD methods:**
  Dilution alone is unlikely to be a practical solution if radon concentrations are high. For instance, unless the unit's walls and floors are constructed or rendered to be a complete sealed isolation assembly, other mitigation methods beyond air mixing or additions of outdoor air will most often be needed if initial radon concentrations are above 10 pCi/L.

  The effects of pressurizing a building or individual airspace can be more pronounced yet each of these methods require rigorous diagnostic evaluations, inspections, and maintenance for continued safety of occupants.
  - See Companion Guidance Section F and G to gain a sense of complexity associated with HVAC inspection and maintenance that needs to be rigorously applied in order to expect long-term success in risk reductions.
  - See Section 10.5 (OM&M Manuals) and Section 12 (Non-ASD Systems/Methods) for requirements of non-ASD methods. These provisions seek to secure the continued safety of occupants.

Overall Indoor Air Quality:

The presence of elevated radon or other soil gas concentrations indoors can sometimes be an indicator of other indoor air quality concerns.

HVAC systems should be maintained with regular inspections and repairs in a manner to ensure healthy indoor air quality. Information that inherently addresses indoor air quality issues relative to most large buildings can be found at EPA: https://www.epa.gov/indoor-air-quality-iaq

Occupant symptoms that might guide or trigger an evaluation of indoor air quality and HVAC are described in EPA's "Problem Solving Tool": https://www.epa.gov/iaq-schools/indoor-air-quality-problem-solving-tool

EPA's "Tools For Schools Action Kit" provides comprehensive tools for evaluation of ventilation systems under the Section for "Ventilation Checklist" and related "backgrounder" document: https://www.epa.gov/iaq-schools



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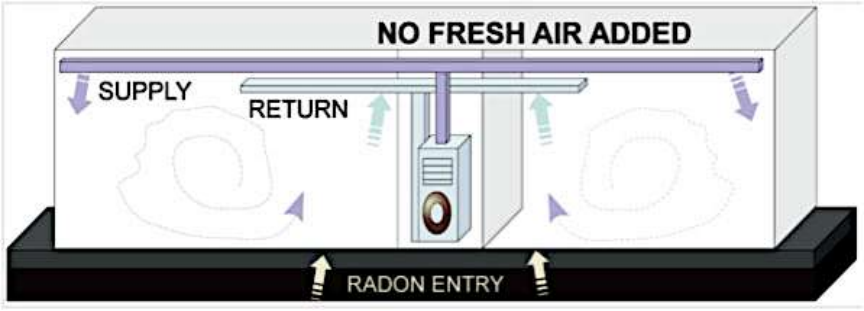
# HVAC GROUP DESCRIPTIONS

## Group 1: BASIC HEATING AND COOLING (HAC)

Dedicated system(s) that do not supply additional outdoor air for ventilation.

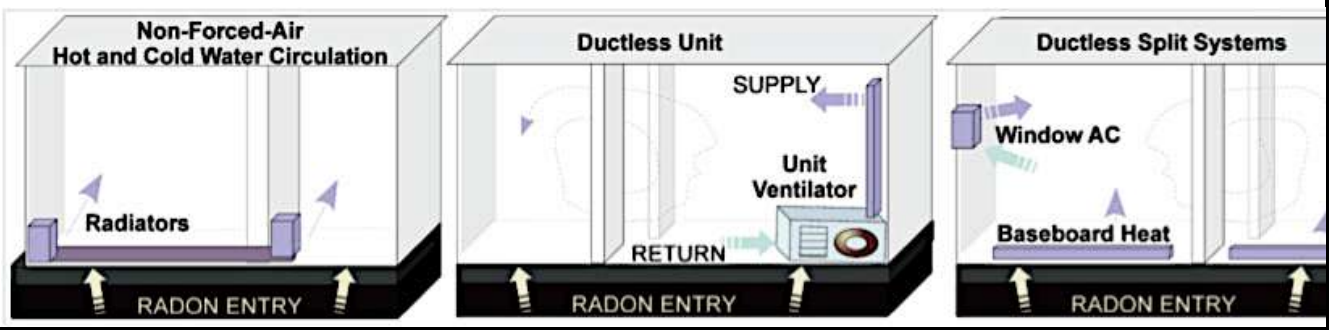



**HAC Systems:**
Many buildings have forced-air heating and air conditioning (HAC) systems.

Supply and return ducts distribute air around the building.

**Ductless Systems:**
Some rooms or dwellings do not have ducted forced-air distribution.

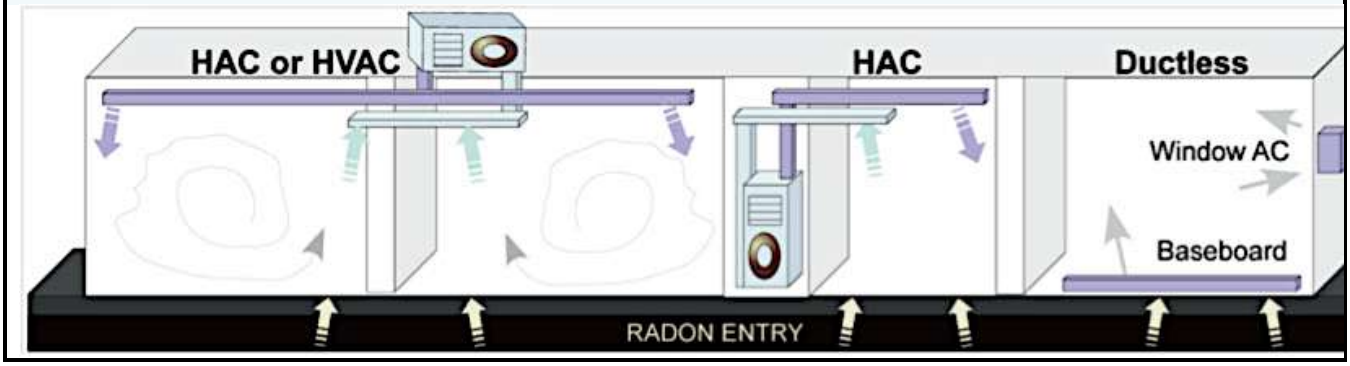
- Hot and Cold-Water Circulation (sometimes referred to as "radiator" systems).
- Window Air Conditioners.
- Wall or Baseboard Heating/Cooling Systems.
- Ductless Split Systems with one unit for cooling and another unit for heat (i.e., Window AC for cooling and Baseboard or Wall units for heat).




## Group 2: MULTI-ZONE SYSTEMS

*Multi-zone systems* are those where different air handlers or systems are employed and independently controlled for different areas within the same dwelling or common use area of a building.

Radon concentrations can vary from room to room based upon variances in system operations.



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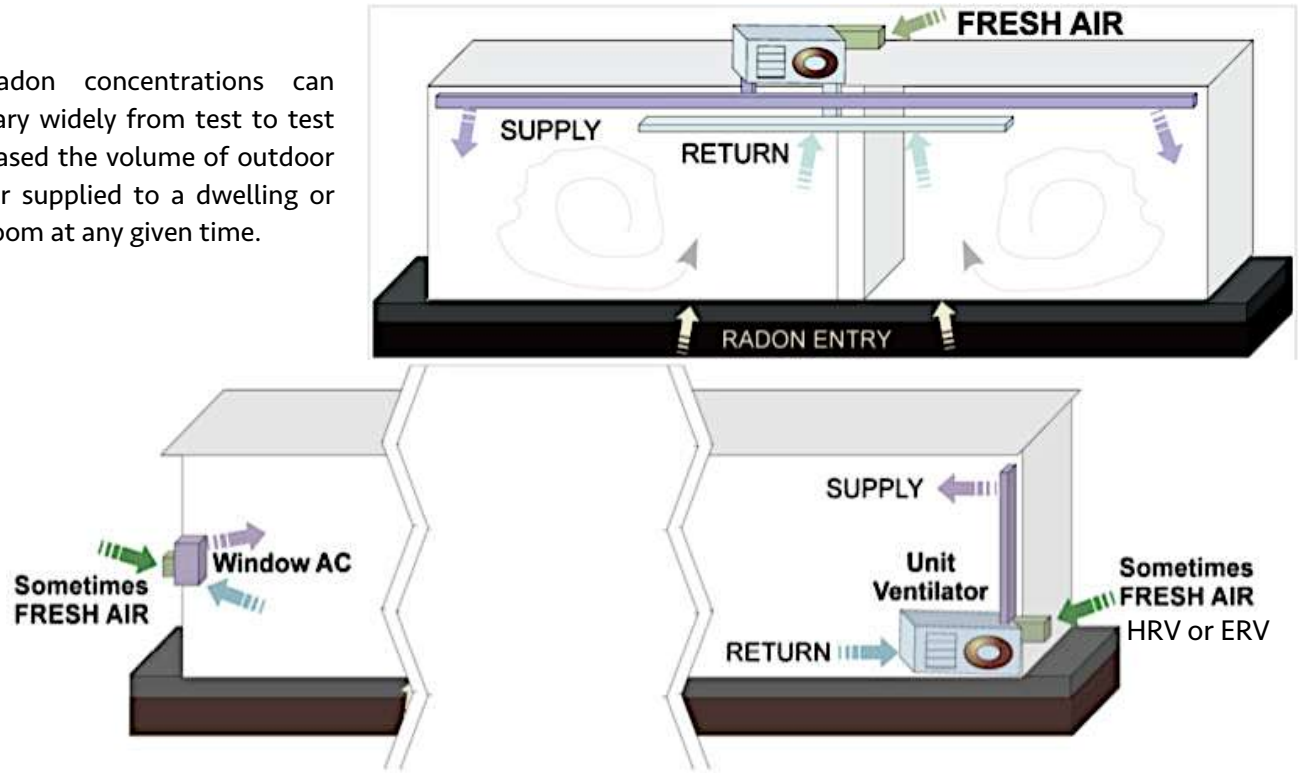
## HVAC GROUP DESCRIPTIONS

### Group 3: VARIABLE OUTDOOR AIR VENTILATION

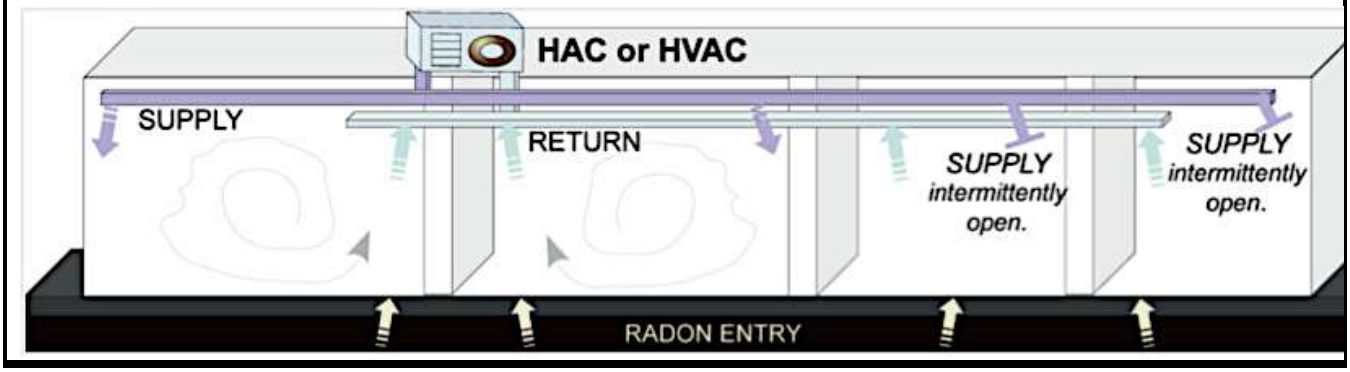
*Variable Outdoor Air Ventilation* (HVAC) systems are those that add outdoor air ventilation for seasonal comfort or energy savings. Such systems may service a whole building, multiple dwellings or a single dwelling or unit ventilator.

Radon concentrations can vary widely from test to test based the volume of outdoor air supplied to a dwelling or room at any given time.




### Group 4: VARIABLE AIR DISTRIBUTION

*Variable Air Distribution* systems are those where airflow from a single air handler is distributed to multiple dwellings, rooms or common use areas with independent controls within each area that open and close duct dampers. The normal operation of these systems can cause changes in distribution of radon or ventilation air and can also affect pressure relationships that can enhance or diminish radon entry.



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## CG Section C CALCULATING AVERAGE BUILDING OPERATING CONDITIONS

The following methodology is intended to be simplistic yet reasonable for use.

1) Know The Average Occupied Indoor Temperature: 74˚ F (23˚ C)
   Due to required comfort for occupants, the average indoor temperature is usually maintained with stability between 68˚ to 82˚ F (20˚ to 28˚ C). Use an average of about 74˚ F (23˚ C) during estimations unless known to be specifically different. HVAC systems are set to respond to needs for maintaining this comfort range during significantly occupied periods.

2) Identify When the Building Is Significantly Occupied

3) Identify The Average Local Outdoor Temperatures During Significantly Occupied Months
   HVAC systems respond to changes in outdoor temperatures by activating heating, cooling and ventilation air handlers including certain designs that introduce outdoor air ventilation into a building.

4) Identify Periods When Heating and Cooling Systems Activate

| | |
|---|---|
| Heating Systems | In response to needs for indoor comfort:<br>Heating systems will often activate when outdoor temperatures drop to below about 65° F (18˚ C). |
| Cooling Systems | In response to needs for indoor comfort:<br>Cooling systems will normally be active when outdoor temperatures exceed about 75° F (28˚ C). |

### Examples of Heating and Cooling Activity

24 Hour Averages

**24 Hour Temp Averages**

| | ZONE | | Annual Avg | 9 mo School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 Very Hot | Miami, FL | 76 | 74 | 82 | 79 | 74 | 69 | 68 | 69 | 72 | 75 | 79 | 82 | 83 | 83 |
| | 2 Hot | New Orleans, LA | 69 | 64 | 79 | 70 | 61 | 55 | 52 | 55 | 62 | 69 | 76 | 81 | 82 | 82 |
| | 3 Warm | Atlanta, GA | 62 | 56 | 73 | 63 | 53 | 45 | 43 | 46 | 53 | 62 | 70 | 77 | 79 | 79 |
| | 4 Mixed | Phillidelpia, PA | 55 | 48 | 68 | 57 | 47 | 36 | 32 | 34 | 42 | 53 | 63 | 72 | 77 | 76 |
| | 5 Cool | Chicago, IL | 49 | 42 | 65 | 53 | 40 | 27 | 22 | 26 | 37 | 49 | 59 | 69 | 74 | 72 |
| | 6 Cold | Minneapolis, MN | 45 | 37 | 61 | 50 | 33 | 19 | 13 | 18 | 31 | 46 | 59 | 68 | 73 | 71 |
| | 7-Very cold | Minot, ND | 39 | 30 | 56 | 45 | 26 | 14 | 6 | 11 | 21 | 41 | 53 | 61 | 68 | 67 |
| | 8 SubArctic | Fairbanks, AK | 27 | 17 | 45 | 25 | 4 | -6 | -8 | -2 | 11 | 31 | 49 | 60 | 62 | 57 |
| | 8 SubArctic | Cambridge Bay | 6 | -6 | 32 | 11 | -9 | -21 | -27 | -27 | -22 | -7 | 15 | 36 | 47 | 44 |

Daytime Only Averages

**Daytime Temp Averages**

| | ZONE | | Annual Avg | 9 mo School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 Very Hot | Miami, FL | 80 | 78 | 85 | 82 | 77 | 73 | 72 | 73 | 76 | 79 | 83 | 85 | 86 | 87 |
| | 2 Hot | New Orleans, LA | 73 | 69 | 83 | 75 | 66 | 60 | 57 | 60 | 67 | 74 | 80 | 85 | 87 | 86 |
| | 3 Warm | Atlanta, GA | 67 | 61 | 78 | 68 | 58 | 50 | 48 | 51 | 59 | 68 | 75 | 82 | 84 | 84 |
| | 4 Mixed | Phillidelpia, PA | 59 | 52 | 73 | 62 | 51 | 40 | 36 | 38 | 47 | 58 | 68 | 77 | 82 | 81 |
| | 5 Cool | Chicago, IL | 54 | 46 | 70 | 58 | 44 | 31 | 26 | 30 | 41 | 54 | 65 | 75 | 79 | 77 |
| | 6 Cold | Minneapolis, MN | 50 | 41 | 66 | 55 | 37 | 23 | 17 | 23 | 35 | 51 | 64 | 73 | 78 | 76 |
| | 7-Very cold | Minot, ND | 45 | 36 | 63 | 51 | 31 | 19 | 11 | 16 | 26 | 47 | 59 | 67 | 75 | 74 |
| | 8 SubArctic | Fairbanks, AK | 32 | 21 | 50 | 29 | 8 | -3 | -4 | 3 | 18 | 37 | 55 | 65 | 67 | 62 |
| | 8 SubArctic | Cambridge Bay | 9 | -3 | 33 | 14 | -6 | -18 | -24 | -24 | -18 | -2 | 19 | 39 | 51 | 46 |



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## 5) Identify The Normal Average Occupied Operating Condition

A. Calculate the Average Occupied Operating Condition
The operational condition for the building or unique sector of the building that represents the greatest amount of significantly occupancy time.

B. Clear Characterization
Identify the operating conditions most likely to emphasize a clear characterization of a radon hazard.
This is primarily time periods when the difference between indoor and outdoor temperatures cause:

a) Some degree of regularity for natural negative air pressure inside the building as compared to outside of the building (e.g., stack effect), and;

b) Some degree of regularity in the activity of heating or cooling system blowers.

This would not include time periods when the volume of outdoor air introduced into the building exceeds the minimum amounts required to maintain occupant health.

**EXAMPLE WORKSHEET**

1) Identify the average occupied indoor temperature: ❑ 74˚ F (23˚ C) ❑ Other _____.

2) Identify the months per year that represent significant occupancy for each unique sector of the building.

❑ 12 months (as common for dwellings and most large buildings that house business occupancies).

❑ 9 months (as common for many school buildings).

❑ Other _____

Identify the hours of the day that represent significant occupancy for each unique sector of the building.

❑ 10-hour occupancies (e.g., Work or school day plus routine afternoon meetings, classes or sports).

❑ 24-hour occupancies (e.g., Dwellings and 24/7 services such as hospitals).

❑ Other _____

3) Identify the average outdoor temperatures during periods of significant occupancy.

| Annual | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ | ___ |

4) Calculate average HVAC activity during significantly occupancy periods

| HVAC Mode | Months in each operational mode | Total Months | Yearly % |
|---|---|---|---|
| Heating Active | ❑ Jan ❑ Feb ❑ Mar ❑ Apr ❑ May ❑ Jun ❑ Jul ❑ Aug ❑ Sep ❑ Oct ❑ Nov ❑ Dec | ___ | ___% |
| Cooling Active | ❑ Jan ❑ Feb ❑ Mar ❑ Apr ❑ May ❑ Jun ❑ Jul ❑ Aug ❑ Sep ❑ Oct ❑ Nov ❑ Dec | ___ | ___% |
| None (mixed) | ❑ Jan ❑ Feb ❑ Mar ❑ Apr ❑ May ❑ Jun ❑ Jul ❑ Aug ❑ Sep ❑ Oct ❑ Nov ❑ Dec | ___ | ___% |

**Example for Schools**

Daytime Averages

> 75˚F Cooling

66˚ - 75˚ F Intermittent

< 65˚F Heat

**Daytime Temp Averages**

| ZONE | | Annual Avg | 9 mo School Avg | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 Very Hot | Miami, FL | 80 | 78 | 85 | 82 | 77 | 73 | 72 | 73 | 76 | 79 | 83 | 85 | 86 | 87 |
| 2 Hot | New Orleans, LA | 73 | 69 | 83 | 75 | 66 | 60 | 57 | 60 | 67 | 74 | 80 | 85 | 87 | 86 |
| 3 Warm | Atlanta, GA | 67 | 61 | 78 | 68 | 58 | 50 | 48 | 51 | 59 | 68 | 75 | 82 | 84 | 84 |
| 4 Mixed | Phillidelpia, PA | 59 | 52 | 73 | 62 | 51 | 40 | 36 | 38 | 47 | 58 | 68 | 77 | 82 | 81 |
| 5 Cool | Chicago, IL | 54 | 46 | 70 | 58 | 44 | 31 | 26 | 30 | 41 | 54 | 65 | 75 | 79 | 77 |
| 6 Cold | Minneapolis, MN | 50 | 41 | 66 | 55 | 37 | 23 | 17 | 23 | 35 | 51 | 64 | 73 | 78 | 76 |
| 7-Very cold | Minot, ND | 45 | 36 | 63 | 51 | 31 | 19 | 11 | 16 | 26 | 47 | 59 | 67 | 75 | 74 |
| 8 SubArctic | Fairbanks, AK | 32 | 21 | 50 | 29 | 8 | -3 | -4 | 3 | 18 | 37 | 55 | 65 | 67 | 62 |
| 8 SubArctic | Cambridge Bay | 9 | -3 | 33 | 14 | -6 | -18 | -24 | -24 | -18 | -2 | 19 | 39 | 51 | 46 |



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**CG Section D** **ASD — Example Maintenance Schedule/Log**

## ASD: Original Startup System Components and Settings

Friendship School and Office Park, 26000 Main, Anywhere, US

| *System* | #1 | #2 | #3 | #4 | #5 | #6 |
|---|---|---|---|---|---|---|
| *System Fan Monitor Location* | Bldg #1 Rm. 110 | Bldg #4 Laundry | Bldg #5 E Corridor | Bldg #5 W. Hall | Bldg #7 Rm 732 | Bldg #9 Office |
| *Fan Model* | A21C | A21C | A63B | A21C | A21C | A21C |
| *Fan Location* | Attic | East side | Rear | Attic | Attic | Attic |
| *Fan Monitors Type* | U-Tube | U-Tube | U-Tube | U-Tube | U-Tube | U-Tube |
| ***Items to inspect with sealed items to remain sealed*** | | | | | | |
| *Fan Monitor (Startup Differential)* | 1.7" | 1.5" | 2.0"/ | 1.5" | 3.5" | 1.0" |
| *Sumps* | Sealed | N/A | Sealed | Sealed | N/A | (2)Sealed |
| *Crawl membrane* | N/A | East wing | N/A | N/A | N/A | N/A |
| *Isolation Assembly* | N/A | N/A | N/A | N/A | Crawlspace | N/A |

### Location of Detailed Information:

See all manufacturer, warranty and instructional information in the systems manual located at:

Main Shop Office

## ASD Inspection / Maintenance Log

| Year 2014 | | Qtr 1 Jan 15 . | Qtr 2 Apr 10 . | Qtr 3 July 15 | Qtr 4 |
|---|---|---|---|---|---|
| Sys. # 1 Bldg #1 | Fan Monitors | [X] Wally M | [X] WM | [X] John B | [ ] |
| | Sealed Items | [X]sump sealed | [X] WM | [X] JB | [ ] |
| | Piping/Labels | [X] WM | [X] WM | [X] JB | [ ] |
| | *Noted concerns:* | | | | |
| | Last Radon Test (at least every 2 years) | [ ] | [ ] | [X]July 10 | [ ] |
| Sys. # 2 Bldg #4 | Fan Monitors | [X] WM | [X] WM | [X] New Fan | [ ] |
| | Sealed Items | [X] WM | [X] WM | [X] JB | [ ] |
| | Piping/Labels | [X] WM | [X] WM | [X] JB | [ ] |
| | *Noted concerns:* 1/15/14 Occupants observed fan noise. | | | | |
| | Last Radon Test (at least every 2 years) | [ ] | [ ] | [X] July 10 | [ ] |
| Sys. # 3 Bldg #5 | Fan Monitors | [X] WM | [X] WM | [X] JB | [ ] |
| | Sealed Items | [X] WM | [X] WM | [X] JB | [ ] |
| | Piping/Labels | [X] WM | [X] WM | [X] JB | [ ] |
| | *Noted concerns:* | | | | |
| | Last Radon Test (at least every 2 years) | [ ] | [ ] | [X] July 10 | [ ] |



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## Non-ASD: Original Startup System Components and Settings

Friendship High School, 26000 Main, Anywhere, US

| *System* | #7 | #8 |
|---|---|---|
| *System Fan Monitor Location* | Bldg #6 Rm. 615 | Bldg #8 Shop |
| *Fan (Air Handler) Model* | Z2946-12 | Z2946-12 |
| *Location* | Basement | Basement |
| *Fan Monitors Type* | U-Tube | U-Tube |
| *Fan Monitor (Startup Differential)* | 12 " | 14" |
| *Sumps* | Sealed | N/A |
| *Crawl membrane* | N/A | N/A |
| *Isolation Assembly* | N/A | All First floor (Windows and Doors) |

### Location of Detailed Information:

See all manufacturer, warranty and instructional information in the systems manual located at:

Main Shop Office

## Non-ASD Mitigation: HVAC Inspection / Maintenance Log

| Year 2014 | | Qtr 1 Jan 15 | Qtr 2 Apr 10 | Qtr 3 July 15 | Qtr 4 |
|---|---|---|---|---|---|
| Sys. # 7 26101 Main, Building 10 | Fan Monitors | [X] John Brown | [X] Bill B. | [X] JB | [ ] |
| | HVAC components *(See attached checklist)* | [X] JB | [X]Controls had been altered. | [X] JB | [ ] |
| | Sealed items | [X] JB | [X] BB | [X] JB | [ ] |
| | Piping/Labels | [X] JB | [X] BB | [X] JB | [ ] |
| | *Noted concerns:* 4/10/14 installed lock-out box for local control settings (w/ radon label). | | | | |
| | Last Radon Test (at least every 2 years) | [ ] | [ ] | [X] July 10 | [ ] |
| Sys. # 8 26111 Main, Building 11 | Fan Monitors | [X] Door closer adjusted. | [X] BB | [X] JB | [ ] |
| | HVAC components *(See attached checklist)* | [X] JB | [X] BB | [X] JB | [ ] |
| | Sealed items | [X] JB | [X] BB | [X] JB | [ ] |
| | Piping/Labels | [X] JB | [X] BB | [X] JB | [ ] |
| | *Noted concerns:* | | | | |
| | Last Radon Test (at least every 2 years) | [ ] | [ ] | [X] July 10 | [ ] |



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Inspected items that might reveal a need for system repair.

## Non-ASD Mitigation: HVAC Inspection Checklist

### Routine Operation and Maintenance

*Note: The information in this table is significantly drawn from EPA's "Tools For Schools Action Kit" that inherently addresses indoor air quality issues that relate to many large buildings.*

| **Address:** 26201 Main, Building 10 **System:** #7 **Date:** Apr 10, 2014 | | **Notes** | **Staff**: |
|---|---|---|---|
| **Inspection:** *Air Handling Unit* | Is the airflow from vents sufficiently meeting mitigation system design specifications?[1] [2] | 1200 CFM | JB |
| | Are the filters clean and properly installed? | Replaced | JB |
| | Are dampers operating correctly | X | JB |
| **Inspection:** *Controls, Temperature and Humidity* | Are the control settings and thermostat set to properly meet mitigation system design specifications? | X | JB |
| | Observations that may warrant further investigation/remediation:<br>• Is air flowing from the vent too cool or too warm?<br>• Does condensation frequently form on windows or cold surfaces?<br>• Is there an objectionable odor?<br>• Are areas in the building overly dusty? | none | JB |
| **Inspection:** *Outdoor Air Supply* | Is the ventilation system including related fans on? | X | JB |
| | Are outdoor intakes, vents or ducts blocked? | X | JB |
| | Is the airflow from vents sufficiently meeting mitigation system design specifications?[1] [2] | 1200 CFM | JB |
| | Is the airflow through outdoor intakes sufficiently meeting mitigation system design specifications?[1] [2] | 250 CFM | JB |
| | Observations that may warrant further investigation/remediation:<br>• Are there reports from occupants regarding drowsiness or discomfort or other observations that suggest outdoor air supply is inadequate (i.e. < 15 cfm per person)?<br>• Are combustion appliances in rooms without adequate ventilation? | none | JB |

[1] **Airflow**: To detect airflow, use special chemical smoke or a piece of tissue. Release puffs of smoke near openings between the complaint area and adjacent areas (openings include cracks, ducts, wiring and plumbing passageways, and leaky or open doors and windows). Release smoke near vents and grilles to determine airflow direction, if any. Do not breathe on or move quickly near puffs of smoke.

[2] **Air Volume:** Flowhoods are designed to measure airflow at grilles and diffusers. Pitot tubes are designed to measure air velocity in ducts; air velocity is then used to calculate airflow. While flowhoods are more expensive to purchase than pilot tubes, they are easier to use and can be used to measure airflow in ducts by summing the airflows from all vents connected to a given duct.



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## CG Section G Comprehensive HVAC System Diagnostic/Repair Checklist

*Informative Advisory:* This table may be helpful during pre-mitigation evaluations or post mitigation inspections associated with a "Long-Term Operation, Maintenance and Monitoring Plan".

| | |
|---|---|
| **1. OUTDOOR AIR INTAKES** | |
| **OBSTRUCTIONS:** | Ensure outdoor air intakes are clear of obstructions, debris, clogs, or covers. |
| **POLLUTANT SOURCES:** | Resolve any problems with pollutant sources located near outdoor intakes. |
| **AIRFLOW:** | Confirm that outdoor air is entering the intake appropriately. |
| **2. SYSTEM CLEANLINESS** | |
| **AIR FILTERS:** | Replace filters per maintenance schedule. |
| **3. CONTROLS FOR OUTDOOR AIR SUPPLY** | |
| | Ensure that air dampers are at least partially open (minimum position).<br>Ensure that minimum position provides adequate outdoor air for occupants. |
| **CONTROLS INFORMATION** | |
| | Obtain and review all design inside/outside temperature and humidity requirements, controls specifications, as-built mechanical drawings, and controls operations manuals (often uniquely designed). |
| **CLOCKS, TIMERS, SWITCHES** | |
| | Ensure summer-winter switches are set the correct position with time clocks set appropriately. Ensure that settings fit the actual schedule of building use (including night/weekend use). |
| **CONTROL COMPONENTS** | |
| | Ensure all controls and sensors are functional at both the occupied (day) and the unoccupied (night) settings. This includes checking line pressure for pneumatic controls under both conditions. |
| **OUTDOOR AIR DAMPERS:** | |
| | Ensure the outdoor air damper fully closes within a few minutes of shutting off the air handler and opens (at least partially with no delay) when the air handler is turned on.<br>• In heating mode, the outdoor air damper should go to its minimum position (without completely closing) when the room thermostat is set to 85°F.<br>• In cooling mode, the outdoor air damper should go to its minimum position (without completely closing) when the room thermostat is set to 60°F and mixed air thermostat is set to 45°F. |
| **FREEZE STATS:** | |
| *Freeze-stats close the outdoor air damper and disconnect the supply of outdoor air when tripped. They trip intentionally when the outdoor temperature range is 35°F to 42°F to protect water coils within HVAC units from the cold. As a result, mitigation systems can fail during the time periods of freezing outdoor temperatures or Freeze-stat failure.* | |
| | For general maintenance, confirm that any freeze stats are functional as designed. |
| **MIXED AIR THERMOSTATS:** | |
| | Ensure that the mixed air stat for heating mode is set no higher than 65°F and for cooling mode, it is set no lower than the room thermostat setting. |
| **ECONOMIZERS:** | |
| *Economizer systems vary the amounts of outdoor air supplied to the building to assist with the cooling load of the room or rooms. Unless economizer systems leave dampers adequately open for meeting minimum mitigation requirements, mitigation systems are likely to fail during the time periods of either high or low outdoor temperatures and including times of high humidity.*<br>*There are two types of economizers, dry-bulb and enthalpy. The dry-bulb is typically set at 65°F or lower. Dry-bulb economizers vary the amount of outdoor air based on outdoor temperature, and enthalpy economizers vary the amount of outdoor air based on outdoor temperature and humidity level.* | |
| | Confirm proper economizer settings are based on design specifications or local practices and in conformance with design criteria required for mitigation.<br>Ensure that dampers operate properly (for outside air, return air, exhaust/relief air, and recirculated air), per the design specifications. |
| **FANS:** | Ensure that all fans (supply fans and associated return or relief fans) that move outside air indoors continuously operate during occupied hours (even when room thermostat is satisfied). |



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| 4. AIR DISTRIBUTION |
|---|
| **AIR DISTRIBUTION:**<br>Ensure that supply and return vents are open and unblocked.<br>Ensure that supply and return air pathways in the existing ventilation system perform as required. This includes passive gravity relief ventilation systems and transfer grilles between rooms and corridors are functioning. If ventilation systems are closed or blocked to meet current fire codes, consult with a professional engineer for remedies.<br>Ensure every occupied space has supply of outdoor air (mechanical system or operable windows). |
| **PRESSURIZATION IN BUILDINGS:**<br>Ensure that the system, including any exhaust fans, is operating on the "occupied" cycle when evaluating pressurization.<br>Ensure that air flows out of the building through windows, doors, or other cracks and holes in exterior wall (for example, floor joints, pipe openings). |
| **5. EXHAUST SYSTEMS** |
| Exhaust systems are designed to keep certain rooms or areas under negative pressure (as compared to surrounding spaces). Exhaust systems are employed often to prevent migration of indoor contaminants from areas such as bathrooms, kitchens and labs to other areas of the building. |
| **EXHAUST FAN OPERATION:** Ensure that air flows into exhaust fan grille(s) |
| **EXHAUST AIRFLOW:**<br>Ensure that air is drawn inwards into the room from adjacent spaces.<br>Ensure that air is flowing toward the exhaust intake. |
| **EXHAUST DUCTWORK:** Ensure ductwork downstream of the fan is sealed and in good condition |
| **6. QUANTITY OF OUTDOOR AIR** |
| **OUTDOOR AIR MEASUREMENTS AND CALCULATIONS:**<br>Measure the quantity of outdoor air supplied to each ventilation unit.<br>•Calculate the number of occupants served by the ventilation unit under consideration.<br>•Divide outdoor air supply by the number of occupants to determine the existing quantity of outdoor air supply per person. |
| **ACCEPTABLE LEVELS OF OUTDOOR AIR QUANTITIES:**<br>Compare the existing outdoor air per person to the recommended levels in ANSI/ASHRAE Standard 62.1-2010 "Ventilation for Acceptable Indoor Air Quality" for buildings that are more than three stories tall or ANSI/ASHRAE Standard 62.2-2010 "Ventilation and Acceptable Indoor Air Quality in Low-Rise Residential Buildings".<br>Correct problems with ventilation units that supplied inadequate quantities of outdoor air. |



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ANSI/AARST

SGM-MFLB 2023

# Soil Gas Mitigation Standards for existing Multifamily, School, Commercial and Mixed-Use Buildings

AARST CONSORTIUM ON NATIONAL STANDARDS
www.standards.aarst.org

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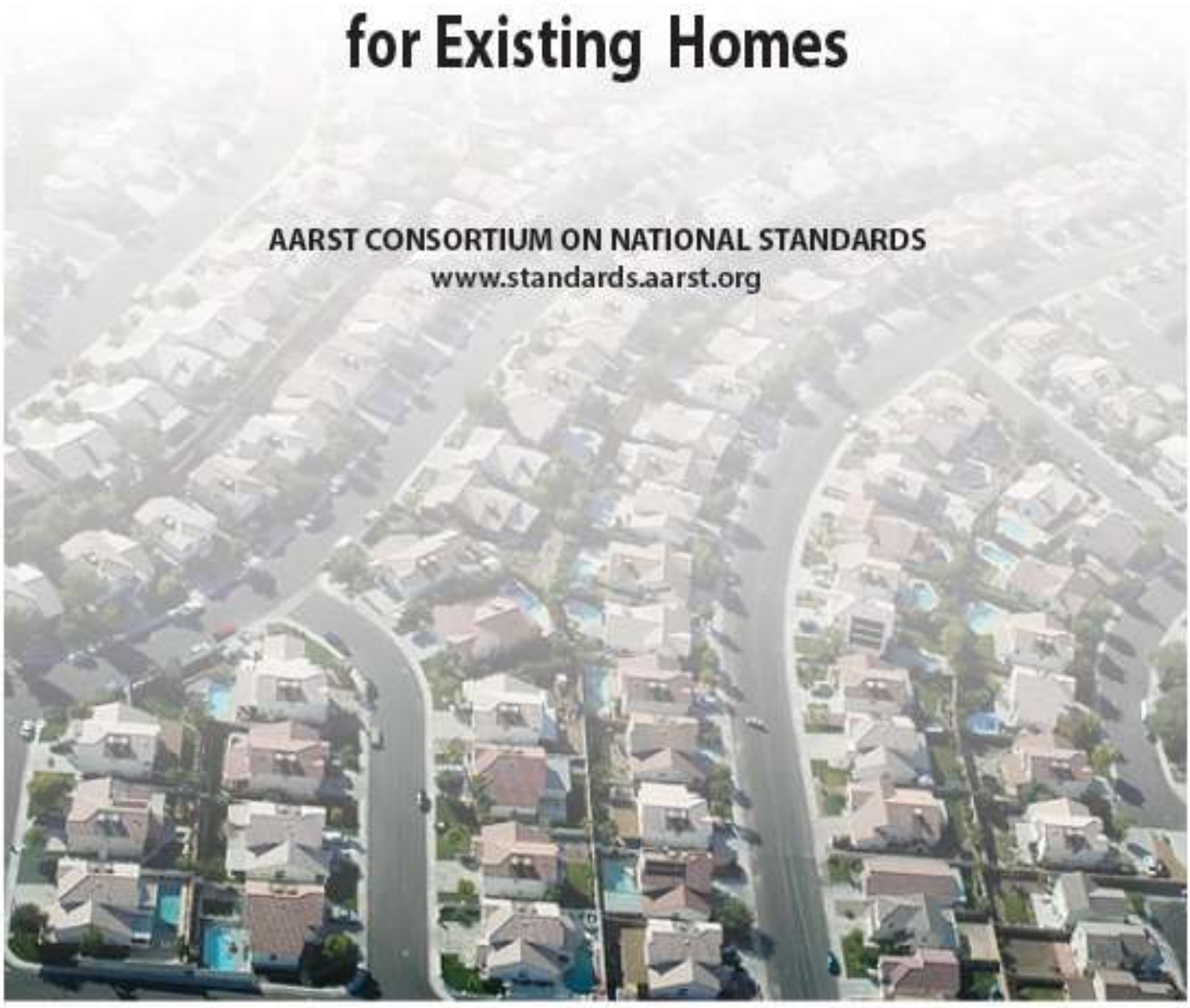

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# SGM-SF 2023

Soil Gas Mitigation Standards for Existing Homes

## Scope Summary and Introduction

This standard specifies practices, minimum requirements and, general guidance for reducing soil gas entry into existing homes in order to mitigate occupant exposures to certain hazardous soil gases, including radon gas, chemical vapors and other hazardous gases. This standard of practice is applicable to residential structures to include those not more than three stories above-grade in height, those often classified as single-family structures, and those that contain not more than four attached dwelling units on a contiguous foundation.

### Updates for 2023

SGM-SF is now harmonized for interactive use with ANSI/AARST SGM-MFLB (Soil Gas Mitigation in Existing Multifamily, School, Commercial and Mixed-Use Buildings). These standards are now rendered in mandatory style where most guidance is not integrated into the body of the standard. This style is necessary to be recognized or adopted by many jurisdictions of authority. Because radon and vapor intrusion mitigation technologies are parallel technologies, provisions that differ are integrated within topics of both SGM-SF and SGM-MFLB and identified as applicable to the topic. While recommended for immediate use, the effective date for compliance with this standard is December 1st, 2023.

Note—SGM-MFLB consolidates ANSI/AARST RMS-MF (rev. 12/20) and ANSI/AARST RMS-LB (rev. 12/20) into a single publication. For clarity when reading, SGM-MFLB provides only:

a) content that is in addition to requirements already rendered in SGM-SF, and

b) content not normally associated with mitigation of homes.

### Significance of Purpose

This document contains minimum requirements and guidance designed to respond to the health threat of radon gas, chemical vapors, and other hazardous soil gases.

**Radon:** Radon is the leading cause of lung cancer among nonsmokers and the second leading cause of lung cancer in the general population. Most people receive their greatest exposure to radon in their homes. Radon in U.S. homes causes approximately 21,000 lung cancer deaths each year.[1] Be it at home, work or school, an individual's exposure to radon gas combines over time to increase the risk of preventable lung cancer.

**Vapor intrusion:** The risk of adverse health effects from inhalation of toxic chemicals in the form of vapor or particulate matter can be significant. The level of concern depends upon the nature, frequency, and duration of exposure to the chemical(s). Where chemicals of concern are present in soils adjoining a building, mitigation methods for chemical vapor concentrations in indoor air are similar.

### Historical Perspective (Radon)

In the 1980s, studies found that exposure to radon in homes can exceed exposures found in studies of mine workers. Since 1988, the Indoor Radon Abatement Act has authorized U.S. state and federal activities to reduce citizen risk of lung cancer caused by indoor radon concentrations. In 1999, with the publication of BEIR VI [1], the National Academy of Sciences confirmed that any exposure to radon holds a degree of risk. In addition, the Academy's BEIR VII committee stated that exposure to radiation, including any concentration of radon, carries risk. In 2009, the World Health Organization's WHO Handbook on Indoor Radon confirmed the association between indoor radon exposure and lung cancer, even at the relatively low radon levels found in residential buildings. [2]

### Normative References

National standards for materials, practices, and building codes are identified in Section 13.2 (Normative References).

### Designation: SGM-SF

As used for catalogue identification, "SGM-SF" stands for Soil Gas Mitigation in Single Family Homes.

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[1] National Academy of Sciences, "Biological Effects of Ionizing Radiation" (BEIR VI Report) 1999

[2] World Health Organization, "WHO Handbook on Indoor Radon: A Public Health Perspective" 2009



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Other ANSI/AARST standards developed to respond to the threat of cancer caused by radon:

| | |
|---|---|
| ANSI/AARST MAH | (Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes) |
| ANSI/AARST MA-MFLB | (Protocol for Conducting Measurements of Radon and Radon Decay Products in Multifamily, School, Commercial and Mixed-Use Buildings)<br>*Note—Previously published as ANSI/AARST MAMF and MALB and now harmonized and consolidated into a single standard.* |
| ANSI/AARST MW-RN | (Protocol for the Collection, Transfer and Measurement of Radon in Water) |
| ANSI/AARST MS-QA | (Radon Measurement Systems Quality Assurance) |
| ANSI/AARST MS-PC | (Performance Specifications for Instrumentation Systems Designed to Measure Radon Gas in Air) |
| ANSI/AARST CC-1000 | (Soil Gas Control Systems in New Construction of Multifamily, School, Commercial and Mixed-Use Buildings) |
| ANSI/AARST CCAH | (Reducing Radon in New Construction of One & Two Family Dwellings and Townhouses) |
| ANSI/AARST RRNC | (Rough-in of Radon Control Components in New Construction of 1 & 2 Family Dwellings and Townhouses) |

## The Consensus Process

The consensus process developed for the AARST Consortium on National Standards and as accredited to meet essential requirements for American National Standards by the American National Standards Institute (ANSI) has been applied throughout the process of approving this document.

## Continuous Maintenance

This standard is under continuous maintenance by the AARST Consortium on National Standards for which the Executive Stakeholder Committee has established a documented program for regular publication of addenda or revisions, including procedures for timely, documented, consensus action on requests for change to any part of the standard.

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# SGM-SF 2023 (w/Companion Guidance printed)

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### Vapor Intrusion Companion Guidance


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# SGM-SF
# Soil Gas Mitigation Standards for Existing Homes

## 1.0 SCOPE

**1.1** This standard of practice specifies minimum requirements for methods that *mitigate* risks to occupants posed by the presence of *radon gas* and chemical vapors or gas in existing homes. This standard of practice is applicable to existing low-rise residential structures often classified as single-family structures and individual *dwellings* within a shared structure that contain no more than four attached *dwelling* units on a contiguous foundation.

### 1.2 Limitations

1.2.1 *Source materials*

This standard does not address practices associated with characterization, possession, handling, containment, generation, or disposal of radioactive or chemically contaminated materials.

1.2.2 *Mitigation methods*

This standard of practice addresses nearly all methods that reduce occupant exposure to *radon* or chemical vapors and gas in indoor air. However, it does not specify requirements related to removal or encapsulation of radioactive or chemical sources.

This standard does not specify requirements for practices related to:

a) removal of *radon gas* or chemicals from water or outdoor air;

b) biological or chemical methods that seek to neutralize toxicity of contaminated soil; and

c) soil vapor extraction (SVE), including contaminant capture and disposal methods.

*Informative advisory—Active soil gas depressurization (ASD)* methods prescribed in this standard *mitigate* occupant risk by preventing soil gas entry into occupied spaces. These designs need only address soil gas volumes that would otherwise intrude into a building. SVE designs that extract volatile organic compounds (VOC) mass from the soil are not designed to mitigate the current risk to occupants unless also demonstrating functional performance as required in Section 9 (Post-*mitigation*).

1.2.3 *Combustible gas*

This standard of practice does not address all practices that may be needed for *mitigation* of potentially combustible soil gases.

1.2.4 *Jurisdictional compliance*

This standard of practice does not contain all code or other requirements of the jurisdictions where the *mitigation* system is installed. Adherence to this standard does not guarantee or supersede compliance with the applicable codes or regulations of any federal, provincial, state, or local authority having jurisdiction.

1.2.5 *Safety*

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

1.2.6 *Design and warranties*

This standard of practice is not a complete design manual. Compliance with its provisions will not guarantee reduction of indoor radon or soil gas to any specific concentration.



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## 2.0 APPLICABILITY

### 2.1 Mandatory Conventions

The terms "shall," "required" and "normative" indicate provisions herein that are considered mandatory. Terms such as "should," or "recommended" and provisions prefaced by the term "Note" or "Informative" indicate provisions that may be helpful or good practice, but which are not mandatory.

### 2.2 Prior Systems

This standard shall not apply to radon or soil gas mitigation systems installed prior to its effective date, except for:

a) portions of a previously installed system that are altered. For the purposes of this standard, altering a radon or soil gas mitigation system does not include incidental repair, such as replacing worn out fans or other equipment with equivalent components, while leaving the remainder of the system unchanged; and

b) portions of a previously installed system that are not compliant with Section 6.4 (*ASD* Exhaust Discharge) and Section 6.5.2 (Safe fan locations).

Details of incidental repairs and system alterations shall be documented in jobsite logs for each event.

### 2.3 Use

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

## 3.0 QUALIFIED CONTRACTORS

### 3.1 Contractors, Teams, and Qualifications

The term "*Contractor*" within this standard shall refer to persons, individuals, or firms, regardless of the organizational structure of the entity, which engage in mitigating occupant risk from *radon gas* or chemical vapors and other soil gases that are present in indoor air.

To be considered qualified, the *contractor*, contracting team, or management team shall include at least one *"qualified mitigation professional"* as defined by:

a) Section 3.2, where mitigating occupant exposure to *radon* gas; and

b) Section 3.3, where mitigating occupant exposure to chemical vapors or other soil gases.

### 3.2 Radon Mitigation Professionals

A *"qualified radon mitigation professional"* is defined as:

"An individual who has demonstrated a minimum degree of appropriate technical knowledge and skills specific to design and installation of systems that mitigate occupant exposure to *radon gas* in existing homes as established in certification requirements of:

a) a national program that is compliant with requirements in Section 13.1; and

b) as required by local statute, state or provincial licensure or certification programs that evaluate individuals for radon-specific technical knowledge and skills."

#### 3.2.1 *Responsibilities*

Responsibilities for *qualified* ***radon*** *mitigation professionals* shall include compliance with all provisions in this standard except where identified within a provision as specific to only *mitigation* of chemical vapors or other soil gases.



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## 3.3 Soil Gas Mitigation Professionals

A *"qualified soil gas mitigation professional" is* defined as:

"An individual who has demonstrated a minimum degree of appropriate technical knowledge and skills specific to design and installation of systems that mitigate occupant exposure to hazardous chemicals vapors and gas in existing homes as established in listing or certification requirements of:

a) a national program that is compliant with requirements in Section 13.1; and

b) as required by local statute, state or provincial licensure or certification programs that evaluate individuals for soil-gas-specific technical knowledge and skills."

### 3.3.1 *Responsibilities*

Responsibilities for *qualified* ***soil-gas*** *mitigation professionals* shall include compliance with all provisions in this standard except where identified within a provision as specific to only *mitigation* of radon gas.

## 3.4 Quality Management

*Qualified mitigation professionals* shall establish, maintain, and follow a written quality management program.

**Informative Figure 3.4 Quality Management**

Continuous Goals:

a) *The Quality Objectives.* Mitigation designs that reduce concentrations attributable to soil gas hazards to below the target action levels, while aspiring to minimize known soil gas hazards; and

b) *Physical Quality.* Mitigation systems that are compliant with standards, codes, and statutes, while aspiring to achieve customer satisfaction.

*Plan*
Implement policies and procedures designed to meet quality goals.

*Track successes and failures*
***Input:*** Identify items to track that will help gauge if you are meeting quality goals.

*Take action to improve*
Make changes in policies and procedures to better meet quality goals.

*Review successes and failures*
***Output:*** Review tracked items for causes of failure in meeting quality goals.

### 3.4.1 *Quality management programs*

**Note**

Quality management programs shall include:

a) a means to track jobsite details relative to the scope of services the *mitigation contractor* provides, to address important tasks based on commitments to quality goals; and

b) retain records of training and experience for all staff members who participate in physical installation of *mitigation* system(s).

### 3.4.2 *Quality control oversight*

The quality management program shall identify individuals, as authorized by the *qualified mitigation professional(s)* and as permitted by statute, state licensure or certification program, who are responsible for *mitigation* activities in accordance with requirements in a) and b) of this Section 3.4.2.



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a) Quality of *mitigation* design
Program records shall include currently valid certifications/licenses for persons identified as *qualified mitigation professionals*, in accordance Sections 3.2 or 3.3, who are to be responsible for the quality of *mitigation* design and effectiveness.

b) Oversight of jobsite activities
For quality management programs that allow subordinate *qualified professionals* or journey level installers to oversee various jobsite activities while working under the responsible charge of a *qualified mitigation professional*, oversight duties shall not be authorized until quality management records include:

1. The identity of the installer and scope of their oversight authority, to include authorization to temporarily stop work if quality or safety is being compromised; and
2. Currently valid certifications/licenses, related experience, and educational benchmarks, as established by authorities identified in Sections 3.2 or 3.3, that demonstrate a minimum degree of technical knowledge and skills specific to the tasks being conducted.

3.4.3 *Jobsite records*

Quality control (QC) records, specific to each individual *mitigation* effort and system design, installation, and modification, shall be retained in jobsite tracking forms, logs, diagrams or photographs that include:

a) details desired by the *contractor* for tracking quality and those otherwise required in this standard;

b) solutions derived during design or installation that are custom to the building and not the same basic design feature for every building;

c) the identity of the *qualified mitigation professional* responsible for design and effectiveness; and

d) the identity of the *qualified mitigation professional* or authorized journey level installer physically present at each jobsite event who is responsible for quality oversight of the event.

3.4.4 *Managing quality*

The quality management program shall include a written commitment to quality goals and identify a *qualified mitigation professional* who, in coordination with management, is responsible to:

a. update ongoing program changes they deem necessary to better meet quality goals, and

b. review QC records and efforts to improve *quality control* at least annually to ensure program changes are updated, effective, documented and disseminated to affected staff members.

Note—See https://www.iso-9001-checklist.co.uk/9.3-management-review.htm

# 4.0 GENERAL PRACTICES

## 4.1 Assemble Building Information

Prior to providing proposals, the *contractor* shall obtain or attempt to obtain information that includes:

a) The objective of the *mitigation*, be it *radon gas*, *chemicals of concern (COCs)*, flammable gas or proactive *mitigation* efforts due to suspected hazards;

b) The results of any *radon* measurements or measurements of *chemicals of concern* with information relative to action levels, toxicology, site classification and any other concurrent remedial actions. Measurement results and any related information shall be recorded and retained in jobsite records;

c) Building details regarding design and construction practices for each attached foundation area. The approximate age of the building or portion of the building targeted for *mitigation* shall be determined and recorded in jobsite records; and

d) Any *diagnostic* procedures and measurements that have been conducted for each building or the common portion(s) of the building(s) to be mitigated.



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4.1.1 *Insufficient data*

The *contractor* shall advise the *client* in writing when additional testing or diagnostics are required to characterize dynamics of *radon* or soil gas entry into the building, particularly as it relates to capacity for either:

a) design of appropriate *mitigation* system(s); or

b) protection for all occupants of the building.

When extenuating circumstances warrant immediate action, the *contractor* is permitted however to proceed with *mitigation designs* and installations.

4.1.2 *Diagnostic proposals*

The *contractor* shall advise the *client* in writing when *diagnostic procedures* are required prior to *mitigation* system installation.

## 4.2 Proposals

*Contractors* shall provide *clients* the following written information prior to initiation of the work:

a) The Qualified Mitigation Professional's name, address and phone number; relevant *radon* or soil gas *mitigation* certification and/or licensing number; and signature (manual or electronic in conformance with the Electronic Signatures in Global and National Commerce [E-SIGN] Act);

b) A description of the proposed *mitigation* system(s) and the elements of the applicable plan for long-term *operation, maintenance, and monitoring (OM&M);*

c) A statement that describes options for initial post-*mitigation* testing, including the option of third-party testing;

d) The conditions of a warranty concerning workmanship and defects in materials;

e) A statement on whether the *contractor* guarantees that the proposed system(s) will or will not reduce *radon* or soil gas concentrations below a specified threshold and conditions or limitations of the guarantee; and

f) Any other limitations that the *contractor* places on the scope of work and any limitations on professional obligations.

4.2.1 *Non-ASD designs*

As required in Section 12.1.4, *contractors* shall provide *clients* an estimate of total ownership costs including installation and annual operating costs where proposed designs include Indoor Air Pressurization, Indoor Air Dilution and Soil Air Dilution *mitigation* methods.

## 4.3 Notification and Hazards

4.3.1 *Owner occupied—Ventilation*

The *contractor* shall inform the *client*, prior to starting work, of the need to ventilate work areas during and after the use of sealants, caulks or bonding chemicals containing volatile solvents.

4.3.1.1 Leaving Notices

Note—Leaving sealant hazard notices, such as provided in Exhibit A, is recommended for most all jobsites.

4.3.2 *Not owner occupied*

Where occupants are not the property owner, the *contractor* shall request that the *client(s)* provide notices to occupants no less than 24 hours before entering the building, to include instructions, warnings, or guidance for disruptive or hazardous situations, as required in Section 4.3.2 of ANSI/AARST SGM-MFLB (Soil Gas Mitigation in Existing Multifamily, School, Commercial and Mixed-Use Buildings).

4.3.3 *Material safety data sheets (SDS)*

Upon request, the *contractor* shall provide *clients* the published safety data sheets for materials used.



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## 4.4 Jurisdictional Authorities

4.4.1 *Jurisdictions*

The *contractor* shall comply with all applicable testing, *mitigation* and reporting requirements issued by the federal, provincial, tribal, state, or local jurisdiction that apply to the contract where the *mitigation* is being performed.

4.4.2 *Local jurisdictions (informative)*

Radon—Information to locate State Radon Offices in the United States can be found at https://www.epa.gov/radon/epa-map-radon-zones-and-supplemental-information#datainfo

Vapor Intrusion—Information to locate State Offices in the United States can be found at https://itrcweb.org/membership/state-engagement

4.4.3 *Building codes, licenses, and permits*

All components of the *mitigation* work shall comply with applicable mechanical, electrical, building, plumbing, energy and fire prevention codes, utility company requirements, and any other regulations of the jurisdiction having authority (JHA) where the work is performed. For localities having no relevant code requirements, the most recent version of nationally published codes shall be observed. Licenses and permits required by the JHA shall be obtained.

# 5.0 SYSTEM DESIGN

## 5.1 Appropriate Systems

5.1.1 *General principles*

In judging appropriate characteristics of a *mitigation* system or method, considerations such as the following shall be evaluated.

a) Safety
The *mitigation* system shall not create health or safety hazards. The building shall not be altered such that the building becomes less safe than its existing condition, to include, but not limited to, maintaining the existing level of fire protection and level of protection provided by means of egress.

b) Accessibility
Equipment installed that requires routine inspection and maintenance, such as fans, system controls and system monitors, shall be installed in a location *accessible* to individuals responsible for system maintenance without destructive or significant disassembly of building components or finishes.

c) Durability
Materials or methods not specified herein that are used in *mitigation* efforts should be capable of retaining functional integrity for the life of the system. Serviceable mechanical and control equipment should have designed life spans that are comparable to other similar mechanical system equipment.

d) Unnecessary Noise
Choices and actions that minimize objectionable *unnecessary noise* should be part of design and installation for each system. Where noise is both objectionable and unnecessary, actions should be taken to reduce *unnecessary noise* to the extent practicable. *Unnecessary noise* shall be defined as noise generated by system vibration or air rushing sounds at air intakes or exhausts that can be reduced by:

1. Reducing the transfer of vibration from system components that come in contact with building materials; or
2. Reducing air velocity at the point of exhaust or at air intakes, such as those within non-habitable spaces or under membranes.

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5.1.2 *Other building systems*

The *mitigation* system shall not:

a) compromise the functionality of mechanical, groundwater control or drainage systems;

b) compromise the functional integrity of roofs, guttering, siding or other structural systems;

c) obstruct doorways or operable windows; and

d) obstruct accessibility to switches, controls, electrical service panels or junction boxes and other equipment, such as HVAC components, which require maintenance over time.

5.1.3 *Permanent systems required*

*Mitigation* systems shall be designed and installed as an integral, permanent addition to the building. Time limits on use of temporary *mitigation* efforts, including for uncontrollable logistics or rapid response situations, shall comply with Section 13.2 in the latest publication of ANSI/AARST SGM-MFLB.

5.1.4 *Collateral mitigation*

Where a *mitigation* system impacts or might impact adjoining *dwellings* or units in a shared building, *contractors* shall:

a) provide disclosures, in accordance with Section 10.6, where a *mitigation* system might result in *inadvertent collateral mitigation*; and

b) comply with Section 13.3 in the latest publication of ANSI/AARST SGM-MFLB when designing *intentional collateral mitigation*.

## 5.2 Nondestructive Investigation

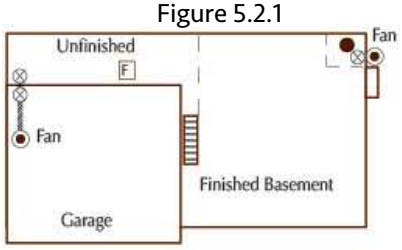
An investigation of the common building structure(s) shall be conducted prior to initiating *mitigation* work. The investigation shall include visual inspection of both the exterior and interior of the building(s) in accordance with Section 5.2.2. Jobsite logs shall include the date and identity of the person conducting the inspections and resulting observations noted on diagrams or in jobsite logs. **Note**

5.2.1 *Diagrams*

Diagrams shall be created and retained in jobsite logs that comply with a) and b) of this Section 5.2.1.

a) Foundation Types and Sizes
A diagram or sketch shall be created that portrays the relative size of each building foundation component of the shared foundation system. The diagram shall identify each attached slab-on-grade, basement, and *crawl space* foundation area, including additions to the original building and attached garages.

Figure 5.2.1




b) Multiple Test Locations
Where *radon* or soil gas measurements have been conducted in multiple *ground-contact* rooms, *dwellings* or non-residential rooms or units, at least one diagram or sketch shall illustrate available test results and their general location. **Note**

5.2.2 *Visual inspections*

5.2.2.1 Exterior Visual Inspection

An exterior visual inspection shall be conducted that includes all exterior faces of the building, as viewed while standing outside the structure. Jobsite logs shall include:

a) **Foundation Walls.** Notation of foundation wall construction type(s), such as poured concrete, stone, and block (CMU); and

b) **Elevations.** Notation portraying the general height of the building above grade and relative elevation of each attached upper foundation floor compared to the lowest foundation slab or earthen floor.



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Where observing air pathways or air handling systems that could hinder or aid effective *mitigation*, as described in Table 5.2.2.1, the conditions observed shall be noted in jobsite logs.

| Table 5.2.2.1 Examples of air pathways or systems that could hinder or aid effective *mitigation* | |
|---|---|
| Between indoors and outdoors | Air intakes, exhaust locations and other openings between indoor and outdoor air that, based on their size, could influence a buildings air exchange rate, air pressures or energy consumption. |
| Between soil and outdoors | Air pathways between soil and outdoor air that, based on their size and location, could represent problems in achieving *ASD* effectiveness |
| Between soil and indoors | Exterior soil, drain tiles or enclosed spaces over soil that, depending on the total air volume leakage of adjoining interior walls, could need a custom solution |

**Note**

5.2.2.2 Interior Visual Inspection

The interior visual inspection shall be conducted to include all ground-contact rooms. Diagrams, sketches or as otherwise recorded in jobsite logs, shall also include components identified in Table 5.2.2.2.

| Table 5.2.2.2 | | Interior Inspection Components |
|---|---|---|
| a) | Foundation walls | Notation, where different from exterior inspections, regarding poured concrete, stone, block (CMU) or other wall foundation material(s) |
| | | Load bearing assemblies, such as masonry partitions, and as associated with unique foundation designs |
| b) | Rooms | A general floor plan layout of room partitions that also denotes finished areas and open earth crawlspaces |
| c) | Mechanical systems | The location of furnaces, air handlers, boilers and water heaters |
| | | Locations of any ductwork under slabs |
| d) | Openings to soil | Both observed sizable openings between soil and indoor air and suspected openings, such as under bathrooms or utility access points **Note** |
| e) | Water drainage | Observations regarding water control systems |
| | 1. Sumps | The location and nature of openings to soil within any pits **Note** |
| | 2. Surface Water Drainage | Presence or absence of drainage systems for surface water on floors or walls |
| | | Drains or drain systems that drain directly to soil or grey water piping **Note** |
| f) | Safety concerns | Observed conditions that pose safety concerns to workers/occupants **Note** |
| | 1. Fire ratings | Observance of fire-rated assemblies or separation required (including for fire-rated walls and fire-rated ceiling and floor assemblies) |

**Note**

**Exception**—Jobsite logs shall be updated with pertinent findings during *mitigation* processes where components listed for identification in Tables 5.2.2.1 and 5.2.2.2 were obscured, inaccessible for visual review, or later found to have been inadvertently overlooked during the visual inspection.

5.2.2.3 Chemically Contaminated Water

Where the purpose of the *mitigation* includes chemical vapor intrusion, the *contractor* shall document and provide timely notice to the *client* regarding components identified in Table 5.2.2.3.



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| | Table 5.2.2.3 | Chemically Contaminated Water |
|---|---|---|
| a) | Sumps/Pits | Observance of sumps or pits that are open to soil |
| | | If closed and the nature of sump lids or pit covers |
| | | If the pit receives surface water from floors or walls |
| | | The destination of water drained or discharged by pumps |
| b) | Water Intrusion | Presence of ground water on the surface of floors or walls |

5.2.3 *Reporting unexpected conditions*

The *contractor* shall provide the *client* timely notice of suspected or unexpected conditions revealed during visual investigations, *diagnostics* or installation that can significantly impact occupant health, budgets, schedules, or other concerns relative to the scope of work. The *contractor* shall document and provide immediate or timely notice to the *client* regarding:

a) hazardous materials or conditions observed but not previously identified by the *client*; and

b) observations of failed or deficient water control systems, to include observance of standing water in a basement or *crawl space*; evidence of groundwater intrusion; and failed pumps or *sump* systems and any pipes that inappropriately discharge or leak contaminants.

## 5.3 Diagnostic investigation

5.3.1 *All mitigation methods*

Where the purpose of *mitigation* includes chemical vapor intrusion and for *mitigation* of multifamily, school, commercial or mixed-use buildings, *diagnostic* analysis shall be conducted prior to final design and installation.

5.3.2 *Targeted focus (all methods)*

The initial target of design and *diagnostic* investigations shall prioritize locations that would *mitigate* occupant exposure to the largest volume of soil gas that is susceptible to migrate into the building.

Exceptions: Where it has been determined that a foundation area is a source of disproportionately more concentrated volumes of radon, chemical vapors, or flammable gas; or where it has been determined that soil gas is not the source of the hazard.

5.3.1.1 Target Limits

It is not required that *diagnostic procedures* or *mitigation* methods be applied to all *ground-contact* portions of a building. The percentage of area targeted for *mitigation* compared to size the full building footprint shall be recorded in jobsite logs or identifiable in jobsite diagrams. *Diagnostic* characterizations shall not be reported as being homogenous across any other individual foundation or building area unless verified.

5.3.3 *Diagnostic and performance test conditions*

Jobsite logs shall include outdoor temperature and the status of heating, cooling, or mixed HVAC operating conditions, at the time when conducting *diagnostic* or performance test measurements. Jobsite logs shall also indicate whether this testing was conducted, as is recommended:

a) with all exterior windows and doors, including garage doors, closed; and

b) with normal occupied indoor temperatures of between 65˚and 80˚ F (18˚ - 27˚ C).

5.3.4 *Non-ASD methods*

All non-*ASD* systems, methods and *diagnostic procedures* shall comply with Section 12 of ANSI/AARST SGM-MFLB. Where installing *ASD* style systems with an inverted fan to pressurize rather than depressurize soil air, the design shall comply with ANSI/AARST SGM-MFLB, Section 12.4 *(Soil Air Pressurization).*



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5.3.5 *ASD diagnostic PFE analysis*

Where required before or during installation, *PFE analysis* shall include evaluations required in a), b) and c) of this Section 5.3.5.

a. *PFE* Distance (Qualitative)

With vacuum applied at the chosen suction point, evidence shall be sought to characterize the distance *PFE* can be achieved across the targeted *soil gas collection plenum(s).* The pilot hole or test port locations shall be at locations that will best characterize:

1. the full expanse of the targeted *soil gas collection plenum(s);* or
2. as an alternative or supplement, other locations where evidence suggests that large volumes of soil gas are susceptible to being drawn into the building by air pressure differences between soil and indoor air.

Where *PFE* is not demonstrated across most of the targeted *soil gas collection plenum(s),* further investigation is required.

b. *PFE* Vacuum (Quantitative)

Once goals for *PFE* distance are achieved, measurements shall be made to quantify air pressure differences under the slab or membrane relative to indoor air. Jobsite logs shall include the values measured in this effort to characterize vacuum strength needed for *ASD* design. The measurements shall be made with a micromanometer or equivalent differential pressure gauge that is capable of reading to 1/1000-inch water column (0.25 Pa). **Note**

c. Exhaust Air Volume (Quantitative)

Once goals for both *PFE* distance and vacuum strength are met, the volume of air exhausted to achieve desired *PFE*, as measured in *cfm* ($m^3$/min), shall be recorded in jobsite logs. Fans chosen and duct pipe configurations, compliant with Section 6.3, shall be capable of transporting this volume of air. **Note**

5.3.5.1 Exception

Where *PFE* test locations or test ports cannot be created due to building materials that are virtually irreplaceable, such as for historical preservation properties, or due to denied access to locations of interest. To exercise this exception, jobsite logs shall include the reason why and alternative locations or methods used for verifying design effectiveness.

## 5.4 Seasonal Compensation

Jobsite logs shall confirm that a comparison was made between:

a) *diagnostic* test conditions, as recorded for compliance with Section 5.3.3, and

b) the normal occupied building operating condition that prevails during the greatest amount of time each year for local buildings, as illustrated in Figure 5.5 b (*Seasonal Compensation*).

5.4.1 *Vapor intrusion*

Because it is not possible to predict worst case conditions based on a single measurement or *diagnostic* event, it shall be recommended to *clients* that designs address a means consistently monitor if the system is meeting *mitigation* goals where assessments or indoor measurements indicate chemical vapor or other hazardous gas pose *acute* or *subchronic* risks.

## 5.5 Decisions (informative)

The following flowcharts illustrate sample procedures for determining the appropriate design choices.



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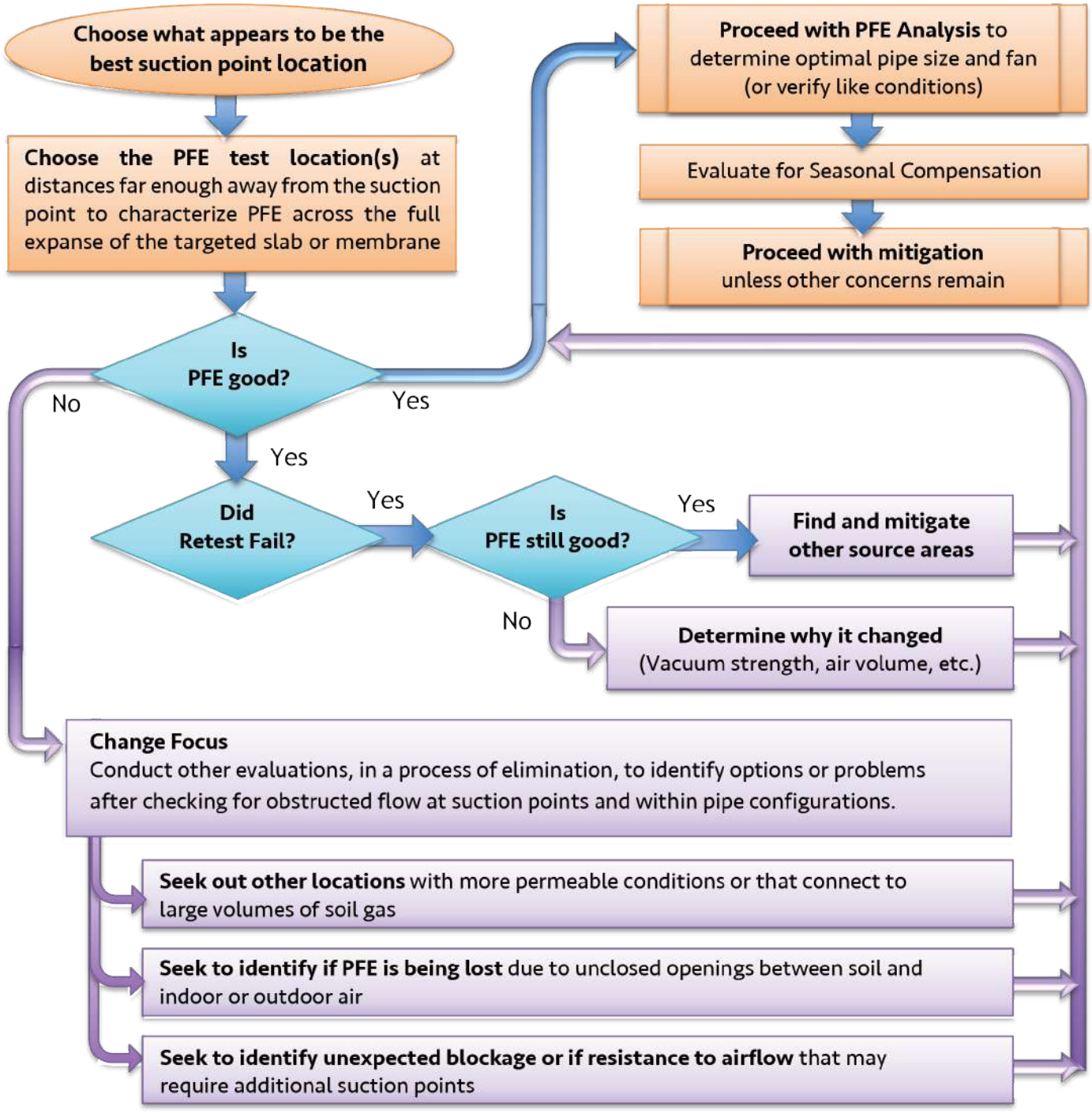
**Figure 5.5-a** **ASD Method—Example Decision Flowchart**




Process of Elimination — **Note**

Understanding Permeability — **Note**

Visual Indications of Permeability — **Note**

Suction Pit Size — **Note**



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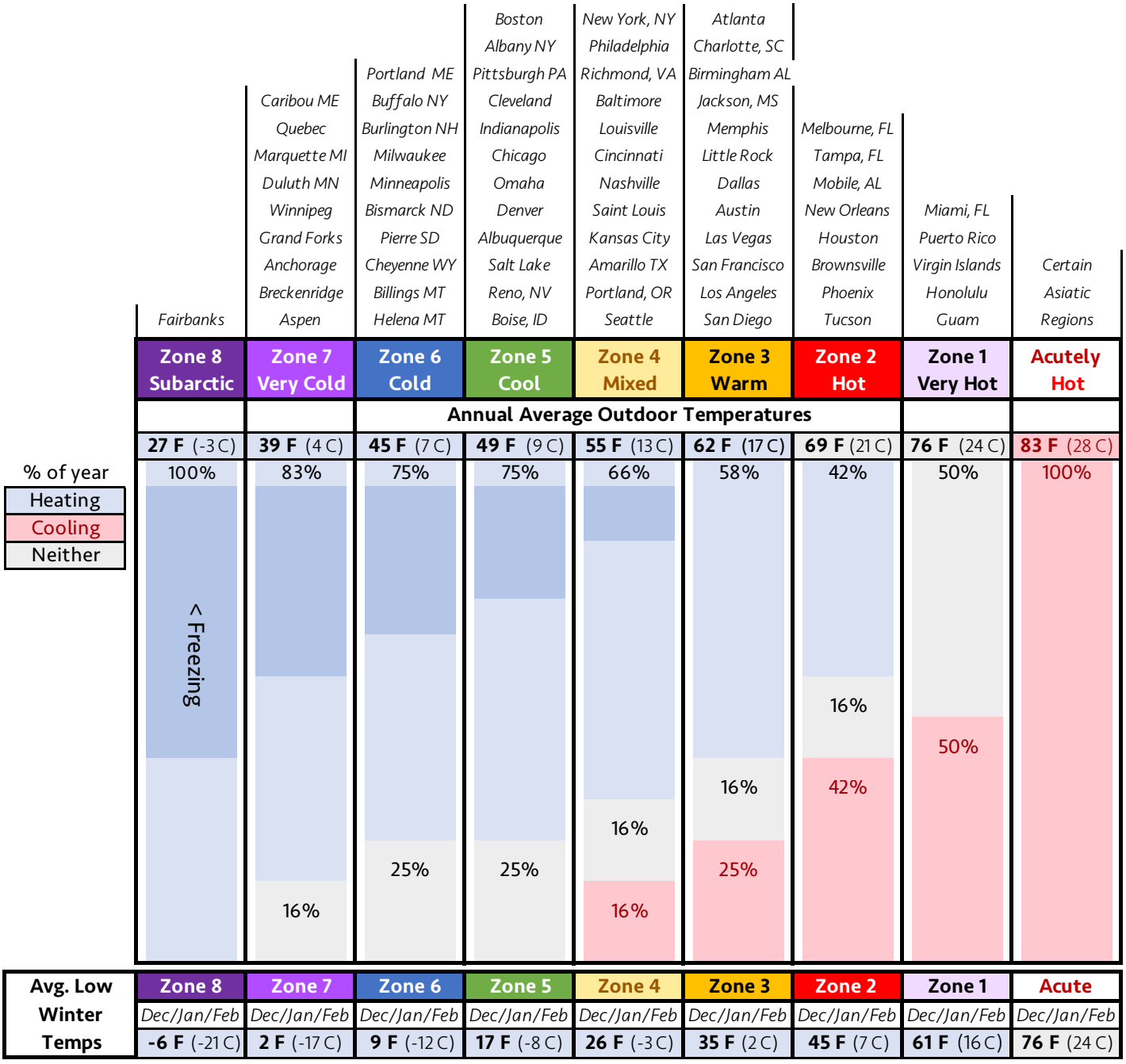
**Figure 5.5-b** **Seasonal Consideration (Climate Zone)**

*Informative advisory*—While estimates can be made, it is not possible to predict worst case conditions based on a single *diagnostic* event or measurement. To know, one must test under the condition of concern.




Climate zone temperatures based 30-year averages published online (e.g., the National Centers for Environmental Information-NOAA) for a major city located within each climate zone. Zone classifications reflect ASHRAE standards 90.1 / 90.2 (The American Society of Heating, Refrigerating and Air-Conditioning Engineers) https://www.ashrae.org



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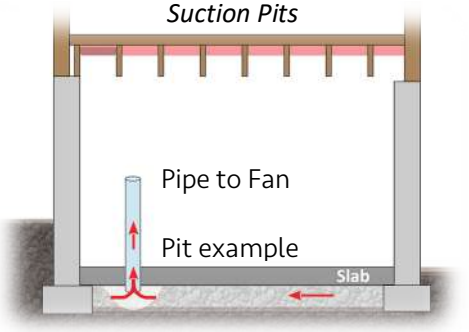
# 6.0 ACTIVE SOIL DEPRESSURIZATION (ASD)

## 6.1 *ASD* Suction Points

### 6.1.1 *Suction pits*

A cleared void space shall exist or be created below all suction points through slab floors and to the side of all *suction points* through walls unless excavation is not practicable. This cleared void space shall be not less than 0.25 $ft^3$ (7 $dm^3$) which equates to 2.0 US gallons (8 L) of excavated sub-slab soil/aggregate.

**Exception:** Where multiple *suction points* are employed, secondary suction pits designed for condensate drainage or airflow balance are permitted to have a smaller cleared void space.



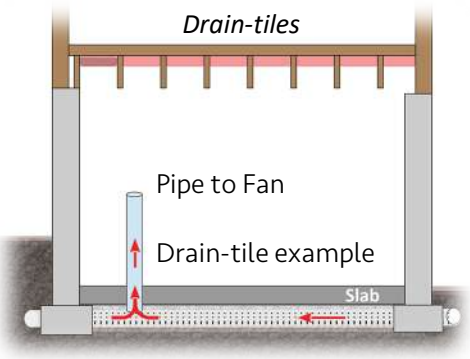

#### 6.1.1.1 Seal the Suction Point

**Note**

Gaps in concrete surrounding suction pipes shall be sealed in a permanent, airtight manner.

When using caulk, the gap opening shall be cleaned and then sealed with caulk complying with ASTM standard C920 class 25 or greater.

To support caulk while it cures, gap openings greater than 1/2 inch (13 mm) in width shall be pre-filled with foam *backer rod* or comparable material prior to applying caulk.




#### 6.1.1.2 Drain-tile Suction

Where the *suction pit* or suction piping directly accesses soil air from a drain-tile, the configuration shall not result in compromising the capacity of the water drainage system.

### 6.1.2 *Sumps*

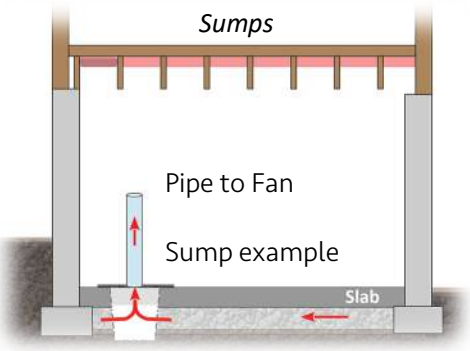
#### 6.1.2.1 Seal the Suction Point (sumps)

Where *sumps* are used as a *suction point*, *sump* lids shall be sealed in accordance with Section 7.5 in an airtight manner.

**Note**

#### 6.1.2.2 Accessibility to Sumps

Provisions of Section 7.5 for sealing *sumps* shall be observed to include that a physical access port or equivalent is required. Flexible coupling disconnects for suction piping, as specified in Section 6.2.6, shall be provided to ease *sump* lid removal.



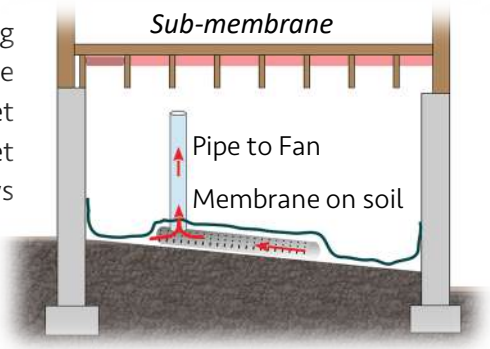

#### 6.1.2.3 Labels Required (sumps)

*Sump* lids shall be labeled in accordance with Section 8.4.6 a.

**Note**

### 6.1.3 *Sub-membrane suction points*

For sub-membrane *depressurization* (SMD), suction pipe ducting shall extend under the *soil gas retarder* membrane and shall be installed to prevent obstruction of air volume flow at the air inlet opening(s) of the suction pipe(s). The suction pipe inlet configuration shall be made open to soil air in a manner that allows *PFE* under the entire expanse of the membrane.




#### 6.1.3.1 Seal the Suction Point (membranes)

The opening around penetrations of a *soil gas retarder* shall be sealed in a permanent, airtight manner. Appropriate sealant

**Note**



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materials shall be applied for *ASD* duct piping and other utility pipe penetrations through the membrane such as gasket fittings, pipe clamps, roof flashing or an appropriate sealant.

6.1.3.2 Seal the Membrane(s)

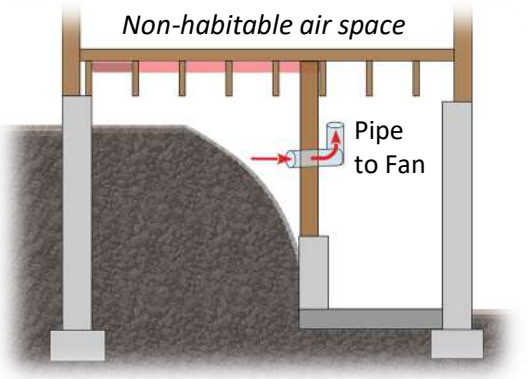
The soil gas retarder installed in accordance with Sections 7.6 and 7.7. The *soil gas retarder*, including seams and edges, shall be sealed to resist air movement between soil and the air above the membrane.

6.1.3.3 Labeling Required (membranes or access ports)

Membranes or *crawl space* access locations shall be labeled in accordance with Section 8.4.6 b.

### 6.1.4 *Non-habitable air spaces*

**Note**




6.1.4.1 Sealing Non-habitable Air Spaces

When depressurizing a non-habitable airspace, all surfaces of the non-habitable airspace that border both indoor and outside air shall be sealed in accordance with Section 7.9 *(Sealed Isolation Assemblies)*.

6.1.4.2 Restricted Use

The resulting system shall not cause the structure to become unsafe or adversely affect the performance of the building to include:

a) Adverse impacts to building systems (with the most notable being *flue gas spillage* from atmospherically vented combustion appliances located elsewhere in the building); and

b) Excessive energy penalties and damage to building components (with the most notable being hot, cold and humid outside air drawn into a *non-habitable airspace* by the *mitigation system*).

*Depressurization* of non-*habitable airspaces* shall not be used where:

a) atmospherically vented combustion appliances are installed within the airspace to be depressurized;

b) isolation cannot be created to resist air movement between the *non-habitable airspace* and surrounding airspaces containing one or more atmospherically vented combustion appliances. Resulting configurations shall not induce *flue gas spillage* described in Section 11.2.2; and

c) the extent of inaccessible openings between the isolated space and both interior and exterior areas surrounding the isolated space has not been evaluated and accounted for in system design and installation.

*Crawl space depressurization* is only allowed where an area cannot be safely accessed or has insufficient height to work in.

**Note**

6.1.4.3 Safety Requirements (non-habitable airspaces)

Where entry into a non-habitable air space being depressurized might occur in the future for maintenance or other reason, precautionary safety features are required to prevent exposures to excessive radon or chemical vapor exposure that can result within the depressurized airspace. Safety features shall include:

a) Access ports to non-habitable air spaces shall be labeled in accordance with Section 8.4.6 c to provide warning and instructions, such as for ventilating the airspace prior entry or as warranted, other precautions and instructions;

b) Doors and access port hatches that can be opened without the use of tools shall be provided hardware to facilitate adding a lock to prevent incidental entry; and

c) Fan monitors required in accordance with Section 8.2 shall be located where they can be accessed without entering the depressurized non-habitable air space.



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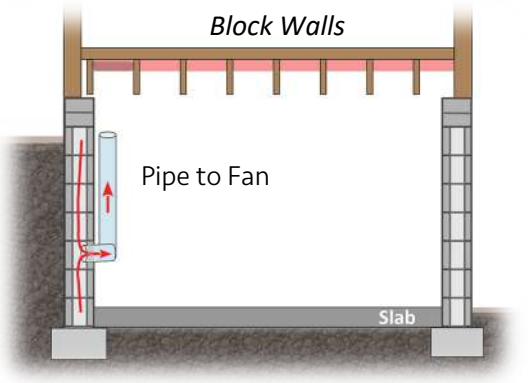
6.1.5 *Block walls*

6.1.5.1 Suction Pipe Locations

Note—Suction pipe locations for Block Wall *Depressurization* will depend on the configuration of the hollow void network(s) within walls to be depressurized and the ability to close openings that surround the void network(s).




Note

6.1.5.2 Sealing (block walls)

For Block Wall *Depressurization*, all *accessible* openings and gaps in the wall that surround the hollow void network being depressurized shall be closed in accordance with Section 7.4.1 to resist air movement between the depressurized void network and both indoor and outdoor air.

## 6.2 *ASD* Piping

6.2.1 *Air and water-tight*

All duct piping and fittings that transport air shall result in being air- and water-tight.

**Exceptions:** Soil gas intake locations, exhaust locations, and fan monitor test ports.

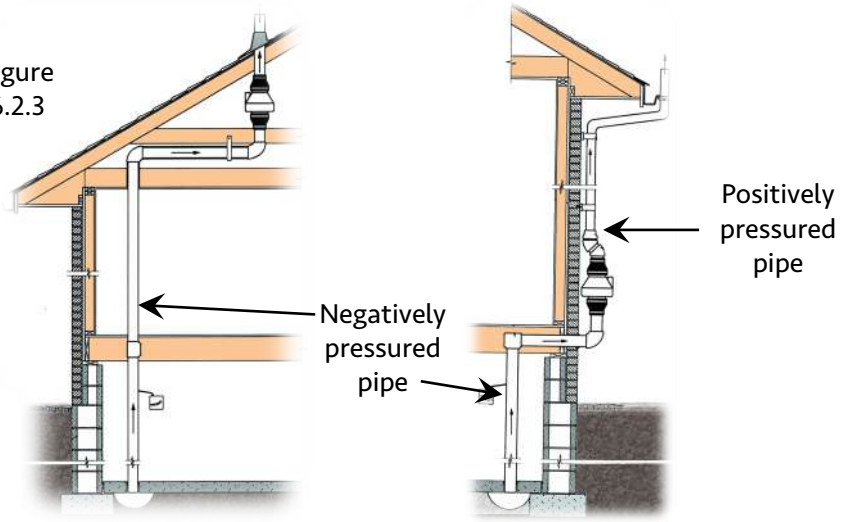
6.2.2 *Slope required*

Configurations that result in obstructed airflow as a result of allowing water to collect within duct piping are prohibited. Above-ground duct piping shall have a continuous downward slope toward the *suction point(s)* of not less than 1/8 inch (3.2 mm) per foot (30 cm) to allow condensation or rainwater within the pipes to drain downward into the ground beneath the slab or *soil gas retarder* membrane. When drainage cannot be achieved, other methods for draining collected water shall be provided.

6.2.3 *Positively pressurized pipe*

Positively pressurized *ASD* duct piping or other positively pressurized components of an *ASD* system shall not be installed in or pass through or under the conditioned space of the building.

Figure 6.2.3




6.2.4 *Labels required (duct piping)*

Duct piping shall be labeled in accordance with Section 8.4.4.



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6.2.5 *ASD pipe materials*

All *ASD* duct piping, except piping routed below concrete slabs or under *soil gas retarder* membranes shall be rigid, non-perforated and meet the following requirements:

a) ABS plastic piping shall comply with ASTM D2661, F628 or F1488. Pipe wall thickness shall be Schedule 40 with solid, cellular core or composite wall. ABS pipe joints shall be solvent welded in accordance with the pipe manufacturer's instructions, with solvent cement conforming to ASTM D 2235.

b) PVC plastic piping shall comply with ASTM D2665, F891 or F1488. Pipe wall thickness shall be Schedule 40 with solid, cellular core or composite wall. PVC pipe joints shall be joined in accordance with the pipe manufacturer's instructions with cement conforming to ASTM D2564. The joint surfaces for PVC plastic pipe and fittings to be solvent welded shall be prepared with:
   1. a primer conforming to ASTM F656; or
   2. a self-priming product; or
   3. as otherwise stipulated in the pipe manufacturer instructions.

c) All *ASD* plastic pipe fittings shall be of the same material as the plastic piping they are joined to, and solvent welded unless joined with flexible couplings in accordance with Section 6.2.6.

Exception 1: Alternative pipe materials

Alternative materials specified in codes for "Above-Ground Drainage and Vent Pipe" [3] are permitted. Alternative pipe materials that include iron, steel and copper piping shall be joined in accordance with the pipe manufacturer's instructions and as required by code.

For buildings classified as single-family structures that contain not more than four attached *dwelling* units on a contiguous foundation, other pipe products are permitted for use where deemed acceptable by:

a) local state licensing/certifying programs that provide written acceptability for the product; or

b) local code authorities for locations that have no state licensing/certifying program.

Exception 2: Downspout material on exteriors

Downspout and other light-duty rigid materials of appropriate durability are permitted for duct piping use if all of the following requirements are met:

a) The material shall be installed only at exterior locations at the pressure side of the *ASD* system;

b) Duct size shall be in accordance with Section 6.3.7;

c) Materials shall be no less than equal to the commercial durability of existing downspout materials used for such buildings where the system is being installed.

   **Exception:** Where the building is a designated heritage preservation site or operates under similar covenants, the materials used for exterior ducting are permitted to vary according to the historic preservation guidelines or other covenant requirements;

d) Use of the specific material shall be acceptable to the *client* and, if applicable, state licensing or certifying authorities; and

e) Joined connections for downspout materials and joints shall be welded to achieve a watertight seal or sealed and *mechanically fastened* at each joined connection using hardware fasteners that are weather rated for outdoor use. When joined connections are sealed and *mechanically fastened*:

[3] As point of reference for alternative piping, see the International Residential Code (IRC) Table P3002.1 (1).



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1. Sealants shall be applied to the inner junction between joined downspout materials in a manner to both establish a complete seal and protect sealants at the bonded location from degradation. Sealants shall be designated by the manufacturer for use on gutter materials; and
2. Where pre-formed or modified flange connections are used to join sections of duct material, the upper portion of duct material at each connection shall be flanged inward and inserted downward into the lower portion of duct material to allow water and condensate to fully drain downward without collecting water and ice at joint connections.

6.2.5.1 Vapor Intrusion Piping

When *ASD* goals include *mitigation* of chemical vapor intrusion, all duct pipe materials shall meet specifications in ASTM D1785 for Schedule 40. For alternatives to plastic pipe identified in Section 6.2.5:

a) An evaluation shall be made prior to installation for alternative materials such as iron, steel, copper, or other pipe materials, relative to corrosive effects that chemicals may have, and

b) Downspout materials shall not be permitted.

6.2.6 *Flexible couplings*

Flexible coupling disconnects that comply with ASTM D5926 or ASTM C1173 are permitted as an alternative for joining two portions of *ASD* duct piping if they establish a secure watertight connection. Equivalent watertight methods are also permitted, such as threaded pipe or union disconnect. Flexible coupling disconnects or equivalent methods are permitted for situations that include:

a) where piping disassembly may be required in the future for maintenance purposes, such as required at sumps and where connecting an *ASD* fan;

b) where joining duct piping materials that are incompatible for solvent welding;

c) where physical constraints inhibit the ability to join duct pipe materials by means of a solvent weld;

d) where intended to minimize noise by breaking the direct transfer of fan vibration to duct piping; and

e) where local codes allow temporary removal and airtight replacement of *ASD* pipe sections to provide access to areas requiring maintenance or inspection of equipment as described in Section 6.2.9.

6.2.7 *Secure duct piping*

6.2.7.1 Duct piping shall be fastened to the structure of the building with hangers, strapping, or other supports that will withstand forces such as wind, ice and other forces or degradation over time. The fastening system shall comply with requirements in a), b), c) and d) of this Section 6.2.7.1.

a) Mechanical hardware or fasteners shall be durable for the purpose and weather-rated when employed outdoors;

b) The anchoring method and fastening materials shall be suitable to secure the anchors in a durable manner to whatever building surface is chosen for securing the duct piping;

c) Existing plumbing pipes, ducts or mechanical equipment shall not be used to support or secure duct piping; and

d) Fastening systems that rely only on extending a nail or screw through the duct piping and into a wall or other supporting surface shall not be used to secure duct piping.

6.2.7.2 Supports for *ASD* plastic piping shall be installed no less than every 10 feet (3 m) on vertical piping and 4 feet (1.2 m) on horizontal piping. Alternate *ASD* duct materials identified in Section 6.2.5, such as iron, steel, or copper, shall be secured in a manner that meets codes [4] and manufacturer recommendations. **Note**

[4] As point of reference, the International Mechanical Code (IMC), the International Plumbing Code (IPC) or the International Residential Code (IRC) that are published by the International Code Council.



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6.2.8 *Provide access clearance*

Duct pipe routing shall not:

a) block egress from entrances and exits to the building, including those designated for fire and safety;

c) compromise effectiveness of fire suppression systems; or

b) block necessary access to any areas requiring maintenance or inspection such as mechanical equipment or a *crawl space*. **Note**

**Exception:** Flexible coupling disconnects or equivalent methods prescribed in Section 6.2.6 are permitted where allowed by code to provide access by temporary removal and airtight replacement of *ASD* pipe sections. Such configurations shall be marked or labeled "Removable for temporary access," or equivalent wording.

6.2.9 *Protect ducts from the elements (insulation)*

Duct piping shall be provided with thermal insulation in accordance with the following two requirements:

a) Where it is likely on a regular basis (e.g., annually or every few years) that freezing temperatures will result in ice buildup within duct piping that would adversely affect system performance, the insulation shall be protected from the elements and have an R-value of not less than 4; and

b) Where it is likely that condensation on exterior surfaces of duct piping would damage building materials, the insulation shall have an external vapor barrier and an R-value of not less than 1.8.

Note—For more extreme climates, greater R-values may be appropriate. **Note**

6.2.10 *Observe codes* [5]

Compliance with codes of the jurisdiction having authority (JHA) and utility company restrictions is required, including those related to maintaining the integrity of a buildings structural members; inhibiting the spread of fire and smoke; and proximity of piping relative to electrical components.

Codes (General) — **Note**

Inhibit the Spread of Fire/Smoke — **Note**

Gas Meters — **Note**

Sawn Lumber (Cutting, Notching and Drilling) — **Note**

[5] As point of reference, see the International Residential Code (IRC) as published by the International Code Council.



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## 6.3 *ASD* Pipe Sizing

*ASD* duct piping shall be sized and configured to result in adequate capacity to transport the volume of air required for establishing a vacuum under each slab or membrane and within each airspace being depressurized by the *ASD* system.

6.3.1 *Minimum inside diameter—air volume capacity*

*ASD* duct piping from the exhaust point to the *soil gas collection plenum(s)* shall be equivalent or greater than the cross-sectional area of a 3-inch (75-mm) inner diameter (ID) pipe or as determined by *PFE* Analysis.

6.3.2 *When larger air volume needs are indicated*

Where *PFE* analysis indicates the necessary airflow for the entire system is more than 80 *cubic feet per minute (cfm)* (2.3 $m^3$/min), duct piping from the exhaust point to the *soil gas collection plenum(s)* shall be equivalent or greater than the cross-sectional area of a 4-inch (100-mm) ID pipe.

6.3.3 *When smaller air volume needs are verified*

Where *PFE* analysis indicates the necessary airflow for the entire system is equal to or less than 40 cfm (1.1 $m^3$/min), 2-inch (50-mm) ID duct piping from the exhaust point to the *soil gas collection plenum(s)* is permitted.

6.3.4 *Equivalent cross-sectional area*

Multiple pipes of various sizes that are joined in a parallel manner to result in a combined air volume capacity that is not less than the equivalent cross-sectional area of pipe diameters required in Sections 6.3.1 and 6.3.2 shall be permitted.

The minimum pipe diameter through parallel pipe sections shall be 2-inch (50-mm) ID pipe.

**Note**

Informative Table 6.3.4
Cross-sectional Area Dimensions

| ID (inner diameter) | Cross-sectional Area |
|---|---|
| 2-inch (50-mm) | 3.1 sq. in. (20 $cm^2$) |
| 3-inch (75-mm) | 7.1 sq. in. (46 $cm^2$) |
| 4-inch (100-mm) | 12.6 sq. in. (81 $cm^2$) |
| 6-inch (150-mm) | 28.3 sq. in. (182 $cm^2$) |

6.3.5 *Maintain whole-system air volume capacity*

The configuration shall not reduce duct pipe diameters or dimensions in the direction of airflow from the soil gas inlet(s) to the exhaust location such as to result in less whole-system air volume capacity than achieved with pipe sizes specified in Sections 6.3.1, 6.3.2 or 6.3.3. All components of the ducting system that reduce air volume transport capacity shall be accounted for in meeting this requirement, to include any rain caps or other obstructions at exhausts and circumference or size of slab penetration connections to soil gas.

6.3.6 *Multiple suction points*

Each suction pipe shall be sized to provide air volume capacity sufficient to establish a vacuum under each slab or membrane and within each airspace being depressurized by the *ASD* system.

Where air valves, dampers or baffles are used to adjust airflow balance:

a) the location, settings and design shall be included in "as built records" for the system; and

b) they shall be marked or labeled to indicate their purpose, settings and instructions, such as "Radon/Soil Gas System Air Valve. Do Not Alter From Marked Setting," or similar wording.

6.3.6.1 Drainage

When multiple suction points are employed, piping extended to secondary *suction pits* exclusively designed for condensate or rainwater drainage do not require any specific pipe diameter.

6.3.7 *Sizing for gutter downspout duct materials*

A natural reduction to airflow capacity shall be accounted for when using gutter downspout in accordance with Section 6.2.5 (Exception 2). Because crimped downspout flange connections reduce airflow capacity, gutter downspout materials employed shall be:

a) no less than 3 x 4 inch downspout material (75 x 100 mm) to meet capacities stipulated in Section 6.3.1 for 3-inch (75-mm) ID pipe; and



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b) no less than 4 x 5 inch downspout material (100 x 127 mm) to meet capacities stipulated in Section 6.3.2 for 4-inch (100-mm) ID pipe. When even larger air volume needs are indicated, duct size shall increase respectively.

Gutter downspout material that is less than 3 x 4 inches (75 x 100 mm) shall not be permitted unless, in accordance with Section 6.3.3, *PFE* Analysis indicates that the necessary airflow for the entire system is equal to or less 40 *cfm* (1.1 $m^3$/min).

6.3.8 *Air velocities (see informative notes)* **Note**

## 6.4 ASD Exhaust Discharge

6.4.1 *General*

6.4.1.1 Measuring Distances—Stretched String

Distances shall be measured between the closest point of the exhaust opening to the closest point of all location requirements specified in Section 6.4 using the shortest distance, as if a string were stretched between them.

6.4.1.2 Definitions

Definitions a), b), c) and d) of this Section 6.4.1.2 shall apply to exhaust requirements in Section 6.4:

a) *Openings In Structure* The openings created in structural walls or roofs for the purpose of mounting windows, skylights, doors or other assemblies that might open to outdoor air;

b) *Operable Openings* The operable or constantly open portion of windows, skylights, doors and other openings designed to readily operate for increasing ventilation with outdoor air. Portions of a window specifically designed to temporarily open for cleaning are not considered readily operable for increasing ventilation with outdoor air;

c) *Exhaust Trajectory* The angle of the pipe or elbow at the *point of exhaust*.

The angle of the exhaust trajectory from the open end of the pipe or elbow is geometrically defined as the straight- or center-line axis that extends outward from the geometric center of the exhaust opening and is perpendicular to the plane of the exhaust opening; and

d) *Exhaust Spread* The exhaust spread extends outward from the *point of exhaust* in the shape of a circular cone. The tip or apex of the cone is at the geometric center of the exhaust opening and the cone profile grows larger as distance from the *point of exhaust* increases.

The total directional spread of the exhaust or cone is defined in degrees by the offset-axis angle of the cone profile compared to the cone's center-line axis. Expanding outward from the *point of exhaust*:

— An exhaust spread radius of 45˚ equals an exhaust spread diameter of 90˚.
— An exhaust spread radius of 11˚ equals an exhaust spread diameter of 22˚.

6.4.2 *Outdoors*

The point of exhaust for all soil gas vent systems shall be located outdoors.



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6.4.3 *Directional spread (restrictions)*

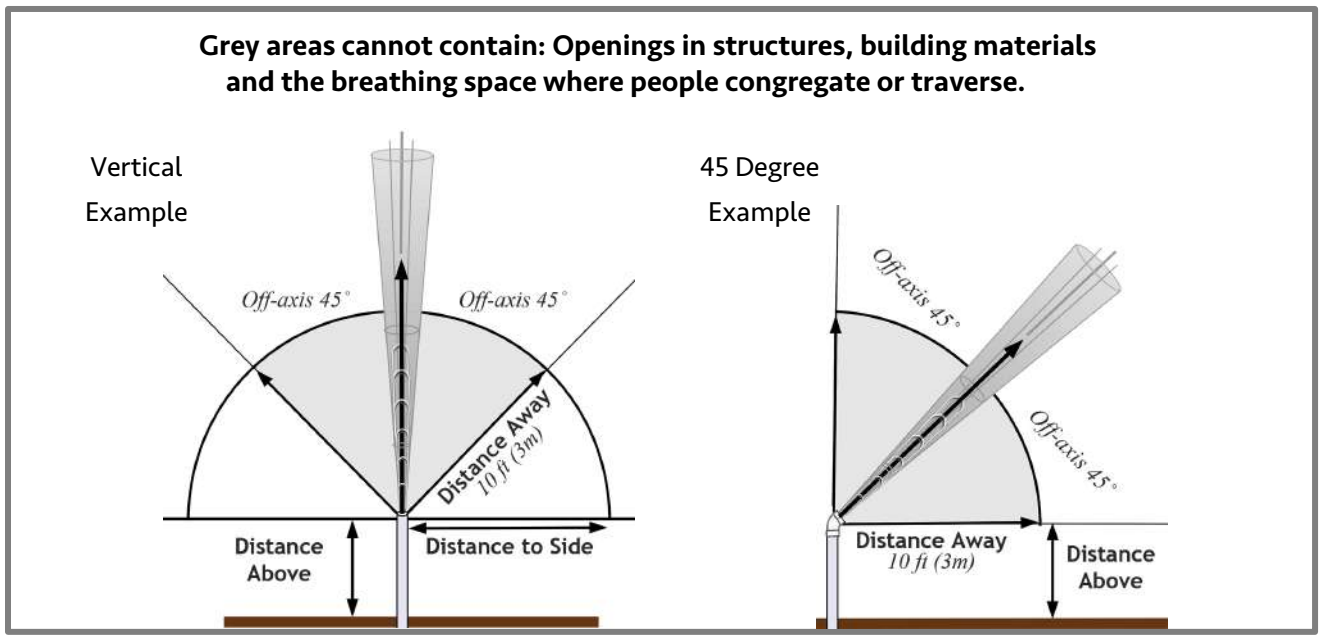
The *exhaust trajectory* with an *exhaust spread* radius of 45˚ shall not encounter openings in any structures, building materials or the breathing space where individuals congregate or traverse within 10 feet (3 m) from the *point of exhaust*.

Exception: EPDM, composite, or otherwise layered water-tight roofing materials.

6.4.4 *Straight-line trajectory (restrictions)*

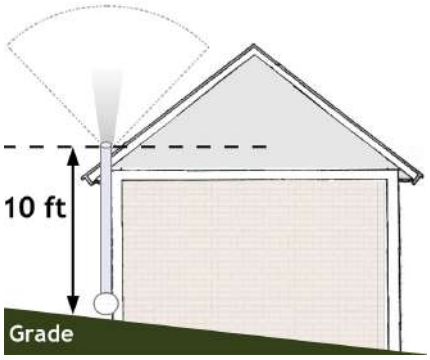
The *straight-line exhaust trajectory* with an *exhaust spread* radius of 11˚ shall not encounter openings in any structures, attic ventilation openings, building materials or the breathing space where individuals congregate or traverse within 20 feet (6 m) from the *point of exhaust*.

Figure 6.4




6.4.5 *Elevation above grade*

The point of exhaust shall be located not less than 10 feet (3 m) above grade nearest to the *point of exhaust* and shall be compliant with Section 6.4.3 (*Directional spread*) and Section 6.4.4 (*Straight-line trajectory*).

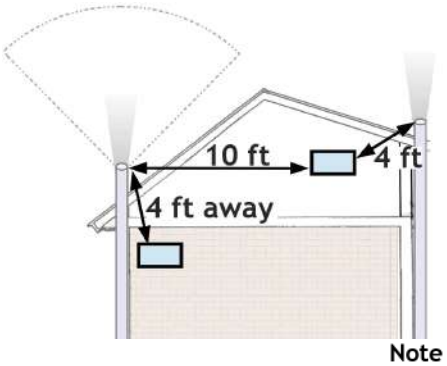



6.4.6 *Separation from operable openings in structures*

The point of exhaust shall be compliant with Section 6.4.3 (*Directional spread*) and located:

a) not less than 10 feet (3 m) horizontally to the side operable openings in structures; and

b) not less than 4 feet (120 cm) away from operable openings in structures that are below the point of exhaust.




Note



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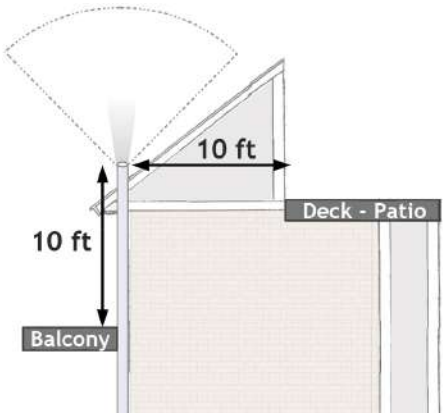
6.4.7 *Separation from people*

In relationship to exterior flooring surfaces such as decking, patios, sidewalks, and exterior corridors where individuals congregate or traverse, the *point of exhaust* shall be:

a) not less than 10 feet (3 m) above or horizontally to the side of exterior flooring surfaces; and

b) compliant with Section 6.4.3 (*Directional spread*) for an elevation of not less than 10 feet (3 m) above exterior flooring surfaces.



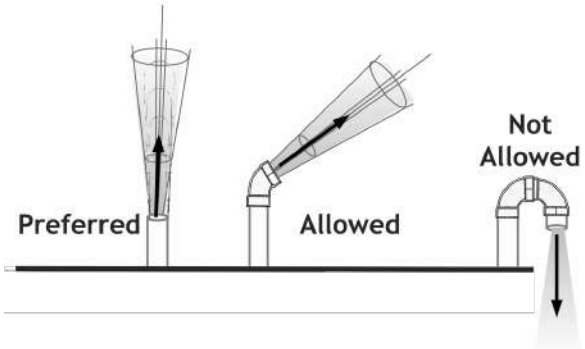

6.4.8 *Equipment wells and parapet roofs*

The point of exhaust relative to open equipment well airspaces or parapet roof construction, where areas are enclosed by more than two walls, shall comply with Section 6.4.3 (*Directional spread*), to include the breathing space where individuals conduct maintenance.

6.4.9 *Angled trajectories*

The point of exhaust shall be directed upward without obstruction at an angle that does not deviate more than 45 degrees from a vertical *exhaust trajectory*. The exhaust discharge shall not exhaust downward.

Exception: 90 degree horizontal exhausts shall comply with requirements in Section 6.4.12.




6.4.10 *Roof*

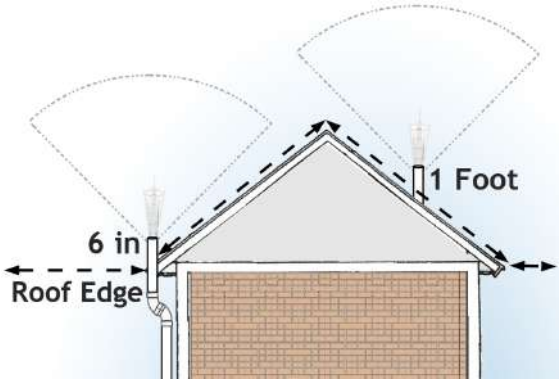
The *point of exhaust* shall comply with Section 6.4.3 (*Directional spread*) and, unless all requirements of Section 6.4.11 are met, the *point of exhaust* shall be:

a) not less than 1 foot (30 cm) above a pitched roof at the point penetrated;

b) not less than 6 inches (15 cm) above the edge of the roof when *ASD* piping is attached to the side of a building;

c) not less than 18 inches (46 cm) above a flat roof; and

d) not less than 4 feet (120 cm) horizontally away from a vertical wall that extends above the roof edge.

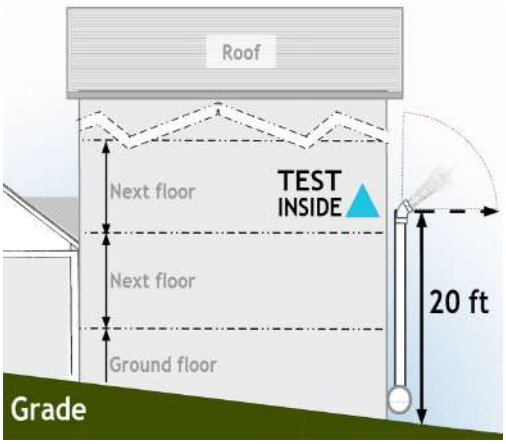



6.4.11 *Below the roof*

The *point of exhaust* shall be permitted to be located below the edge of the roof if the configuration complies with all requirements of Section 6.4 and requirements of a), b), and c) of this Section 6.4.11:

a) The justification for not locating the exhaust above the edge of the roof shall be recorded in the operations and maintenance plan and shall be based upon either:

1. the inability to comply with other requirements of Section 6.4 if the point of exhaust were located above the roof, or



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2. the edge of the roof exceeds 20 feet (6 m) above grade nearest to the point of exhaust;

b) The *point of exhaust* shall be: compliant with Section 6.4.3 (*Directional spread*); not less than 20 feet (6 m) above grade nearest to the point of exhaust; and not less than 4 feet (120 cm) away from operable openings that are above the point of exhaust; and

c) Testing shall be conducted within the occupiable area that immediately adjoins the 45˚ (*Directional spread*) required in Section 6.4.3. This testing is required no later than in conjunction with the initial post-*mitigation* test and shall be recommended for inclusion in all future post-*mitigation* tests.

6.4.12 *Horizontal trajectory*

While it is best practice to avoid horizontal trajectories, 90-degree horizontal exhaust trajectories are permitted if compliant with all other distances required in Section 6.4 and Section 6.4.12.1 or Section 6.4.12.2.

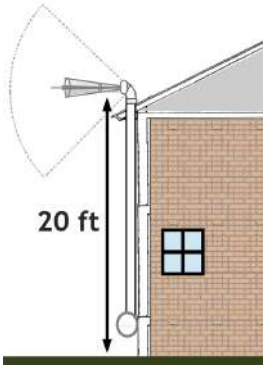
**Note**

6.4.12.1 90-Degree Horizontal Discharges

If passing the edge of the roof, the *point of exhaust* for a 90-Degree horizontal discharge shall not be less than 20 feet (7.5 m) above grade nearest to the point of exhaust. The point of exhaust shall comply with Section 6.4.3 (*Directional spread*) including for distances above the breathing space where individuals congregate or traverse as stipulated in Section 6.4.7.

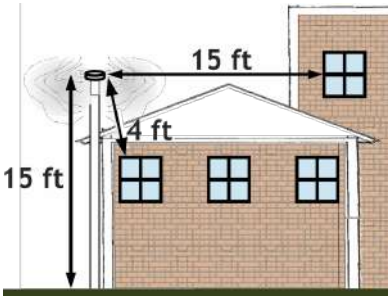
Where "T" style rain caps are configured for 90-Degree horizontal discharge in two directions, both discharge trajectories shall meet these requirements.

**Note**




6.4.12.2 Diffused Horizontal Discharge/Rain Caps

The *point of exhaust* for diffused horizontal discharges shall not be less than 15 feet (4.6 m) above grade nearest to the *point of exhaust* and not less than 4 feet (120 cm) above or 15 feet (4.6 m) away from *operable openings* into the structures, such as windows, skylights and doors.




6.4.13 *Increased distances for large capacity systems*

When the *ASD* system is designed for larger airflow capacities with duct piping larger than 4-inch (100-mm), distances shall be increased beyond what is required in Section 6.4 to comply with Table 6.4.13 in the most current publication of ANSI/AARST SGM-MFLB.

6.4.14 *Protection from the elements (see Informative notes)*

**Note**

## 6.5 *ASD* Fan Installation

6.5.1 *Fan design*

*ASD* fans chosen shall be:

a) designed for *continuous duty* operation;

b) designed or otherwise sealed to reduce the potential for leakage of water and soil gas;

c) designed to allow rainwater or condensation from within *ASD* piping to pass through or around the fan when operating; and

d) represented by the manufacturer as both appropriate for the class of contaminants being extracted and manufactured with features that meet minimum safety standards , to include:



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1. thermal protection integral to the fan that prevents dangerous overheating of the motor [6];
2. protection against electrical shock for fans mounted both on the interior and exterior of buildings, that may include a fan installed in a weatherproof protective housing that results in a code compliant configuration; and
3. other features that result in a safe fan installation, such as specified by codes[7] where evaluations of chemicals in soil have indicated that gases passing through the fan are corrosive or could result in a fire, explosion, or serious personal injury.

**Note**

6.5.2 *Safe locations required*

To avoid accidents that can result in systems leaking radon and soil gas into *occupied spaces* due to a failed pipe joint or other sealed connection:

a) *ASD* fans shall not be installed in the conditioned (heated/cooled) or otherwise occupiable space of a building; and

b) *ASD* fans shall not be installed directly beneath conditioned or occupiable spaces of a building, such as a fan installation within a basement, *crawl space*, or enclosed garage beneath occupiable space.

6.5.3 *Approved locations*

In compliance with requirements in Section 6.5.2, *ASD* fans are to be installed in attics, on the exteriors of buildings, or in garages that are not beneath conditioned or otherwise occupiable spaces.

Note—Ventilated attics or the exterior of the building are preferred locations. Considerations also include locations that avoid objectionable noise from fan vibration and exhaust air.

6.5.4 *Fan Installation*

Installation of *ASD* fans shall comply with requirements in a), b), c), d) and e) of this Section 6.5.4.

a) *ASD* fans shall be sized to provide the pressure difference and airflow capacity necessary to achieve the *mitigation* goals;

b) *ASD* fans shall be installed in a configuration that avoids condensation buildup in the fan housing. To achieve this requirement, *ASD* fans shall be installed on vertical runs of *ASD* piping or in accordance with the manufacturer's specifications;

c) *ASD* fans shall be mounted to piping using flexible couplings that comply with ASTM D5926 or ASTM C1173 or using an alternative method specified by the manufacturer that achieves a watertight connection; and

d) *ASD* fans subject to extreme climate conditions shall be protected with thermal insulation, as needed, in accordance with Section 6.2.10.

e) *ASD* fans shall not be installed below ground.

**Exception:** Locations that are created or exist below grade that are not beneath conditioned or otherwise occupiable space of a building, such as outside the building shall be permitted if configured to protect the fan and electrical components from damage and degradation. Such locations or any enclosures created shall include reasonable access for maintenance and adequate groundwater control such as drainage and, as applicable, *sump* pump systems. As applicable, all electrical components, including wiring and service switch configurations, shall be rated for use in wet or damp environments.

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[6] As a point of reference, products evaluated by an OSHA Nationally Recognized Testing Laboratory for meeting applicable safety standards, such as UL 507 Standard for Safety for Electrical Fans published by Underwriters Laboratories Inc., Northbrook, Illinois. ulstandards.ul.com

[7] As a point of reference, additional information on code compliant fans rated for hazardous applications such as explosion proof fans are provided in the attached Companion Guidance for Vapor Intrusion.



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# 7.0 SEALING

## 7.1 General

7.1.1 Sealing is not to be regarded as a permanent, stand-alone *mitigation* method.

> Note—The use of sealing alone has not been shown to significantly or consistently reduce radon entry into buildings[8]. The purpose and viable goal of sealing efforts are limited to achieving a continuous air barrier that resists air movement between soil and indoor air.

7.1.2 *Accessibility to cracks and openings*

For the purpose of sealing requirements herein, the term "accessible" shall mean *accessible* without destructive or significant disassembly of building components or finishes. If inaccessible openings or cracks may compromise the performance of a *mitigation* system, then they shall be disclosed to the *client* and included in *operation, maintenance, and monitoring (OM&M)* documentation.

## 7.2 Sealant Materials

7.2.1 *Caulking cracks*

When sealing cracks in slabs or foundation walls, the caulks and sealants shall be durable materials, such as urethane or polyurethane, complying with ASTM standard C920 class 25 or greater or equivalent material. Caulks and sealants shall be applied according to the manufacturer's recommendations.

**Note**

7.2.2 *For larger gaps*

Where a crack or joint is greater than 1/2 inch (13 mm) in width, foam *backer rod* or other comparable filler material to support wet caulk until it cures shall be inserted into the existing gap prior to applying caulk.

7.2.3 *For larger openings*

When sealing larger openings to soil in slabs and foundation walls, the materials shall be durable, such as: non-shrink cementitious products; expanding foam; plastic; or other comparable materials and methods appropriate for the application.

7.2.4 *For heated pipes and flues*

When sealing openings around combustion appliance flues and hydronic heat or steam pipes, noncombustible materials shall be used.

7.2.5 *For sump lids and hatchway doors*

For *sump* lids, hatchway doors or other items that require access in the future, nonpermanent sealant materials are required, such as silicone caulk, gasket materials or other equivalent method.

7.2.6 *Vapor Intrusion sealants*

When *ASD* goals include *mitigation* of chemical vapor intrusion, the *contractor* shall advise the *client* if any sealant products used are known to have long curing periods or contain constituent chemicals identified in *mitigation* goals.

**Note**

## 7.3 Accessible Slab Cracks

*Accessible* openings to soil around suction piping, utility penetrations and where the slab meets the foundation wall shall be closed or sealed to resist air movement between soil and indoor air.

**Note**

7.3.1 *Perimeter channel drains*

*Accessible* gaps to soil at perimeter channel drains and foundation drainage boards shall be closed or sealed to the extent practical without compromising water control capability of the perimeter drainage system.

[8] The EPA "Consumer's Guide to Radon Reduction" 402-K92-003, August 1992 and 402/K-10/005, December 2016



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Where sealing perimeter channel drain gaps, methods shall employ materials that will achieve closure yet retain flexibility to allow natural movement of foundation slabs and walls.

## 7.4 Other Openings to Soil

Other *accessible* and significant openings to soil in slabs or walls shall be sealed to resist air movement between soil and indoor air, such as: at support posts; electrical conduits that are open to soil; and openings for plumbing fixtures under bathtubs.

### 7.4.1 *Block walls*

Where Block Wall *Depressurization* is installed, all *accessible* openings and gaps in hollow block masonry walls that surround the hollow void network being depressurized shall be closed to resist air movement between the depressurized void network and both indoor air and outdoor air. Closure shall result in resisting migration of air into the depressurized void network, to include:

a) open blocks at the top course of hollow block masonry walls and open blocks under door or window openings; and
b) cracks or openings in the block walls, both inside and outside of the building.

Materials used to close openings and gaps shall be in accordance with Sections 7.2.3, 7.2.4 or equivalent.

### 7.4.2 *Basement de-watering systems*

If an *ASD suction point* must be installed into a basement de-watering system, exposed openings into the drainage system that can be sealed without compromising water drainage features shall be sealed, to include as required in Section 7.3.1.

**Note**

## 7.5 Sumps and Pits

*Sumps* or other *accessible* pit openings in the interior slab(s) that connect to soil air shall be covered and sealed to the extent possible without compromising the water control capability of the *sump*. The manner of closure shall not compromise safety concerns, such as emergency pressure relief discharge from hydronic heating system water boilers. Covers are not required for pits that do not connect to soil air.

### 7.5.1 *Sump cover specifications*

*Sumps* in interior floors that connect to soil air shall have a rigid lid made of sturdy and durable plastic such as polycarbonate plastic or other rot-resistant, rigid material sufficient to support anticipated loads in the area of use. The lid shall be *mechanically fastened* in a manner to facilitate removal for maintenance. The lid shall be sealed to resist air movement between soil gas and indoor air with a gasket or with nonpermanent caulk such as silicone. Penetrations through the lid such as gaps around electrical wiring, water ejection pipes and *ASD* piping shall be sealed.

#### 7.5.1.1 Sump Pit Access

Where work includes installing, modifying, or altering a sump cover for a pit that includes a *sump* pump, the sump cover shall include a removable handhole port or section of the lid no less than 4 inches (10 cm) in diameter that allows physical access for routine verification that pumps are operational. The access port shall achieve open access and reclosure without the use of sealants, as can be achieved by way of friction fit or screw-on caps, rubber grommets or equivalent methods. *ASD* suction pipe connections shall not be used for access ports.

**Note**

#### 7.5.1.2 Labeling Required (sump covers)

*Sump* lid labels shall be provided in compliance with Section 8.4.6 a.

### 7.5.3 *Sump pump water discharge*

If flexible rather than rigid water discharge piping is found, the *contractor* shall recommend in writing that rigid pipe for water discharge from permanent *sump* pumps be installed. *Sump* pumps or piping configurations for water discharge from the sump pump shall have a backflow prevention valve as typically



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provided to protect against pump failures. Should there be a need for the *contractor* to alter the destination of discharged sump water, the destination shall meet requirements of local authorities.

7.5.4 *Chemically contaminated water*

When *mitigation* goals include *mitigation* of *chemical vapor intrusion* and the *sump* needs to be installed or its discharge modified, *sump* water shall be handled and discharged to a destination as specified by a qualified environmental consultant.

7.5.5 *Surface water relief (slabs)*

An alternative drainage system shall be provided and installed in accordance with guidance in Section 7.8.1 when sealing a *sump* or other slab opening that is the only drain relief for excess water on the slab surface.

## 7.6 Membranes Over Exposed Soil

The membrane material shall be not less than nominally 6-mil (0.006 inch; 0.152 mm) in thickness.

7.6.1 *Durable for application*

Where exposed soil areas are expected to be regularly traversed for storage or other purposes, membranes with tensile strength and puncture resistance to withstand anticipated loads shall be employed. Where a membrane will be exposed to sunlight, such as at window wells in a *crawl space*, the membrane shall be resistant to UV degradation.

Exception: Where running mats or other protective materials are installed to protect the membrane where trafficked; where heavy items are stored; or where exposed to sunlight.

7.6.2 *Vapor intrusion (membranes general)*

The *contractor* shall account for the known *chemical(s) of concern* in relationship to manufacturer guidance on *soil gas retarder* materials to help ensure degradation of the material will not occur over time when in contact with the *chemical of concern*.

7.6.3 *Seams (membranes general)*

Seams where membrane materials are joined shall be sealed in accordance with Section 7.7.1 when sub-membrane *depressurization* (SMD) is employed. Otherwise, seams between adjacent membrane sheets shall be overlapped not less than 12 inches (30 cm).

7.6.4 *Repairs*

Tears or punctures in the membrane shall be sealed by:

a) a tape recommended by the membrane manufacturer; or
b) an additional sheet of the membrane material that covers and overlaps the tear or puncture not less than 6 inches (15 cm) on all sides and that is sealed with a caulk complying with ASTM C920 class 25 or greater, or an equivalent method.

7.6.5 *Label membranes or access ports*

Membranes or the *crawl space* access port shall be labeled in accordance with Section 8.4.6 b.

7.6.6 *Surface water relief (See important informational notes)* **Note**

## 7.7 Sub-Membrane Depressurization (SMD)

In addition to all requirements in Section 7.6, *soil gas retarder* membranes associated with SMD shall be sealed and secured in accordance with Section 7.7.1 through Section 7.7.4 to result in a closed *soil gas collection plenum* under the membrane that resists air movement between soil and air above the membrane.

7.7.1 *SMD—Seams*

The seams between adjacent membrane sheets shall be overlapped and sealed with a compatible sealant or a caulk complying with ASTM C920 class 25 or greater. Alternatively, a method such as membrane tape recommended by the manufacturer that results in an equivalent durable bond shall be permitted.



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7.7.2 *SMD—Pipe penetrations*

The opening around penetrations of a *soil gas retarder* for *ASD* duct piping and other utility pipe penetrations shall be fully closed using materials and methods that result in permanent closure. **Note**

7.7.3 *SMD—Securing the membrane*

*Soil gas retarder* membranes shall be *mechanically fastened* to foundation walls or footings and at structural supports. All outer edges of the membrane shall be secured by materials and methods that are capable of withstanding anticipated loads that might pull or tear the membrane away from walls or other surfaces.

Any wood installed as part of a *mitigation* system that directly contacts masonry or soil, such as when employed to secure a membrane, shall be resistant to decay and insects or otherwise protected.

7.7.4 *SMD—Sealing the membrane perimeter*

The entire perimeter of the sub-membrane *soil gas collection plenum* shall be sealed or closed in a manner to resist soil gas movement between the soil and air above the membrane using caulk that complies with ASTM C920 class 25 or higher, or alternative materials or methods that provide similar performance.

When portions of the *crawl space* cannot be accessed or have insufficient height to work in a safe manner, as established by the Occupational Safety and Health Administration (OSHA) or other authorities, the edges of the membrane within the boundaries of *accessible* areas shall be closed. **Note**

Exception: Where it can be demonstrated to be warranted, systems are permitted with a portion of the membrane edges unclosed. Such design shall meet any additional requirements in Sections 6.1.4 (*Non-habitable air spaces*) and Section 12.6 (*Soil gas dilution*). Open membrane edges shall be disclosed to the *client(s)* in documentation along with justification for the design. **Note**

## 7.8 Drains

7.8.1 *Drains to soil (see informative notes)* **Note**

7.8.2 *Utility drains to soil*

Openings in the slab or at *sumps* that serve for mechanical system water drainage and are likely to draw soil air into a building shall be modified to stop this airflow. The modification shall retain drainage capability, such as the use of a one-way flow valve, re-routing the drain line into a condensate pump or floor drain, or a trap in the drain that can hold at least 6 inches (15 cm) of water.

7.8.3 *Drains to daylight (see informative notes)* **Note**

## 7.9 Sealed Isolation Assemblies

*Sealed isolation assemblies* are not to be regarded as a permanent, stand-alone *mitigation* method. **Note**

7.9.1 *Sealing (isolation assemblies)*

When applying *depressurization* or *pressurization* to air within a *sealed isolation assembly*, any *accessible* openings between the isolated space and areas surrounding the isolated space shall be sealed to resist air movement between the isolated airspace and both indoor and outdoor air. Access doors or hatches that are not to be permanently sealed shall be fitted with airtight gaskets and a means of positive closure.

7.9.2 *Labeling required (isolation assemblies)*

Access ports into sealed isolation assemblies shall be labeled in accordance with Section 8.4.6 c.



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# 8.0 FOR ALL SYSTEMS AND METHODS

## 8.1 Long-Term Plan for OM&M

A plan for long-term *operation, maintenance, and monitoring (OM&M)* is required for all *mitigation* methods.

## 8.2 System Monitors

### 8.2.1 *Viewable operating range monitors*

All *mitigation* systems that incorporate a fan shall include a system monitoring mechanism to directly indicate if the fan, blowers, or other integral mechanical components are operating within the established operating range. Design and installation of such monitors shall comply with requirements in both a) and b) of this Section 8.2.1.

a) Continuous Display
The monitoring device shall provide continuous display of a measured value within the established operating range. The monitor shall be located where it is easily seen and protected from damage or degradation.

b) Start up values
Monitoring devices that continuously display a viewable operating range shall be clearly marked or labeled to indicate the measured pressure, airflow volume or amperage readings that existed at the time *mitigation* goals were achieved.

Exception: Fan monitors that provide remote electronic monitoring and notification in the event of *ASD* fan or other mechanical failure, such as to accommodate where occupants are not the responsible party for system maintenance.

### 8.2.2 *Active notification monitors*

All *mitigation* systems that incorporate a fan shall also include a monitoring mechanism that actively alerts occupants or other responsible individuals in the event of fan or other mechanical failure. The alert mechanism shall include one or more of the following warning signals:

a) Audible notification that is clear and distinct; or

b) Visual light notification that is vividly observable; or

c) Notification by telemetric means, such as by email or other electronic communication.

**Note**

### 8.2.3 *Required for all system monitors*

Requirements for all mechanisms or systems that monitor fan or airflow functionality include:

a) System monitors shall be *readily accessible* to individuals responsible for system maintenance without destructive or significant disassembly of building components or finishes.

b) System monitors shall be protected from the elements and durable for the ambient environmental conditions;

c) System monitors shall be labeled in accordance with Section 8.4.3;

d) Battery operated components shall not be used unless equipped with a low-power warning feature;

e) Components that require electricity for indication of system failure shall be on non-switched circuits and designed to reset automatically when power is restored after power supply interruptions; and

f) Components that require electricity for indication of system failure shall not be powered by the same branch circuit as the *mitigation* system fan(s).

Exception: Where the monitoring system has an independent means, such as a battery backup system, that actively alerts occupants or other individuals of component failure or branch circuit deactivation.



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## 8.3 Electrical

The electrical service for *ASD* Fans shall comply with the following provisions in addition to all other electrical code requirements. [9]

8.3.1 *Disconnect required*

For *ASD* fans, a means of electrical disconnect shall be provided in the line of sight and within 6 feet (1.8 m) of the *mitigation* system fan(s).

Exception: A switch remote from the fan location shall be permitted when concerns sufficiently warrant preventing inadvertent deactivation of the fan.

8.3.2 *Labels required (disconnects)*

Labeling shall comply with Section 8.4.5.

8.3.3 *Protection from shock*

All outdoor wiring for *ASD* fans shall be protected in conduit, unless otherwise permitted by local code, and shall not be a plug disconnect.

8.3.4 *Not allowed*

Wiring shall not be located in or chased through the *ASD* duct piping. **Note**

## 8.4 Labeling

8.4.1 *Label materials and lettering*

All labels shall be made of durable materials that are capable of withstanding ambient conditions where mounted. All label lettering and other annotation on systems shall be of a color in contrast to the color of the background on which the lettering is applied. The minimum lettering size shall conform to requirements a) and b) of this Section 8.4.1.

a) Label titles shall be with lettering not less than 1/4 inch (6 mm) in height.

b) Additional informational text shall be with lettering not less than 1/8 inch (3 mm) in height.

8.4.2 *Primary labels*

A system description label shall be placed on a primary component of each system. Approved locations for the system description label include on duct piping near an *ASD* fan monitor, within 12 inches (30 cm) of the electric service panel or other prominent location. System monitor devices shall have a label on or near the mechanism that describes how to interpret the monitor and actions to take if a monitor indicates fan failure or degraded fan performance.

The primary label titles shall describe the system purpose, such as “Radon Reduction System” or "Soil Gas Control System." Information required on or near the label(s) shall include content required in Sections 8.4.2.1 or 8.4.2.2 of this Section 8.4.2.

[9] As required by local statutes. For further information, see NFPA 70 The National Electric Code® as published by NFPA.



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8.4.2.1 Owner-Occupied Maintenance

For systems installed in individually owned and occupied *dwellings* or units where system maintenance and monitoring for continued effectiveness will be the responsibility of the owner, the primary label shall include:

a) Date of installation;

b) Maintenance and monitoring instructions, to include:

1. A description of the system monitors and actions to take if the system monitors indicate system degradation or failure, and
2. A recommendation to verify continued system effectiveness over time, such as:
   - a recommendation to conduct a radon test at least every 2 years, or
   - other monitoring procedures as specified in an *OM&M* plan for radon or chemical vapor intrusion systems;

c) State and federal informational resources, to include websites or phone numbers; and

d) The installer's name, phone number and applicable certification/license identification.

*Fig. 8.4.2.1 Example*

**RADON REDUCTION SYSTEM**
**Installed: _____ WC" ____**
**Maintenance**
**(1) Routinely Check Pressure Gauge**
**The fan is active if oil level on the left is different from the right.**
**If the fan appears to be off:**
**√ Check hose connection on gauge**
**√ Check electrical (switch or breaker)**
**√ If still indicating a problem, call for service.**
**(2) Retest for radon every 2 years**
**For Service: 1-800-RN2-2222**
**R. Smith RPP# 54321**
**Health Department Contacts:**
**www.epa.gov/radon; the radon hotline 1-800-SOS-RADON (Persons with hearing or speech difficulties should call 711.); or at www.epa.gov/radon/find-information-about-local-radon-zones-and-state-contact-information**

8.4.2.2 Independent Maintenance

Where system maintenance and monitoring are the responsibility of someone other than the occupant:

a) Informational content on a primary label that is observable to building maintenance staff or occupants shall include:

1. A description of system monitor(s) or monitoring systems and, as applicable, actions to take if the system monitor indicates system degradation, and
2. The name and contact information of the party responsible for maintenance and repairs.

*Fig. 8.4.2.2 Example*

**RADON REDUCTION SYSTEM**
**System Fan Monitor**
**The system fan is active if oil level on the left is different from the right. Please call to report if the fan appears to be off.**
**This system is under the care of:**
**R. Smith, L.L.C 1-800-RN2-2222**

8.4.3 *System equipment*

System equipment shall be marked or identified with a label title that portrays the system purpose. The labeling shall also comply with requirements in a), b) and c) of this Section 8.4.3.

a) Mechanical Equipment
*ASD* fans and other system air handling and mechanical equipment shall be labeled.

b) System Monitors
The system monitoring device(s) shall be provided a label near the mechanism, such as a primary label or other label, that includes:

1. Information on how to interpret the monitor; and
2. What to do if a monitor indicates fan failure or degraded fan performance; and

c) System Controls
Where systems include controls for mechanical equipment, a label shall be provided on or near the control mechanism. System control settings that existed at the time *mitigation* goals were achieved



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shall be clearly marked on the equipment, a label or provided with equipment instructions. General instructions for operation of each control mechanism shall be provided.

8.4.4 *Label duct piping*

Interior duct piping shall be marked with not less than one label at each floor level and within attics, garages and *crawl spaces* that portray the system purpose. Examples include "Radon Reduction System" or "Soil Gas Control System." **Note**

8.4.5 *Label electrical disconnects*

Disconnects, such as switches or plugged connections, for turning off *mitigation* system fans shall be labeled or marked to indicate their purpose. The label title shall identify that the disconnect as a component of the *mitigation* system. Examples include "Radon Fan – Do Not Turn Off," or "Radon Fan – Do Not Unplug."

8.4.6 *Label sealed components* **Note**

Certain components that are sealed to resist air movement between soil and indoor air shall be labeled in accordance with requirements in a), b), c) and d) of this Section 8.4.6.

a) Sump Covers

Sump lids shall be labeled to identify the lid as a component of the *mitigation* system.

Note—Instructions are recommended, such as "If opened, take care to reseal this cover."

b) Crawl Spaces or Membranes

Where *soil gas retarder membranes* have been installed, a label or marking shall be located in a conspicuous place or places. Examples include access panels or immediately visible once entering the *crawl space*, such as on membrane material near the access location. The label shall include:

1. A label title that indicates the presence of a *mitigation* system component, and
2. Instructions to help preserve the integrity of the membrane. Examples include, "Do Not Alter. Damage or alteration to plastic membrane sheeting can negatively impact system performance".

c) Access Locations

Where *mitigation* methods address air within a *non-habitable airspace* that can be accessed, labels shall be provided in a conspicuous place on the outside of access ports, hatches, and doors into the airspace or immediately visible once entering the airspace. The label shall include:

1. A label title that indicates the presence of a *mitigation* system component;
2. Instructions to help retain system effectiveness. Examples include "Keep closed. Leaving open can negatively impact building safety"; and
3. Instructions essential health and safety guidance where there are known health and safety hazards. Examples include:
   a. "Warning—Entry into this airspace can be hazardous. Precautions to ventilate this area are recommended;" and
   b. Applicable descriptions of recommended personal safety procedures, such as the possible need for protective gloves, clothing, respirators, or other personal safety equipment.

## 8.5 Inspection for Compliance

Prior to delivery and release of the completed system(s), a *qualified radon mitigation professional* or qualified *soil gas mitigation professional*, as applicable, shall have verified:

a) compliance with this standard;

b) conformance with the intended design criteria; and

c) compliance with local statutes and codes, including for related work conducted by other qualified professionals, as applicable and to the extent practicable.



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Any items found that are not compliant with this standard and local statutes or codes shall be brought into compliance.

**Exceptions:** Professional obligations to identify and correct items that are noncompliant with this standard of practice or local statutes, or codes shall have limits in accordance with Section 8.5.1.

8.5.1 *Limitations of professional obligations*

*Contractor* obligations regarding inspection for compliance shall be limited to visual inspection and photographic evidence of *readily accessible* components that do not require disassembly of components or finishings to achieve access. Limits to a *contractor's* obligations include a) and b) of this Section 8.5.1.

a) *Contractors* shall not be obligated to meet a minimum requirement in this standard of practice where the requirement is found to be in violation of local statutes or codes; and

b) *Contractors* shall not be obligated to have identified all items that may be noncompliant with local statutes or codes due to:

1. inherent limits of a visual inspection.
2. existence of conditions of that are outside the scope of work and skill sets normally associated with *mitigation*, such as preexisting conditions of mechanical or electrical systems.
3. reliance on superior capabilities reasonably expected from contracted specialists for knowledge of statute and code compliance; or
4. deviations or interpretations of a local jurisdiction that may subjectively or factually conflict with national or regional trends in code and code interpretation.

8.5.2 *Review with clients (See important informational notes)* **Note**

## 8.6 Retention of Records

Records of all *mitigation* work performed shall be kept for no less than: 6 years, as required by state regulations, or for any warranty period, whichever is longest. Health and safety records including *mitigation Installer radon* or *soil gas* exposure logs, as applicable, and other appropriate medical monitoring records shall be maintained as required by state or federal statutes.

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# 9.0 POST-MITIGATION

## 9.1 Functional Evaluations

Upon completion of the *mitigation* effort, as installed or augmented, actions prior to releasing the work product for post-*mitigation* testing of indoor or soil gas concentrations shall comply with all portions of this Section 9.1 and Section 8.5 (Inspection for Compliance).

### 9.1.1 *General*

Jobsite records shall be updated to include:

a. As-installed site plan diagrams or sketches that shall include key components of the *mitigation* system as they exist upon completion of the *mitigation* effort or alteration; and

b. Fan equipment model(s) and any building systems installed or altered to achieve *mitigation* goals.

### 9.1.2 *Non-ASD mitigation methods*

Once *mitigation* efforts that include non-*ASD mitigation* systems or methods are complete, evaluations to validate functional performance shall be conducted as required in Section 12 (Non-ASD Methods).

### 9.1.3 *ASD systems*

Once all sealing, piping and other components of the *ASD* system are complete, evidence relative to system performance shall be gathered as required in a), b) and c) of this Section 9.1.3.

a) *Depressurization* Performance

A minimum of one differential pressure measurement shall be made at a location distant from the suction point(s) with intent to evaluate if *depressurization* has been achieved within each targeted soil gas collection plenum. The term soil gas collection plenum shall include where subterranean pathways, such as voids or drain systems, are targeted as a primary source of soil gas entry.

The measurement shall be made using a differential pressure gauge that is capable of reading 1/1000-inch water column (.25 Pa) differences in air pressure. Jobsite log records of the event(s) shall include:

1. The outdoor temperature and building operating conditions, in accordance with requirements in Section 5.3.3; and
2. The measured air pressure within targeted *soil gas collection plenum(s)*, relative to indoor air.

Exception 1: Where, as with stone walls, it is not physically possible to measure *depressurization* with a pressure gauge, evidence obtained and recorded in jobsite logs from smoke testing or other *diagnostic* tools or method is permitted.

Exception 2: Where *PFE* test locations or test ports cannot be created due to building materials that are virtually irreplaceable, such as for historical preservation properties, or due to denied access to locations of interest. To exercise this exception, jobsite logs shall include the reason why and alternative locations or methods used for verifying design effectiveness. **Note**

b) Whole System Vacuum

The vacuum within the *main trunk* duct piping on the negatively pressured side of the fan shall be measured and recorded in jobsite logs. If the measurement is outside of the manufacturer recommended operating range, further investigation is required with findings recorded in jobsite logs.

c) Other Pertinent Conditions

A description of other pertinent observations shall be recorded in jobsite logs, to include:

1. A summary of materials and permeable conditions found under targeted slabs and actions taken to comply with requirements for *suction pit* size.
2. Identification of area targeted for *mitigation* compared to size of the full building footprint; and



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3. Locations of any sizable, unclosed openings between soil and indoor air that could not be closed to restrict air movement between soil and indoor air.

9.1.4 *Vapor intrusion and ASD*

Where goals include mitigating chemical vapor intrusion, a report shall be provided to *clients* prior to release of the system for further evaluations and testing that includes:

a) measured values and conditions observed as required in a), b) and c) of Section 9.1.3;

b) measured values for *cfm* ($m^3$/min) rate of exhausted air; and

c) as-installed site plan diagrams or sketches and a comparison of the mitigated area relative to *COC* concentrations measured in soil.

**Note**

9.1.4.1 Vapor Intrusion Test Ports

For systems intended to mitigate chemical vapor intrusion (VI), test ports for future *PFE* and soil gas sampling shall be created and configured to result in permanent test ports that are prominently documented in the *OM&M* manual. The test ports shall comply with a) and b) of this Section 9.1.4.1.

a) Physical properties

The test ports shall be:

1. *accessible* for future measurements without disassembly of building components or finishes;
2. installed to not present hazards such as tripping hazards to occupants;
3. installed after removing a portion of aggregate, packed fill or expansive soils that can often exist under a test port;
4. installed to retain functionality over time, such as by implementing hardware to allow easy access and closure of the test port in the future; and
5. sealed in a permanent, airtight manner at the opening between test port hardware and penetrations of a slab or *soil gas retarder* with a configuration that durably secures the test port in place.

b) Test port locations

The test ports shall be:

1. located at distances remote from the *suction point* to best characterize the full expanse of the targeted *soil gas collection plenum(s),* such as the most distant *accessible* slab locations;
2. installed at no less than three locations for any structure and include:
   a. at least one location for each slab floor of the building to include each basement, upper slab, garage and other slab-on-grade area that is greater than 64 square feet (6 $m^2$); and
   b. at least one location for soil gas collection plenum(s) addressed by each slab and membrane suction point.

## 9.2 Radon Test After Mitigation

For radon *mitigation*, initial post-*mitigation* testing shall comply with all provisions of this Section 9.2.

9.2.1 *Timeliness*

To provide an initial measure of system effectiveness, a short-term radon measurement shall be conducted no sooner than 24 hours after a *mitigation* system is operational and within 30 days after installation.

Exception: It shall be permissible that the initial retest after *mitigation* is delayed beyond 30 days in accordance with Section 9.2.4.1.

9.2.2 *Test protocols*

All testing shall be conducted in accordance with the most current version of ANSI/AARST MAH "Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes;" in accordance with any state



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protocols and requirements, where applicable; and as allowed in Section 9.2.4. For compliance with ANSI/AARST MAH:

a) Radon test devices employed shall be listed as approved by a national authority such as the National Radon Proficiency Program (NRPP), the National Radon Safety Board (NRSB) or a program that verifies compliance with the most current version of ANSI/AARST MS-PC; or as required by local statutes for jurisdictions that have a program for evaluating and approving devices.

Note—Identification of two existing certification bodies is not an endorsement of either program.

b) A Qualified Measurement Professional is an individual who has demonstrated a minimum degree of appropriate technical knowledge and skills specific to radon measurement in single-family residences as established in listing or certification requirements of:

1) a national program that is compliant with requirements in Section 13.1; and
2) as required by statute, state licensure or certification program, where applicable.

9.2.3 *Additional tests*

As applicable when exhausts are located below the roof or when non-*ASD mitigation* methods include mechanically induced pressurization or dilution, testing specific locations for *diagnostic* purposes or no later than the initial retests after *mitigation* is required in accordance with Section 6.4.11 c (Below the roof), and Sections 12.3 (Indoor Air Pressurization) and 12.4 (Soil Air Pressurization).

9.2.4 *Contractor obligations*

*Contractor* obligations to ensure post-*mitigation* testing is conducted have been satisfied once post-*mitigation* test results are accepted by the *client* as satisfactory evidence for the initial status of system effectiveness. For the purposes of this initial post-*mitigation* test, *contractor* obligations are satisfied regardless of whether this testing is conducted by:

a. an independent, *qualified measurement professional*; or
b. the *contractor* who installed the *mitigation* system(s), if also a *qualified measurement professional* (and if allowed by local statutes or code). To avoid any appearance of conflict of interest, the *contractor* shall recommend to the *client* that post-*mitigation* testing be conducted by an independent *qualified measurement professional*; or
c. the owner or occupant of the home.

9.2.4.1 **Exception:** *Contractor* obligations to obtain some form of test data that sufficiently demonstrates initial system effectiveness are, under this standard, satisfied when the *client* and *client* representatives or other person responsible for the property:

a) refuse to provide access or retest reports, or
b) are nonresponsive to outreach efforts to coordinate testing or obtain test reports; or
c) are prohibited by state or local law from contacting the person(s) responsible for the property.

If access is refused or legally unavailable, or if reasonable efforts across 3 months after installation do not result in a response, the *contractor* shall forward a radon test kit to the property in care of the current occupant. The firm analyzing the test kit shall be an independent laboratory listed by NRPP, NRSB or equivalent national program, or by the state radon laboratory licensing or certification program. The laboratory shall be instructed to deliver copies of the test results to the person(s) who conducted the test.

## 9.3 Testing for *Chemicals of Concern* (*COC*)

**Note**

Due to various considerations, *qualified soil gas mitigation professionals* are not required under this standard to ensure post-*mitigation* measurements are conducted for hazardous chemical vapors or other substances.



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# 10.0 DOCUMENTATION—ALL SYSTEMS AND METHODS

## 10.1 Long-Term Plan for OM&M Required

A long-term plan for *operation, maintenance, and monitoring (OM&M)* is required for all *mitigation* systems and methods applied. The plan for *OM&M* shall be provided in an information packet, in accordance with Section 10.2, or in an *OM&M* manual, in accordance with Sections 10.5.

## 10.2 Owner-Occupied Maintenance

The *contractor* shall provide an information package that contains a plan for *OM&M* that includes essentials for *ASD* systems installed where the *dwelling* or unit is both individually owned and occupied by the person(s) responsible for *OM&M*. The information package shall be:

a) labeled "Radon Reduction System," "Soil Gas Reduction System" or as otherwise labeled to describe the purpose of the information package; and

b) attached to the system piping in a visible location within interior spaces.

Exception 1: If no portion of the system is visually *accessible* within interior spaces, the information package shall be securely mounted in another interior location where it is visually and physically *accessible*, such as in a mechanical room.

Exception 2: Where the information package is electronically available on a website for a period of not less than 6 years at no additional cost to current or future person(s) responsible for *OM&M*. When exercising this exception, the primary system labeling, required in Section 8.4.2.1, shall include instructions for how to electronically obtain the information package. If requested, the *contractor* shall similarly provide the information package in paper or electronic media per the request.

### 10.2.1 *Information package*

The information package shall include content that complies with a), b), c), d) and e) of this Section 10.2.1.

a) Essentials

Consistent with owner-occupied labels in Section 8.4.2.1, the information package shall include:

1. The date of installation;
2. Maintenance and monitoring instructions applicable to the *mitigation* purpose, to include:
   a. A description of system monitors and actions to take if system monitors indicate system degradation or failure; and
   b. A recommendation to verify continued system effectiveness over time, such as either:
      — a recommendation to conduct a radon test at least every 2 years and to check system monitors quarterly to ensure the system is still functioning; or
      — other monitoring procedures as specified in an *OM&M* manual as required herein, such as required for chemical vapor intrusion and non-*ASD mitigation* methods;
3. State, provincial, federal and, if applicable, local informational resources, to include websites or phone numbers; and
4. Contact information for service inquiries to include the name, address, phone number and email address of the service provider and relevant certification or license number(s) of the *qualified mitigation professional(s)* responsible for quality and standards compliance.

b) System descriptions

A description of the *mitigation* system(s) as installed shall be provided to include:

1. System components labeled on a floor plan sketch or portrayed in narrative that describes system components and locations.



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2. Basic operating principles;
3. An estimation of annual operating costs; and
4. Fan equipment model(s) and startup parameters, including system monitor pressure gauge readings and any control settings that existed at the time *mitigation* goals were achieved.

c) Adverse or extenuating circumstances
A description shall be provided of important observations that have potential to adversely affect the *mitigation* system(s) or other building systems; and

d) Warranty/Guarantees
Information shall be provided regarding warranties, guarantees and related conditions or limitations that are consistent with proposals, as required in Sections 4.2 d, e, and f (Proposals).

e) Additional Retest Guidance
The following or equivalent guidance shall be provided in the information packet:

> "Testing to verify continued effectiveness is to be conducted in conjunction with any sale of a building and after any of the following events occur:
> - ✓ New adjoining additions, structures or parking lots;
> - ✓ Building reconfiguration or rehabilitation
> - ✓ A ground contact area not previously tested is occupied or a home is newly occupied;
> - ✓ Heating or cooling systems are altered with changes to air distribution or pressure relationships;
> - ✓ Ventilation is altered by extensive weatherization efforts;
> - ✓ Sizable openings to soil occur due to:
>   - — groundwater or slab surface water control systems or sewer lines are added or altered (e.g., sumps, drain tiles, shower/tub retrofits, etc.) or
>   - — natural settlement causing major cracks to develop;
> - ✓ Earthquakes, blasting, fracking, or formation of sink holes nearby; or
> - ✓ An installed mitigation system is altered."

## 10.3 Non-*ASD* Methods

Regardless of whether the owner or an independent party is responsible for maintenance, an *OM&M* manual compliant with Section 10.5 shall be provided where non-*ASD mitigation* designs are employed.

## 10.4 Independent Maintenance

Where maintenance and monitoring of *mitigation* components are the responsibility of someone other than the occupants, the *contractor* shall provide the *client* a written *OM&M* manual after mitigation that complies with all provisions of Section 10.5.

## 10.5 OM&M Manuals

*OM&M* manuals shall include all content required in Section 10.2 for owner-occupied information packages. In addition, the *OM&M* manual shall comply with all portions Section 10.5 as published in the latest publication of ANSI/AARST SGM-MFLB. These provisions include Sections 10.5.1 (Stewardship/Monitoring), 10.5.2 (Historical Information), 10.5.3 (System components), 10.5.4 (Maintenance inspection checklists), 10.5.5 (Repairs), and 10.5.6 (Retention of OM&M records).

## 10.6 Inadvertent *Collateral Mitigation*

Where *mitigation* is not conducted in all attached units or *dwellings* in a shared building, both the following, or equivalent, statement and example notice in Figure 10.6 shall be prominently included with information packets and *OM&M* manuals to inform the *client* of inherent obligations to neighboring occupants:



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> *"There are inherent obligations to occupants of adjoining dwellings regarding disclosure of elevated radon concentrations found and potential effects on adjoining dwellings as a result of the mitigation system.*
>
> *In accordance with the ANSI/AARST standards, mitigation firms are obligated to advise the client of inherent obligations to neighboring occupants.*
>
> *It is strongly recommended to distribute the following message in writing to occupants of adjoining dwellings and, if applicable, to the homeowner's association or management firm that provides stewardship for neighboring properties."*

Figure 10.6 **Example Notice to Neighboring Property Owners and Occupants**

From: _____

Elevated radon concentrations were found at (addresses): _____

A mitigation system [ ] has been installed, or [ ] is planned to be installed.

In the interest of health protection, we have been advised to provide you the following messages:

1) Test your home for radon — it's easy and inexpensive. Any building on any parcel of land can have a radon problem.
2) The radon reduction system installed or planned for installation in our dwelling can inadvertently move air and extend a vacuum under some adjoining units or dwellings with the intent to stop radon entry into your dwelling. It is recommended that occupants of adjoining units:
   a) Seek to maximize radon reductions and energy conservation by closing openings to soil (e.g., closed covers over sumps and large holes).
   b) Check for any adverse impacts such as flue gas spillage from combustion appliances.
3) We cannot warrant any degree of radon reductions, nor can we be responsible for maintaining radon reductions, maximizing energy conservation, or checking for unlikely yet possible environmental impacts for adjoining units. For additional guidance, it is recommended to contact the state or local radon office. Sources in the U.S. include the national radon hotline at 1-800-SOS-RADON (1-800-767-7236) and state radon offices that can be found at: https://www.epa.gov/radon/epa-map-radon-zones-and-supplemental-information#datainfo



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# 11.0 HEALTH AND SAFETY

## Advisory Notice

This document cannot address all health and safety concerns associated with *mitigation* installations. Users of this document are responsible for establishing and implementing appropriate safety practices and compliance with applicable federal, state, and local regulations relating to worker health and safety.

## 11.1 Safety Management Program

The *contractor* shall establish, maintain, and follow a written safety management program. The program shall address health hazards and safety for jobsite workers and others, as it specifically pertains to *mitigation* activities. Where worker safety regulators require review of worker safety programs, the *contractor* shall provide the safety management program and related records as required by federal or local jurisdictional authority.

### 11.1.1 *Resources*

The program policies shall address a means for making personal safety equipment available to all jobsite workers, including, but not limited to eye protection, hearing protection, respiratory protection, knee pads, fire extinguishers, hard hats, and steel-toe boots and protective gloves.

## 11.2 Safety Training

The safety management program shall address a means to inform and educate jobsite workers on safety practices and policies by way of educational courses or staff briefings.

**Note**

### 11.2.1 *Worker training*

Safety precautions reviewed no less than annually with all jobsite workers shall include discussion of:

a) Ventilation of work areas to reduce exposure to radon, radon decay products, hazardous vapors and other airborne hazards;

b) Safe use of all jobsite equipment including safe practices when using ladders or scaffolding, and identifying and avoiding electrical hazards;

c) Safety procedures, that should often include a buddy system, whenever conducting work in *crawl spaces*, confined spaces and where hazards exist from excavation, falling or heat exhaustion. This discussion to include symptoms and appropriate responses to heat exhaustion and Hantavirus;

d) Safety procedures prior to and while drilling through slabs, such as efforts to identify if there are utility lines below slabs or steel tendons within post-tension slabs;

e) Personal safety equipment, to include:

1. Eye protection from flying dust and debris, such as during sawing and drilling;
2. Ear protection from repetitious exposure to loud noise, such as generated by hammer drills;
3. Respiratory tract protection from airborne particulates and biological hazards, such as masks to protect against airborne silica dust, organic vapors, asbestos, glass fibers and communicable diseases; and
4. Protection against bodily harm by way of protective gloves, steel toe boots and hard hats; and

f) Safe driving practices, including parking and backing up at jobsites, and procedures to minimize harm that can result from repetitious muscle strain activity; and

g) Safety considerations relative occupational exposure to radon, chemical and hazardous gases, to include safety data sheets (SDS) and how to access SDS information related with hazardous compounds in products used during construction, such as caulk and glues or bonding products.



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11.2.2 *Oversight training*

Person(s) physically onsite who are deemed responsible for overseeing jobsite, educational or briefing events shall additionally include, but not limited to, discussion of:

a) Stopping work until safe conditions can be secured;
b) Posting or providing notice for occupants regarding observed hazards;
c) Hazardous building conditions identified in Section 11.3; and
d) Responses to and reporting work-related accidents or illness.

## 11.3 Hazardous Building Conditions

In any planned work area where it is suspected that contaminants such as asbestos, lead paint, mold or other toxins exist, work shall be conducted in a manner that meets applicable regulations and maintains consideration for the health and safety of both workers and occupants.

11.3.1 *Asbestos*

In any planned work area where it is known or suspected that asbestos may exist and be disturbed, work shall not be conducted until an accredited asbestos inspector who, where applicable, is licensed by the state or local jurisdiction determines that such work will be undertaken in a manner that complies with applicable asbestos regulations.

*Informative advisory*—Deteriorating, damaged or disturbed asbestos-containing products can pose a serious health threat to occupants and workers. Asbestos-containing materials can include certain materials for insulation, fireproofing, acoustical materials, floor tiles and adhesives. Care should be taken to recognize that asbestos inspection reports do not always specify the location of asbestos and that previously hidden asbestos-containing materials that can be exposed during construction or renovations.

Note—The *client* should be notified that proper assessment and abatement procedures are to be followed as regulated by NESHAP, OSHA, the LSHR and state and local regulations for the protection of the health and safety of occupants, and *contractors*. For more information, see www.epa.gov/asbestos

11.3.2 *Lead-based paint*

*Informative advisory*—Common renovation activities such as sanding and demolition can create hazardous lead dust and chips, which can be harmful to adults and children.

Note 1—Any activity that disturbs paint (unless it is known by testing to not be lead-based paint) in pre-1978 target housing is subject to the EPA Lead Renovation, Repair and Painting (RRP) rule (40 CFR 745, Subparts E and Q). EPA has established the Lead-Safe Certification Program for contractors in response to this concern. For more information, see a reference such as www.epa.gov/getleadsafe

Note 2—In addition, all target housing that is federally owned and target housing receiving federal assistance fall under "The Lead Safe Housing Rule" (24 CFR Part 35 Subparts B through R). Please refer to Subpart R—Methods and Standards for Lead-Paint Hazard Evaluation and Hazard Reduction Activities (24 CFR Sections 35.1300 through 35.1355) for HUD specific methods and standards that would be applied for target housing. The Lead Safe Housing Rule and additional HUD information is available at www.hud.gov/healthyhomes .

11.3.3 *Flue gas spillage*

*Clients* and impacted residents shall be advised of *flue gas spillage* that is encountered during the course of *mitigation* activities. If *flue gas spillage* is observed to result from the *mitigation* system operation, the system shall be deactivated until the condition has been evaluated and corrected. In such event, the *client* or impacted resident shall be advised to contact an HVAC contractor or other qualified person to evaluate and correct *flue gas spillage* condition as well as to verify proper appliance installation and performance.

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## 11.4 Radon Mitigation

All jobsite workers physically installing radon *mitigation* systems shall be advised of occupational hazards of exposure to radon and the need to apply protective measures.

### 11.4.1 *Jobsite worker exposure to radon*

Where the purpose of *mitigation* includes *mitigation* of radon gas, the safety management program shall include a means to monitor each worker's exposure to *radon* at each work site based on:

a. The highest pre-*mitigation* indoor radon measurements; or

b. Actual jobsite measurements of radon or radon decay products; or

c. Measurements from a radon dosimeter such as an alpha track or comparable device consistently worn at the job site and stored in a low-radon environment during nonworking hours; or

d. As required by jurisdictions of authority.

### 11.4.2 *Radon exposure limits*

Jobsite worker exposure shall be limited to 4 working level months (WLM) or 400 pCi/L-Months (pCi/L-M) over any 12-month period in accordance with requirements in a) or b) of this Section 11.4.2.

Note—Less than 1 WLM or 100 pCi/L-M over any 12-month period is a recommended goal that is commonly met for concentrations jobsite workers typically encounter day to day.

a. WLM calculations shall be based upon the jobsite worker's exposure hours times the exposure concentration, as expressed in working level (WL) units of measurement. Working level hours (WLH) shall be derived from WL measurements multiplied times exposure hours. Ongoing totals of WLH shall be divided by 170 workhours/month to achieve working level months (WLM).

Table 11.4.2 a Example Spreadsheet Calculations (WLM)

| | A | B | C | E | | F | G |
|---|---|---|---|---|---|---|---|
| | *Data Entry* | | | *Calculations* | | | |
| 0 | Date | Hours | pCi/L | WL | WLH | WLM | TOTAL WLM: **0.038 WLM** |
| 1 | 1/12/2021 | 8 | 32 | 0.32 | 2.56 | 0.015 | |
| 2 | 1/13/2021 | 4 | 5 | 0.05 | 0.20 | 0.0012 | |
| 3 | 1/13/2021 | 4 | 7 | 0.07 | 0.28 | 0.0016 | **Total to not exceed 4 WLM in any 12-month period** |
| 4 | 1/14/2021 | 8 | 10 | 0.10 | 0.80 | 0.0047 | |
| 5 | 1/15/2021 | 8 | 22 | 0.22 | 1.76 | 0.0104 | |
| 6 | 1/16/2021 | 4 | 22 | 0.22 | 0.88 | 0.0052 | |
| | | | | =pCi/L / 100 | =WL * Hours | =WLH / 170 | =(SUM) WLM |
| | | | | If calculating 50% ER: =(pCi/L/100) * 0.5 | | | |

Note—The limits in this standard are based on 100% equilibrium ratio (ER). Where required to report WLM using 50% equilibrium ratio, the WL value or pCi/L-M value would be reduced by 50%.



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b. Equivalent pCi/L-M calculations shall be based upon the jobsite worker's exposure hours times the exposure concentration expressed in *pCi/L* units of measurement. pCi/L- hours shall be derived from radon (pCi/L) measurements multiplied times exposure hours. Ongoing totals of pCi/L-hours shall be divided by 170 workhours/month to achieve picocurie months (pCi/L-M).

Table 11.4.2 b Example Spreadsheet Calculations (pCi/L-M)

| | A | B | C | E | F | G |
|---|---|---|---|---|---|---|
| | *Data Entry* | | | *Calculations* | | |
| 0 | Date | Hours | pCi/L | pCi/L-Hours | pCi/L-Months | Total pCi/L-Months: **3.81 pCi/L-M** |
| 1 | 1/12/2021 | 8 | 32 | 256 | 1.5 | |
| 2 | 1/13/2021 | 4 | 5 | 20 | 0.12 | |
| 3 | 1/13/2021 | 4 | 7 | 38 | 0.16 | **Total to not exceed 400 pCi/L-Months in any 12-month period** |
| 4 | 1/14/2021 | 8 | 10 | 80 | 0.47 | |
| 5 | 1/15/2021 | 8 | 22 | 176 | 1.04 | |
| 6 | 1/16/2021 | 4 | 22 | 88 | 0.52 | |
| | | | | = pCi/L Hours | = pCi/L hours / 170 | =(SUM) pCi/L-Months |

## 11.5 Chemical Vapor Mitigation

11.5.1 *Chemical vapor Intrusion (VI)*

All jobsite workers physically installing systems intended to reduce occupant exposure to hazards from chemical vapors or other soil gas of concern shall be advised of occupational hazards from exposure to such substances and the need to apply protective measures when handling and controlling such hazardous substances. The health and safety program shall include additional educational courses or staff briefings that include review and discussion of a) and b) of this Section 11.5.1:

**Note**

a) Understanding chemical exposure scenarios.
Note—Three groups of people, or "receptors," can potentially be exposed to chemical contaminants at residential locations where *mitigation* systems are installed;

**Informative Table 11.5 Chemical Exposure Scenarios**
Summary of various exposure scenarios

| Receptor (Persons) | Media to Which Exposed | Routes of Exposure | Common Exposure Durations | Hazards Related to Installations | Hazards Related to Frequency of Exposure |
|---|---|---|---|---|---|
| Mitigation Installers | Sub-slab soil | 1. Dermal contact<br>2. Ingestion following hand-to-mouth<br>3. Inhalation of vapor / particulates<br>4. Ingestion of particulates | 2 hr/event | Varies depending on chemicals present and materials used during system installation | Varies from one-time acute exposure to a series of acute exposures over many years (that can combine to result in a subchronic or chronic risk scenario) |
| | Indoor air | Inhalation of vapor and, to a lesser extent, particulates | 6 hr/event | | |
| Monitoring Events | Indoor air | Inhalation of vapor | 1 hr/event | | |
| Residents | Indoor air | Inhalation of vapor | 12-24 hours/day | Short-term and dependent upon materials used during system installation | |



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b) Personal protection regarding contaminated soil, contaminated indoor air and explosive or fire hazard situations.

Note—For guidance, see:

- The NIOSH pocket guide to chemical hazards: www.cdc.gov/niosh/npg/ ;
- ATSDR (The Agency for Toxic Substances and Disease Registry) list of contaminants commonly encountered: www.atsdr.cdc.gov/SPL ; and
- For their minimal risk levels: www.atsdr.cdc.gov/mrls .

11.5.3 *Safety oversight*

Where the purpose of *mitigation* includes *mitigation* of chemical vapors or other soil gas of concern, the safety management program shall designate a person to oversee activities who is:

a) trained and qualified in OSHA's HAZWOPER requirements; and
b) authorized to stop work until safe conditions can be secured.

11.5.3.1 Jobsite Hazards

Prior to mitigating any structure for chemical vapor intrusion or explosive gas the *contractor* shall request in writing that the *client* provide a written statement confirming any need, or if there is not a need, for special considerations regarding site conditions and handling or control of hazardous substances, to include:

a) Worker Exposures (relative to maximum concentrations that workers should expect to encounter from inhalation, ingestion and dermal exposures to hazardous substances);
b) Handling of Toxic Soil and Groundwater (including groundwater that might be found in sump wells or intruding above slabs or into *crawl spaces*); and
c) Flammable or Explosive Gases or Vapors.

*Informative advisory*—The health and safety practices needed can depend on identifying known hazards at the jobsite(s). If the *client* does not furnish appropriate information and guidance related to known chemical or explosive gas hazards, the *contractor*, who is ultimately responsible for jobsite safety, is denied the capacity to institute safe practices.

11.5.3.2 OSHA Requirements

*Informative advisory*—OSHA mandates special requirements and worker training under certain circumstances. For guidance see:

- The attached Companion Guidance for Vapor Intrusion;
- OSHA HAZWOPER training requirements: https://www.osha.gov ; and
- OSHA requirements for "Permit-required confined spaces": OSHA's 29 CFR 1910.146, clause (c)(5)(ii)(C), on test, subclause (1), Oxygen content, (2), Flammable gases and vapors, and (3), Potential toxic air contaminants.

## 12.0 NON-*ASD* MITIGATION METHODS

All Non-*ASD mitigation* systems and methods shall comply with Section 12 of the most current publication of ANSI/AARST SGM-MFLB.

These provisions include Sections 12.1 (General), 12.2 (Sources for Air Delivered to a Building), 12.3 (Indoor Air Pressurization), 12.4 (Soil Air Pressurization), 12.5 (Indoor Air Dilution), 12.6 (Soil Air Dilution), 12.7 (Passive Methods and Systems), 12.8 (Air Cleaning), 12.9 (Water), 12.10 (Building Materials), and 12.11 (Source Removal).



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# 13.0 NORMATIVE APPENDICES AND REFERENCES

## 13.1 National Certification/Listing Programs

For private sector certifications and listings, this standard requires a national program that evaluates and lists qualified individuals, training courses and other products or services, such as laboratory services, integral to achieving public health goals intended by this standard. Programs meeting the purpose, need and requirements of this standard are those with policies as established in a), b) and c) of this Section 13.1.

a) Programs with published policies that:
   1. require persons to undergo education and an impartial examination process prior to granting personal certification or certificates of educational achievement; and
   2. require surveillance of continued competence, not less than as demonstrated by continuing education on standards updates, compliance and other related technical knowledge and skills, prior to granting recertification or renewed certificates or listings; and
   3. require, for the certification of radon measurement laboratories, initial demonstration and scheduled ongoing surveillance of compliance with ANSI/AARST MS-QA (Radon Measurement Systems Quality Assurance).

b) Programs that:
   1. have a written policy and means for receiving and adjudicating complaints against individuals or companies who have been granted a credential; and
   2. have publicly published educational and examination requirements for each credential or listing available online where readily accessible for consumers of credentialed services.

c) Programs that include educational prerequisites as follow:
   1. Qualified Mitigation Professionals—Homes
      Certifications granted that qualify individuals as proficient in designing radon or soil gas *mitigation* systems in existing homes are to include:
      a. no less than 32 hours education prior to granting certification that focuses on tasks required in this standard, ANSI/AARST SGM-SF (Soil Gas Mitigation Standards for Existing Homes); and
      b. biennial recertifications after completing continuing education requirements and any other program surveillance activities.
   2. Qualified Radon Measurement Professional—Homes
      Certifications granted that qualify individuals as proficient in conducting radon measurements in existing homes are to include:
      a. no less than 16 hours education prior to granting certification that focuses on tasks required in ANSI/AARST MAH (Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes); and
      b. biennial recertifications after completing continuing education requirements and any other program surveillance activities.

Informative Note 1—The National Radon Proficiency Program (NRPP), the National Radon Safety Board (NRSB), or equivalent programs that also meet requirements of a), b) and c) of this Section 13.1 meet the requirements of this standard.

Note that identification of existing certification bodies is not an endorsement of their programs.



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Informative Note 2—The purpose of requirements in this Section 13.1 is to ensure contractors have an appropriate degree of technical, engineering, and scientific knowledge to protect occupants by successfully reducing hazards associated with *radon gas*, chemical vapors or other soil gases that are present in indoor air.

## 13.2 Normative References

Published by the AARST Consortium on National Standards
For the latest versions of AARST/ANSI documents, see: www.standards.aarst.org

ANSI/AARST MAH (Protocol for Conducting Measurements of Radon and Radon Decay Products in Homes)

ANSI/AARST SGM-MFLB (Soil Gas Mitigation in Existing Multifamily, School, Commercial and Mixed-Use Buildings)

*Note—Previously published as ANSI/AARST RMS-MF and RMS-LB and now harmonized and consolidated into a single standard.*

Published by the ASHREA
For the latest versions of ASHRAE documents see: www.ashrae.org

- 62.1 Ventilation for Acceptable Indoor Air Quality for buildings that are more than three stories tall (Appendix B—Separation of Exhaust Outlets and Outdoor Air Intakes)

Published by ASTM International
For the latest versions of ASTM documents see: www.astm.org

- C33 Standard Specification for Concrete Aggregates
- C920 Elastomeric Joint Sealants
- C1173 Flexible Transition Couplings for Underground Piping Systems
- D1785 Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- D2564 Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems
- D2665 Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings
- D5926 Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
- E1745 Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs
- F656 Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings
- F891 Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core
- F1488 Coextruded Composite Pipe
- D2787 Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)

Published by the International Code Council, Inc.
For the latest versions of ICC documents see: www.iccsafe.org

- The International Residential Code® (IRC)
- The International Building Code® (IBC)
- The International Mechanical Code® (IMC)
- The International Plumbing Code® (IPC)
- The International Energy Conservation Code (IECC)



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## 14.0 DESCRIPTION OF TERMS

Terms not defined herein have their ordinary meaning within the context of their use as defined in "Webster's Collegiate Dictionary."

**Accessible:** Capable of being reached for operation, repair, and inspection.

**Accessible, Readily (Readily Accessible):** Capable of being reached quickly for operation, repair, or inspections without requiring those to whom ready access is requisite to take actions such as to use tools (other than keys), to climb over or under, to remove obstacles, or to resort to portable ladders, and so forth.

**Active soil depressurization (ASD):** A family of radon mitigation systems involving mechanically driven soil depressurization, including sub-slab depressurization (SSD), sub-membrane depressurization (SMD), block wall depressurization (BWD) and *crawl space* depressurization (CSD).

**Backer rod:** A semi-rigid closed-cell foam material resembling a rope (available in various diameters) that is used to fill around pipes, large cracks, etc. to assist in making a sealed penetration.

**Becquerel per cubic meter (Bq/m³):** A unit of measure for radioactivity in one cubic meter of air. CONVERSION: 1 Bq/$m^3$ equals 0.027 picocuries per liter (*pCi/L*).

**Chemicals of Concern (COC):** Chemicals in vapor, liquids or soil that have been identified at a site location to potentially pose health and safety hazards.

**Client:** The person(s), or company that contracts with a *contractor* to install a mitigation system in a building.

**Collateral mitigation:** The ability to mitigate more than one occupied *dwelling* or unit with a single mitigation system.

**Continuous Duty:** A motor may be rated as either continuous duty or intermittent duty. Continuous duty rated motors are rated to be run continuously without any damage or reduction in life of the motor while intermittent duty motors must be allowed to stop and cool before restarting.

**Contractor:** Any person(s) or contracting firm regardless of organizational structure who installs a mitigation system. See Section 3 for descriptions of Qualified Mitigation Professionals.

**Crawl space:** A foundation type with an open area beneath the livable space of a *dwelling* that typically has either a concrete slab or earthen floor.

**Cubic feet per minute (cfm):** A measure of the flow rate of a fluid, such as air. CONVERSION: 1 cfm = 1.699 cubic meters/hour ($m^3$/hr).

**Depressurization:** A negative pressure induced in one area relative to another.

**Diagnostic procedures:** One or multiple procedures for identifying or characterizing conditions under, beside and within buildings to project the effects of various system designs. Diagnostic procedures can include sub-slab pressure field extension tests or analysis; visual observations; characterization of pressure or air exchange rates between indoors and outdoors and also between floors or adjoining air spaces; and *diagnostic radon measurements* at locations of interest (e.g., common areas, mechanical spaces and spaces not in ground contact).

**Diagnostic radon measurements:** Diagnostic Radon Measurements are intended to confirm specific conditions or effects of mitigation activities. Test locations are identified by their relationship to the specific information being sought. Diagnostic Radon Measurements are not a substitute for testing in accordance with ANSI/AARST measurement protocols.

**Dwelling:** A building or portion of a building that is used, intended, or designed to be built, used, rented, leased, let, or hired out to be occupied or that are occupied for living purposes.

**Feet per minute (fpm):** A measure of the velocity rate of a fluid, such as air. CONVERSION: 1 fpm = 0.3048 meters per minute (0.3m/min).

**Flue gas spillage:** A condition in which the normal movement of combustion products up a flue (due to the buoyancy of the hot flue gases) is reversed, resulting in the combustion products entering the building. Flue gas spillage of combustion appliances (such as fireplaces and furnaces) can occur when *depressurization* in the house overwhelms the buoyant force of the hot gases. Flue gas spillage can also be caused by a blockage in the chimney or flue termination.

**High-rise building:** A building that is 75 feet (23 m) or higher.



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**HAC system:** Heating and cooling (air conditioning) systems that are not designed to also supply outdoor air ventilation. HAC systems are common to single-family residences.

**HVAC setback:** HVAC "setback" is normally the automated or manual operation of system controls to cause different activity for heating, cooling and ventilation systems during occupied periods compared to unoccupied periods.

**HVAC system:** Heating and cooling (air conditioning) systems that are additionally capable of supplying outdoor air ventilation. If they do not supply outdoor air ventilation, they are more technically referred to as HAC systems.

**Informative:** Informational content or guidance that is not considered mandatory by this document.

**Intentional collateral mitigation:** *ASD* system(s) intentionally designed to reduce radon/soil gas concentrations in multiple *dwellings* that have each been identified by testing to indicate radon/soil gas concentrations that exceed acceptable limits.

**Jurisdictional authorities:** Governing authorities that regulate specific installation requirements or manner of activities will normally include a combination of authoritative bodies because of laws or other requirements adopted at a local municipality, county, province, or state. In addition, national jurisdiction will apply for a variety of activities that are regulated as a result of federal statutes. In some cases, tribal or international laws or treaties result in an authority that holds jurisdiction over certain activities.

**Mechanically fastened:** A means of connection such as for duct joints or electrical connections that entails more than a pressure fit, glued or twist connection (i.e., mechanical screws employed to secure connection of wiring or ducting).

**Mitigation:** System or steps to reduce radon concentrations or other pollutants in the indoor air of a building.

**Mitigation Installer:** A staff member or sub-contractor who participates in installation of the mitigation system(s) and therefore, regardless of qualifications or other obligations herein, is included in considerations for worker health and safety.

**Nontransient:** Occupancy of more than 31 days.

**Normal occupied operating conditions:** The operational condition for the building or unique sector of the building that exists during the greatest amount of significantly occupied time.

**Normative:** Provisions or referenced documents that state practices considered mandatory and required by this document.

**Occupied:** Any area of the building that is occupied on a regular basis for more than 4 hours a day. See "Significantly occupied" and "Occupied work or school weeks"

**Occupied work or school weeks:** Those weeks that do not include vacation days such as national or religious holidays, winter breaks or similar weeks where test conditions do not represent normal occupied operating conditions for the building. See "Normal Occupied Operating Condition", "Occupied" and "Significantly occupied".

**Operation, Maintenance and Monitoring plan (OM&M):** A document that includes information on the operation and maintenance of installed system(s) and guidance for monitoring the effectiveness of the system in the future.

**Operations Manual:** A document that is normally compiled by the mitigator to provide requirements and guidance for operation and maintenance of the mitigation system(s). This manual is a component of an Operation, Maintenance and Monitoring Plan (*OM&M*) that additionally includes information on monitoring effectiveness of the system.

**Overseeing Professional:** An individual or firm that aids to assemble and coordinate a qualified team of professionals of diverse skill sets.

**Overseeing Team:** Those individuals associate with project commissioning for vapor intrusion projects that normally include: Responsible Parties; Regulatory Authorities when compliance with local, state or federal regulatory standards is required; and An Overseeing Professional to assemble and coordinate a qualified team of professionals of diverse skill sets.

**Picocurie per liter (pCi/L):** A unit of concentration radioactivity corresponding to 0.037 decays per second or 2.22 decays per minute in a liter of air or water. 1 pCi/L = 37 becquerels per cubic meter ($Bq/m^3$).

**Pressure field Extension (PFE):** The distance that a pressure change, created by drawing soil-gas through a suction point, extends outward in a sub-slab gas permeable layer, under a membrane, behind a solid wall or in a hollow wall.

**Pressure field Extension Test:** A *diagnostic* procedure to evaluate the potential effectiveness of an ASD system by using a shop vacuum or other fan or vacuum device to draw air from the space below a slab or from the cavities inside a block wall. Measuring the change in pressure at various small test holes through the slab or the block wall using a micro-manometer or heatless smoke can provide evidence of the potential effectiveness of an *ASD* system.



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**Pressure Field Extension (PFE) Analysis:** For *ASD* design and optimization, an analysis of 1) qualitative evidence for the distance potential of Pressure Field Extension, and 2) quantitative measurements employed for determining vacuum pressure and air flow volume rates required to achieve a consistent vacuum across the area observed.

**Pressurization:** A positive pressure induced in one area relative to another.

**Quality Control:** For mitigation professionals, actions to retain evidence of actual operational and installation quality that is compared to intended goals for quality. The comparison is systematically used to control quality with corrective actions as needed on a jobsite or for improvements to operational procedures.

**Quality Management System (QMS):** A documented plan of action, often described as a QA plan, which includes Quality Control Procedures for tracking the difference between planned actions and the actual resulting installation or product with systematic review for managing and improving quality.

**Radon (Rn):** A colorless, odorless, naturally occurring, radioactive, inert gaseous element formed by radioactive decay of radium-226 (Ra-226) atoms. The atomic number is 86. Although other isotopes of radon occur in nature, in this document, radon refers to the gas Rn-222. Rn-222 is measured in picocuries per liter (*pCi/L*) or in becquerels per cubic meter ($Bq/m^3$).

**Re-entrainment:** The unintended re-entry into a building of radon or soil gas that is being exhausted by a mitigation system.

**Responsible Party (RP):** Can be the property owner(s) or extend to include private businesses and/or governmental agencies

**Sealed isolation assemblies:** The surrounding physical components to an airspace that might include the entire building shell or an isolated airspace within a building that has been sealed to resist air movement between the isolated airspace and both indoor air and outdoor air.

**Setback:** See HVAC Setback.

**Significantly occupied:** The time period when the building is typically occupied by the majority of the workers or students. See "Normal Occupied Operating Condition", "Occupied", "Significantly occupied" and "Occupied work or school weeks".

**Soil gas collection plenum:** A 3-dimensional enclosure for collecting radon and other soil gases from under slabs, soil gas retarders or from behind walls that surrounds a void or gas permeable layer. There are at least six sides to this enclosed airspace, and none are perfectly sealed, especially at the side facing soil.

**Suction pit:** Space that exists or is created below the suction pipe.

**Suction point:** Location at which suction piping is routed through the slab, foundation, membrane, drain tile or sump cover.

Sump (Sump pit): A pit below the subsurface grade of a building, which is commonly intended as a component of a ground water control system. Sump pumps and drainage piping are often additional components of such ground water control systems.

**Townhouse:** A single family *dwelling* (also referred to as a townhome) that is constructed in a group of three or more attached units where each unit extends from the foundation to the roof and has a yard or public way on at least two sides.

**Unique sector of a building:** Portions of a common building that are individually classified by the general design and the intended design of each active heating, cooling, and ventilation system (HVAC).

**Unit:** A building or portion of a building that is used, intended, or designed to be built, used, rented, leased, let, or hired out to be occupied or that is occupied for commercial, residential or public purposes.

**Working level (WL):** Any combination of short-lived radon decay products in one liter of air that will result in the ultimate emission of 1.3 x 105 MeV of potential alpha energy. This number was chosen because it is approximately the alpha energy released from the decay products in equilibrium with 100 pCi of Ra-222. Exposures are measured in working level months (WLM).

**Working Level Month (WLM):** A unit of concentration radioactivity corresponding to 1 working level (WL) for 170 hours per month. Although this unit of measurement came from assuming 40-hour work week exposures, it is commonly used to set limits for annual exposure to radon decay product alpha energy.



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## Exhibit A
## Sample Posted Notice: "CONTRACTOR TO OCCUPANTS"
## Sealant Warning

Radon Company
Anytown, USA 800-000-0000

Dear Building Occupants,
Important steps are being taken to lower the risk to residents in this building.

The work has required **application of sealants.**

[✓] **Wet Caulk/Sealants**. Take care to not step in or touch sealants until they are dry.

[✓] **Vapor from sealants:** 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 air-tight 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. **If symptoms are observed:** Leave the area immediately to breathe fresh air. Avoid further exposure. If symptoms persist, get medical attention.

We thank you for your cooperation in helping to ensure safe and healthy homes.

Sincerely,
Mitigation Company, Anytown, USA

*Informative advisory*—For all jobsites, including owner-occupied properties, it is recommended that the *contractor* post or leave similar notices for affected occupants when using sealants.



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# CONSENSUS BODY MEMBERS

**Sincere appreciation is both expressed and deserved for years of contributions in time and wisdom provided by all the following consensus body members and staff.**

## Mitigation Standards—Consensus Body 2018-2022

***Note***—*SGM-SF 2023 is dedicated to the memory of Steve Tucker who faithfully sought fairness and integrity in this work to, as a volunteer, find consensus agreement across what can often be very diverse points of view.*

**Chair:** Steve Tucker (OR) **Assistance Team:** Gary Hodgden (KS)

| Stakeholder Group | Delegate | Affiliation |
|---|---|---|
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| | Chad Robinson (KS) *Alternate* | Midwest University Radon Consortium (MURC) |
| (Regulated States Rn) | Josh Kerber (MN) | Minnesota Department of Health |
| | Patrick Daniels (IL) *Alternate* | Illinois Emergency Mgmt. Radon Program |
| (Federal EPA Rn) | Tommy Bowles (DC) | U.S. Environmental Protection Agency (EPA) |
| (Federal OHH) | Warren Friedman (DC) | HUD Office of Healthy Homes |
| (Proficiency Program) | Bruce Snead (KS) | AARST-NRPP (Policy Advisory Board) |
| | Kyle Hoylman (KY) *Alternate* | AARST-NRPP (Credentialing Committee) |
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| | James Fraley (GA) *Alternate* | Professional Measurement Service Provider |
| (Home Mitigation Prof.) | Bill Brodhead (PA) | Professional Service Provider |
| | Aaron Fisher (PA) *Alternate* | Professional Service Provider |
| (Large Bldg. Mitigation) | Tony McDonald (OH) | Professional Service Provider |
| | Fred Elrott (CA) *Alternate* | Professional Service Provider |
| (VI Mitigation Prof.) | Tom Hatton (NJ) | Professional Service Provider |
| | Rachel Saari (MI) *Alternate* | Professional Service Provider |
| (Building Scientist) | Todd McAlary (CN) | Professional Service Provider |
| | Chris Ferguson (IN) *Alternate* | Professional Service Provider |
| (Site Assessment VI) | Chris Lutes (NC) | Professional Measurement Service Provider |
| | Chris Bonniwell (WI) *Alternate* | Professional Measurement Service Provider |
| (VI Stewardship VI) | David Gillay (IN) | Professional Legal Services |
| (Fan Manufacturers) | Dave Hill (MA) | Spruce |
| | Paul Owen (MA) *Alternate* | *Spruce* |
| (Ventilation Manufacturers) | Hamid Massali (KS) | Fantech |
| | Michelle Festa (PA) *Alternate* | Festa |

Assist Team: Joanna Mandecki, Nanci Hermberger, Lindsey Beal, Denise Bleiler, Wensday Worth and Marilyn Patrick

## SGM-SF Consensus Body 2014-2016

**Chair:** Dave Kapturowski (MA) **Assistance Team:** Gary Hodgden (KS)

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| (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) |



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| | | |
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| (Mitigation Prof. Rn) | David Grammer (NJ) | Professional Service Provider |
| | Keith Volsted (IL) *Alternate* | Professional Service Provider |
| (Measurement Prof. Rn) | David Wilson (TN) | Oak Ridge National Laboratory |
| (Building Inspectors) | Nate Burden (PA) | Professional Service Provider |
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| | Eugene Pinzer (DC) *Alternate* | HUD Office of Healthy Homes |
| (Regional HUD) | Paul Mohr (MO) | HUD Field Representatives |
| | Sam Gieryn (MO) *Alternate* | HUD Field Representatives |
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| (Educators VI) | Kelly Pennell (KY) | University of Kentucky Dept. of Civil Engineering |
| (Regulated States VI) | David Swim (WI) | Wisconsin Department of Natural Resources |
| | Pat Troth (IN) *Alternate* | Indiana Dept. of Environmental Management |
| (Federal EPA VI) | Henry Schuver (DC) | EPA Office of Emergency Response (OSWER) |
| | Rich Kapuscinski (DC) *Alternate* | EPA Office of Emergency Response (OSWER) |
| (Mitigation Prof. VI) | Tony McDonald (OH) | Professional Service Provider |
| | Tom Hatton (NJ) *Alternate* | Professional Service Provider |
| (Building Scientist VI) | Rachel Saari (MI) | Professional Service Provider |
| | Robert Truesdale (NC*) Alternate* | RTI (Research Triangle Institute) |
| (Site Assessment VI) | Chris Lutes (NC) | Professional Service Provider |
| | Eric Lovenduski (NY) *Alternate* | Professional Service Provider |
| (Stewardship VI) | David Gillay (IN) | Professional Service Provider |
| | Chris Bonniwell (WI) *Alternate* | Professional Service Provider |
| (Regional EPA) | Michael Murphy (IL) | USEPA Region 5 (North-Central Region) |
| | Alana Lee (CA) *Alternate* | *USEPA Region 9 (Pacific-Southwest Region)* |
| (Public Health NGO VI) | Lenny Siegel (CA) | Center for Public Environmental Oversight |



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SGM-SF 2023

AARST CONSORTIUM

# Companion Guidance


| | | |
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| Sect. 3.4 | **Quality Management** | CG 1 |
| Sect. 5 | **System Design** | CG 1 |
| Sect. 6 | **ASD** | CG 6 |
| Sect. 7 | **Sealing** | CG 14 |
| Sect. 8 | **All Systems/Methods** | CG 15 |
| Sect. 9 | **Post-Mitigation** | CG 16 |
| Sect. 11 | **Health and Safety** | CG 17 |


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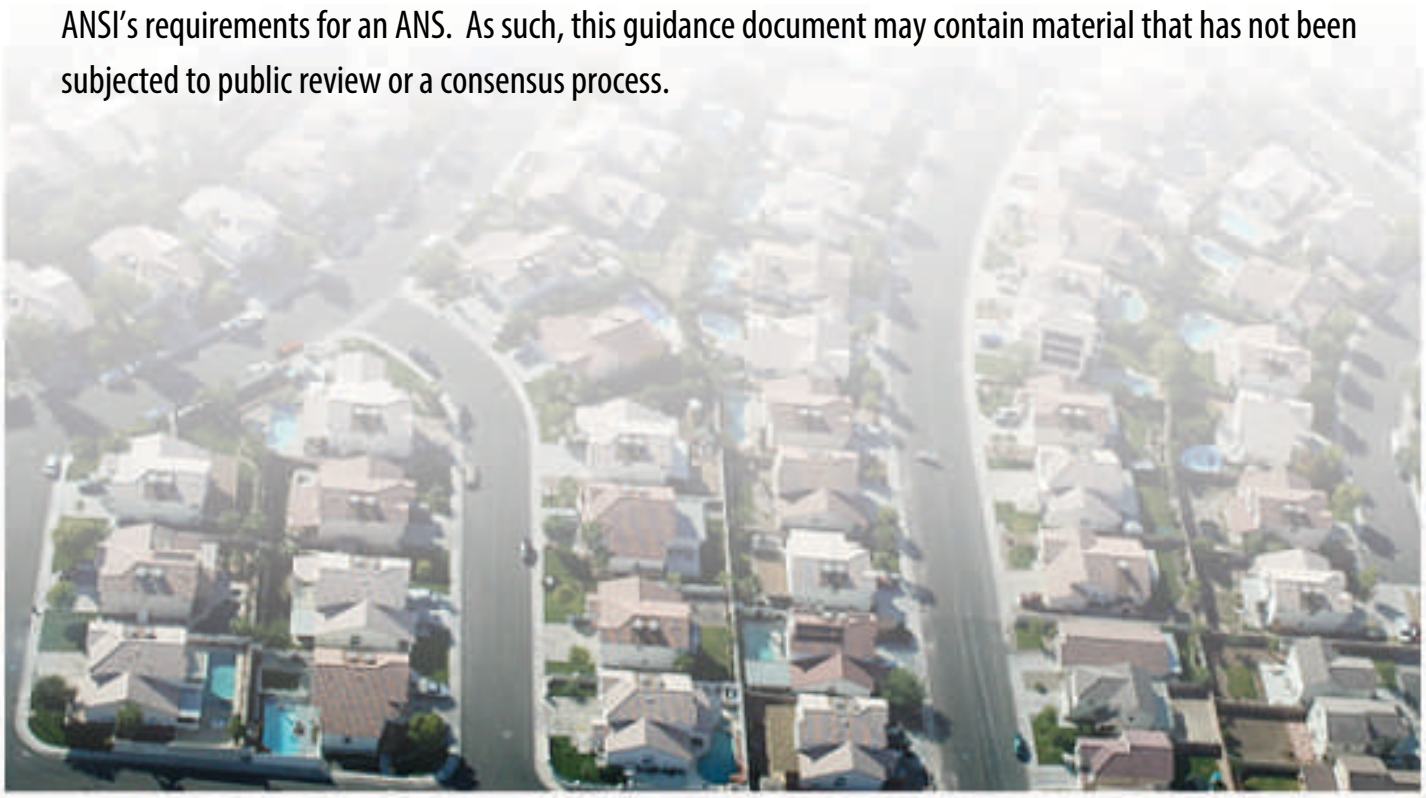

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## 1.0 SCOPE

## 2.0 APPLICABILITY

## 3.0 QUALIFIED CONTRACTORS

### 3.4 Quality Management

*Advisory*—Be it a single person or a large firm, the more work you do, the more valuable quality management becomes. For managing quality, one compares procedures and jobsite data (input) to successes and failures (output).

- Input information includes written procedures for staff member roles and responsibilities, standards, codes, customer satisfaction and worker safety.
- The output results are tracked (e.g., retest results, standards compliance, and customer satisfaction).
- The comparison identifies actions necessary to improve procedures and installation quality.

## 5.0 SYSTEM DESIGN

### 5.1 Appropriate Systems

5.1.1 *General principles*

d) Unnecessary Noise

*Informative advisory*—Choices and actions that minimize objectionable unnecessary noise should be part of design and installation for each system. Where noise is both objectionable and unnecessary, actions should be taken to reduce unnecessary noise to the extent practicable.

### 5.2 Nondestructive Investigation

*Informative advisory*—It is recommended that the qualified mitigation professional review all available measurements of radon or soil gas, construction drawings, specifications and other information regarding the building that might be of value in determining the mitigation strategy.

5.2.1 *Diagrams*

Diagrams or sketches may be accompanied with narrative and photographic documentation.

5.2.2.1 Exterior Visual Inspection

Note—Walking the exterior helps to ensure all portions of the building are accounted for and allows visual evaluation for ground water erosion or settlement of soil below portions of the structure.

5.2.2.2 Interior Visual Inspection

d) Openings to soil

Important examples include:

(1) under showers or tubs,
(2) open blocks in the tops of (CMU) block walls;
(3) sizable openings or multiple gaps in walls that adjoin soil,
(4) channel drains adjoining foundation walls, and
(5) exposed earth.

e) 1. Sumps

Important sump details include:

(1) If not open to adjoining soil aggregates that are permeable,
(2) If connected to exterior drain-tile,
(3) If designed to capture surface water, and
(4) Uncommon or backup means for draining or ejecting water from the pit.



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5.2.2.2

e) 2. Surface water drainage

BACK

A few examples where custom solutions might be needed:

(1) Existing drain system not designed to accommodate a laundry machines, or

(2) Water drainage systems that may need to be closed, isolated, or depressurized.

f) Safety concerns

BACK

A few examples of safety concerns that may warrant precautions:

(1) Hazardous confined spaces,

(2) Observations of suspected friable asbestos and

(3) Flue gas spillage.

5.2.2.2 Interior Visual Inspection

BACK

Note—Walking ground-contact areas is also a good time to consider custom solutions, such as additional suction points that could be needed for addressing other radon or soil gas source areas not initially targeted.

5.3.5 *ASD diagnostic PFE analysis*

b. PFE Vacuum (Quantitative)

BACK

Note—These measurements identify the vacuum strength needed to overcome resistance posed by fill materials within the soil gas collection plenum and indoor air pressures, including as they change across seasons.

c. Exhaust Air Volume (Quantitative)

BACK

Note—A balance between both vacuum and airflow is needed for effective systems. The airflow rate needed to overcome leakage between soil and indoor or outdoor air tells you how to choose piping sizing and fan flowrate capacities.

See informational guidance for Section 6.3.8 (Airflow velocities) relative to consequences of ignoring flowrate.

Figure 5.5-a ASD Method—Example PFE Analysis Flowchart

Process of Elimination

BACK

When PFE is poor or post-mitigation indoor testing fails to meet mitigation goals, a process of elimination is used to identify the cause and cure.

The first step typically includes checking for basic functional problems and evaluation for the extent of PFE achieved (i.e., distance across targeted slabs or membranes). As the first step in the process of elimination, this evaluation dictates where to focus attention.

Examples include:

1) If poor PFE across a large portion of the targeted area, the focus is to prominently enhance PFE across the targeted area.
2) If there is good PFE across most of the targeted area, the focus is on other soil gas sources, such as other ground-contact areas or drains open to soil.



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## Understanding Permeability

Hydraulic Conductivity (water and air)

| Range of Hydraulic Conductivity of Natural Soils | | | |
|---|---|---|---|
| **USCS Class** | **Soil Type** | **Hydraulic Conductivity Range** gallons per day/ft$^2$ | **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 |

Note—This table helps illustrate the relative differences you can encounter that dictate the ease of extending a vacuum across distances. Those highlighted with gray present challenges in achieving PFE.

Unified Soil Classification System (USCS) ASTM D 2487

| MAJOR DIVISIONS | | | SYMBOLS | TYPICAL NAMES |
|---|---|---|---|---|
| COARSE-GRAINED SOILS OVER 50% > No.200 SIEVE SIZE | GRAVELS | CLEAN GRAVELS WITH LESS THAN 5% FINES | GW | Well-graded gravels or gravel-sand mixtures, little or no fines |
| | | | GP | Poorly graded gravels or gravel-sand mixtures, little or no fines |
| | MORE THAN 1/2 OF COARSE FRACTION > No.4 SIEVE SIZE | GRAVELS WITH OVER 15% FINES | GM | Silty gravels, gravel-sand mixtures |
| | | | GC | Clayey gravels, gravel-sand-clay mixtures |
| | SANDS | CLEAN SANDS WITH LESS THAN 5% FINES | SW | Well-graded sand or gravelly sands, little or no fines |
| | | | SP | Poorly graded sands or gravelly sands, little or no fines |
| | MORE THAN 1/2 OF COARSE FRACTION < No.4 SIEVE SIZE | SANDS WITH OVER 15% FINES | SM | Silty sand, sand-silt mixtures |
| | | | SC | Clayey sands, sand-clay mixtures |
| FINE-GRAINED SOILS OVER 50% < No.200 SIEVE SIZE | SILTS & CLAYS LIQUID LIMIT 50% OR LESS | | 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 |
| | | | OL | Organic silts and organic silty clays of low plasticity |
| | SILTS & CLAYS LIQUID LIMIT GREATER THAN 50% | | 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 | Peat and other highly organic soils |

Note—A more detailed perspective. Those highlighted with gray present challenges in achieving PFE.



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BACK

## Visual Indications of Permeability

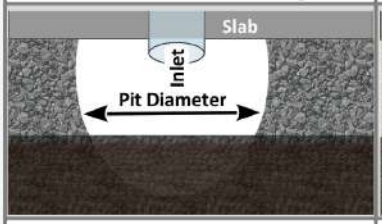
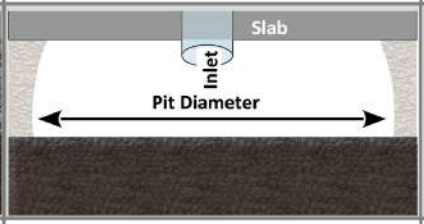
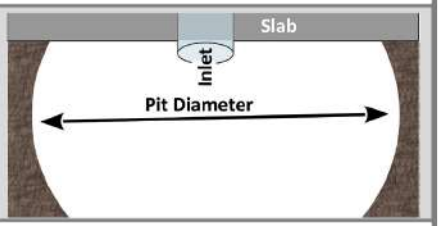
The size of pores between stones or soil fragments indicate how permeable that aggregate is. However, one should not assume permeable or non-permeable conditions witnessed are uniform across any targeted area.

| | |
|---|---|
| | Gravel or crushed stone<br>Abundant hydraulic conductivity exists with 3/4-inch stones. |
| | Gravels with fine sand, silt or expansive clay filling the pores between stones present challenges in achieving PFE. |
| | Sands and fine gravels<br>Open pores between sand granules or stones indicate permeable aggregates. Larger exposed aggregate surfaces in pits likely needed. |
| | Sands that contain more than 10% fine sand, silt, and clay present challenges in achieving PFE. |
| | Soils<br>An example where PFE is often enhanced by larger pits that expose more pore openings between soil aggregate fragments. |
| | Expansive soils or soils that contain more than 35% sand, fines, clay, and silt present challenges in achieving PFE. |
| | Solid clay is impervious to air movement.<br><br>Note—One makeshift way to help identify expansive soils and clay is to roll a handful of soil in your hands to see how well it clumps together. |

BACK

## Optimize Soil Gas Transfer to Pipe Inlets

Where the total size of the pores exposed in a suction pit represents an open area smaller than the open end of a suction pipe, soil gas transfer and system airflow are inhibited.

| Duct pipe size | **Gravel**<br>Open face of gravel for pits with a 4" (10 cm) layer of gravel. | **Sand**<br>Open face of sand for pits with a 4" (10 cm) layer of sand. | **Soil**<br>Open face of soil when creating pits at various depths in soil. |
|---|---|---|---|
| |  |  |  |
| | *Recommended Minimum* | *Recommended Minimum* | *Recommended Minimum* |
| 3"<br>(7.6 cm) | ≥ 12" diameter pit<br>(10 cm x 30 cm) | ≥ 36" diameter pit<br>(10 cm x 30 cm) | The void needed may require extracting 5 to 7.5 US gallons (19-28 L) of sub-slab soil aggregate. |
| 4"<br>(10.2 cm) | ≥ 16" diameter pit<br>(10 cm x 33 cm) | ≥ 48" diameter pit<br>(10 cm x 33 cm) | Note—For most soils, PFE distances directly under a slab are not often increased by excavating more than 7.5 gallons. |
| 6"<br>(15.2 cm) | ≥ 24" diameter pit<br>(10 cm x 61 cm) | ≥ 72" diameter pit<br>(10 cm x 61 cm) | |



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BACK

## Seasonal Compensation

**The Goal:** An installed ASD system that continuously controls the destination of soil gas with an appropriate degree of care to not compromise other building systems and health of occupants.

**General:** Inducing a negative pressure difference of about 1 pascal (4/1000-inch water column) within soil gas relative to indoor air is commonly witnessed to successfully reduce radon entry for most, if not all year. This is partly because even zero pressure difference reduces soil gas entry. However, the season when these measurements are conducted can make a critical difference.

As outdoor air grows colder than indoor air seasonally, the negative pressure indoors grows both stronger and consistent day and night. This pressure that brings soil gas into homes is competing with ASD fan induced air pressure.

**Cold weather example:** During coldest weather, even barely detectable PFE sometimes witnessed in challenging structures does not usually need additional protective buffer. If success is confirmed by indoor measurements under these conditions, one can expect that fan induced PFE will be stronger in mild weather.

**One cold weather example of concern:** If during cold weather a strong vacuum such as 5 pascals (20/1000-inch water column) is applied, PFE vacuums are expected to increase in mild weather. With studies showing that about 40-50% of ASD exhaust air is often coming from within the building, high vacuum ASD systems with robust airflows increase the likelihood of unnecessary energy penalties and compromised building systems such as inducing flue gas spillage at combustion appliances.

**Mild weather concern for seasonal compensation:** When PFE measurements are made in mild weather, the amount of increased indoor negative pressure during cold weather is an unknown commodity. If negative pressure internal to the building during cold weather increases to overwhelm PFE witnessed, the system or portion of the system will temporarily cease to stop soil gas entry. As a protective buffer for this situation, seasoned professionals often seek to achieve about 2.5 pascal (10/1000-inch water column) pressure difference in mild weather, whenever possible.

In addition: Soil gas sources not targeted, such as other adjoining slabs, may only experience substantial soil gas entry during colder weather or other periods of stronger negative indoor air pressure.

**Verification:** Actual confirmation of adequacy would require testing under varied seasonal conditions.

**Buildings larger than a house:** Larger or taller structures can generate stronger fluctuations of indoor negative pressure in response to seasonal weather. Larger buildings also often have more complex HVAC systems that can induce significant negative pressure indoors. These are considerations to account for in system design.



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## 6.0 ACTIVE SOIL DEPRESSURIZATION (ASD)

### 6.1 *ASD* Suction Points

#### 6.1.1 *Suction pits*

BACK

*Informative advisory*—Where sub-slab material exhibits poor permeability, larger pits are recommended, such as 1 $ft^3$ (28 $dm^3$) or larger. This void equates to 7.5 US gallons (28 L) or more of sub-slab aggregate.

Note—Pit size needs are based on permeability of the sub-slab material. If the combined surface area of exposed pore openings between granules of soil, sand or gravel is less than the cross-sectional area dimension of the suction pipe intake opening, a larger pit will likely enhance PFE.

#### 6.1.2 *Sumps*

6.1.2.1 Seal the Suction Point (sumps)

BACK

*Informative advisory*—Sumps that connect to soil air should not be used as the primary suction point unless other options are inadequate for achieving PFE. Concerns include compromised accessibility to pumps, increased noise, and some localities disallow use of a sump as the primary suction point.

6.1.2.2 Accessibility to Sumps

BACK

*Informative advisories*

(1) The suction pipe should not extend lower than 1 inch below the sump lid.

(2) Visual access to conditions in the pit is recommended.

(3) Flexible coupling disconnects should be located such as to facilitate easy removal of the cover.

#### 6.1.3 *Sub-membrane suction points*

BACK

*Informative advisories*

(1) It is recommended to attach at least 3 feet (1 m) of perforated pipe to suction pipe air intakes. This helps prevent membrane material from obstructing the air intakes.

(2) At least 10 feet (3 m) of perforated pipe is recommended where conditions might restrict PFE, such as where membrane material might adhere to moist soil. Geotextile matting can also achieve the intent of this recommendation.

(3) For large membranes, longer lengths of perforated pipe or multiple suction points are recommended.

#### 6.1.4 *Non-habitable air spaces*

BACK

Note—This type of ASD system depressurizes an entire airspace that is not used or constructed for habitation. Examples include crawl spaces, utility tunnels, under raised flooring, behind partitioned walls and sometimes entire rooms.

6.1.4.2 Restricted Use

BACK

*Informative advisory*—Sub-membrane depressurization (SMD) for open earth crawl spaces is a preferred mitigation method to minimize energy penalties and damage to building components, even if access needs to be created.



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6.1.5 *Block walls*

6.1.5.2 Sealing (block walls)

BACK

*Informative advisory*—If the top or wall surfaces of the void network cannot be closed to resist air entry into the voids, depressurization of the block wall(s) may not be possible. Where openings are not accessible, closure of voids in a course of blocks below the inaccessible openings at a location above outside grade should be considered to isolate a smaller void network for depressurization.

## 6.2 *ASD* Piping

6.2.7 *Secure duct piping*

6.2.7.2 Supports

BACK

*Informative advisory*—Where exposed, such as in basements and attics, pipe lengths that can move laterally or vertically are commonly witnessed to cause failed or leaking joint connections. This is known to occur merely as the result of occupants or workers jarring or bumping into pipes, or by natural forces such as wind.

6.2.8 *Provide access clearance*

BACK

CODE EXAMPLE

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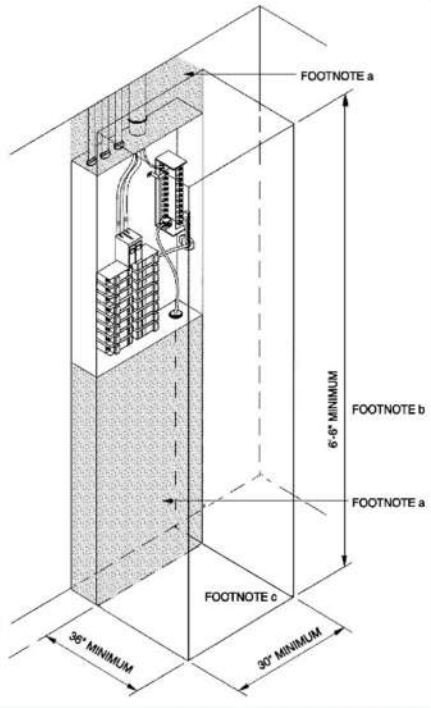
EQUIPMENT LOCATION AND CLEARANCES

"Working space and clearances. Access and working space shall be provided and maintained around all electrical equipment to permit ready and safe operation and maintenance of such equipment in accordance with this section and Figure E3405.1.




a) Equipment, piping and ducts foreign to the electrical installation shall not be placed in the shaded areas extending from the floor to a height of 6 feet above the panelboard enclosure, or to the structural ceiling, whichever is lower.

b) The working space shall be clear and unobstructed from the floor to a height of 6 feet or the height of the equipment, whichever is greater.

c) The working space shall not be designed for storage.

d) Panelboards, service equipment and similar enclosures shall not be location in bathrooms, toilet rooms, clothes closets or over the steps of a stairway."

*Advisory*—The clearance distances shown are 36 inches deep and 30 inches wide.

FIGURE 3405.1 WORKING SPACE AND CLEARANCES



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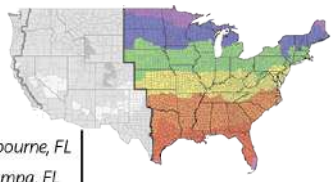
### 6.2.9 *Protect ducts from the elements (insulation)*

BACK

Freeze-up and pipe drip in wet or humid climates (e.g., East of the Continental Divide).



| | Fairbanks | Caribou ME, Quebec, Marquette MI, Duluth MN, Winnipeg, Grand Forks, Anchorage, Breckenridge, Aspen | Portland ME, Buffalo NY, Burlington NH, Milwaukee, Minneapolis, Bismarck ND, Pierre SD, Cheyenne WY, Billings MT, Helena MT | Boston, Albany NY, Pittsburgh PA, Cleveland, Indianapolis, Chicago, Omaha, Denver, Albuquerque, Salt Lake, Reno, NV, Boise, ID | New York, NY, Philadelphia, Richmond, VA, Baltimore, Louisville, Cincinnati, Nashville, Saint Louis, Kansas City, Amarillo TX, Portland, OR, Seattle | Atlanta, Charlotte, SC, Birmingham AL, Jackson, MS, Memphis, Little Rock, Dallas, Austin, Las Vegas, San Francisco, Los Angeles, San Diego | Melbourne, FL, Tampa, FL, Mobile, AL, New Orleans, Houston, Brownsville, Phoenix, Tucson | Miami, FL, Puerto Rico, Virgin Islands, Honolulu, Guam | Certain Asiatic Regions |
|---|---|---|---|---|---|---|---|---|---|
| | **Zone 8 Subarctic** | **Zone 7 Very Cold** | **Zone 6 Cold** | **Zone 5 Cool** | **Zone 4 Mixed** | **Zone 3 Warm** | **Zone 2 Hot** | **Zone 1 Very Hot** | **Acutely Hot** |
| | | | **Annual Average Outdoor Temperatures** | | | | | | |
| | **27 F** (-3 C) | **39 F** (4 C) | **45 F** (7 C) | **49 F** (9 C) | **55 F** (13 C) | **62 F** (17 C) | **69 F** (21 C) | **76 F** (24 C) | **83 F** (28 C) |
| % of year | 100% | 83% | 75% | 75% | 66% | 58% | 42% | 50% | 100% |
| Heating | < Freezing | | | | | | | | |
| Cooling | | 16% | 25% | 25% | 16% | 25% | 42% | 50% | 100% |
| Neither | | | | | | 16% | 16% | | |
| **Avg. Low Winter Temps** | **Zone 8** | **Zone 7** | **Zone 6** | **Zone 5** | **Zone 4** | **Zone 3** | **Zone 2** | **Zone 1** | **Acute** |
| | Dec/Jan/Feb | Dec/Jan/Feb | Dec/Jan/Feb | Dec/Jan/Feb | Dec/Jan/Feb | Dec/Jan/Feb | Dec/Jan/Feb | Dec/Jan/Feb | Dec/Jan/Feb |
| | **-6 F** (-21 C) | **2 F** (-17 C) | **9 F** (-12 C) | **17 F** (-8 C) | **26 F** (-3 C) | **35 F** (2 C) | **45 F** (7 C) | **61 F** (16 C) | **76 F** (24 C) |
| **Avg. Daytime Summer Temps** | **Zone 8** | **Zone 7** | **Zone 6** | **Zone 5** | **Zone 4** | **Zone 3** | **Zone 2** | **Zone 1** | **Acute** |
| | Jun/Jul/Aug | Jun/Jul/Aug | Jun/Jul/Aug | Jun/Jul/Aug | Jun/Jul/Aug | Jun/Jul/Aug | Jun/Jul/Aug | Jun/Jul/Aug | Jun/Jul/Aug |
| | **65 F** (18 C) | **72 F** (22 C) | **76 F** (24 C) | **77 F** (25 C) | **80 F** (27 C) | **83 F** (28 C) | **86 F** (30 C) | **86 F** (30 C) | **89 F** (32 C) |

**Concerns for freeze up (wet climate zones 6, 7 and 8)**

The "average low winter" outdoor temperature across Dec-Jan-Feb, for climate zones 6, 7 and 8, includes cold spells likely to occur each year that are ≥10 degrees F colder than this "average low" temperature. Icing in wet climates typically begins wherever the inner wall surfaces of piping, rain caps and fans, normally kept above 32 F (0˚ C) by contact with warmer < 50 F (10 C) soil gas, have fallen to below freezing temperatures. Freeze up is likely in wet climates within days or weeks of exposure to less than ~ 0˚ F (-18 C) outdoor temperatures.

**Concerns for drip on outer pipe surface (humid climate Zones 1 and 2)**

The "average daytime summer" outdoor temperature across Jun-Jul-Aug, for zones 1 and 2 includes hot/humid spells that occur each year to cause prolonged periods of condensation drip from the outer surfaces of piping. This condensation occurs where cooler soil gas, often < 50 F (10 C) within piping keeps the outer pipe surfaces colder than the adjoining hot/humid outdoor air.



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6.2.10 *Observe codes*

BACK

*Informative advisory*—Codes that impact choices for pipe routing include but are not limited to:

a) **Codes intended to maintain the integrity of building structural members.**
These codes place limits on the extent and location for sawing, notching and boring holes in a building's structural support members. In example, codes normally prohibit:
   1. notches in solid wood joists, rafters, and beams within the middle 1/3rd of its span and notches greater than 1/6th of its width, and
   2. holes that are closer than 2 inches to the top or bottom of solid wood members;

b) **Fire codes intended to inhibit the spread of fire and smoke.**
For example, national codes normally prohibit flammable materials such as plastic pipe from:
   1. touching or being too close to heat sources to include flues and chimneys,
   2. compromising fire/smoke barriers between floors (e.g., metal barriers in flue chases), and
   3. penetrating a fire-rated assembly unless specific procedures are taken, such as installing fire collars to control the spread of fire and smoke (e.g., a garage wall or ceiling if constructed as a fire-rated component and at penetrations into upper floor dwellings); and

c) **Codes and local utility company restrictions regarding proximity of piping and electrical components that could:**
   1. inhibit access for inspection and repairs, and
   2. be ignition sources for flammable materials (such as an electrical switch that is located near natural gas meters and liquid propane or gasoline holding tanks).

*Inhibit the spread of fire and smoke*

BACK

CODE EXAMPLES—INHIBIT THE SPREAD OF FIRE AND SMOKE

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Penetrations of firestops and draftstops.
"Penetrations through fire blocking and draftstopping shall be protected in an approved manner to maintain the integrity of the element penetrated."

*(Guidance example—Where an existing wall and/or ceiling assembly constitutes fire-rated separation, such as between a garage and living space or between floors of multifamily dwellings, pipe penetrations are to be configured to retain the existing fire-rated separation. Fire collars at pipe penetrations are commonly employed to meet this need.)*

Chimney clearances.
"Any portion of a masonry chimney located in the interior of the building or within the exterior wall of the building shall have a minimum airspace clearance to combustibles of 2 inches (51 mm). Chimneys located entirely outside the exterior walls of the building, including chimneys that pass through the soffit or cornice, shall have a minimum airspace clearance of 1 inch (25 mm). The air space shall not be filled, except to provide fire blocking in accordance with Section R1003.19."

*Gas meter clearance*

BACK

Gas meter clearance.
*(Guidance example—A 36-inch (1 m) radius distance from natural gas meters is commonly required by utility company restrictions and some local codes relative to:*

1. *Distance away for electrical plugs, switches, or other potential source of ignition, and*
2. *Clearance needed for meter maintenance.*



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## CODE EXAMPLE—CUTTING, NOTCHING AND DRILLING

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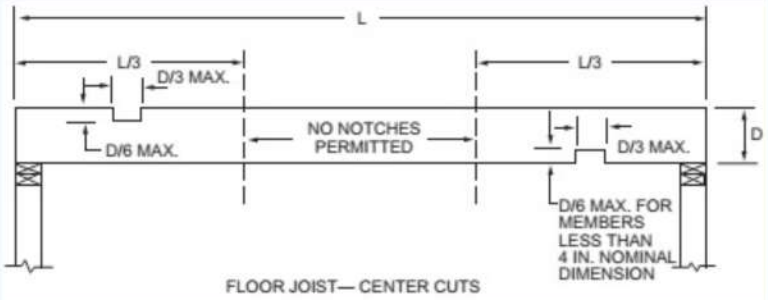
### Sawn lumber

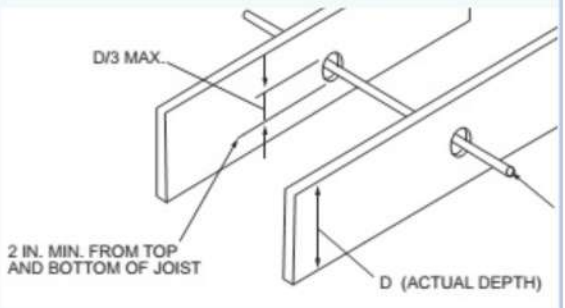
"Notches in solid lumber joists, rafters and beams shall not exceed one-sixth of the depth of the member, shall not be longer than one-third of the depth of the member and shall not be located in the middle one-third of the span."



FLOOR JOIST— CENTER CUTS

"Notches at the ends of the member shall not exceed one-fourth the depth of the member. The tension side of members 4 inches (102 mm) or greater in nominal thickness shall not be notched except at the ends of the members. The diameter of holes bored or cut into members shall not exceed one-third the depth of the member.

Holes shall not be closer than 2 inches (51 mm) to the top or bottom of the member, or to any other hole located in the member. Where the member is also notched, the hole shall not be closer than 2 inches (51 mm) to the notch."

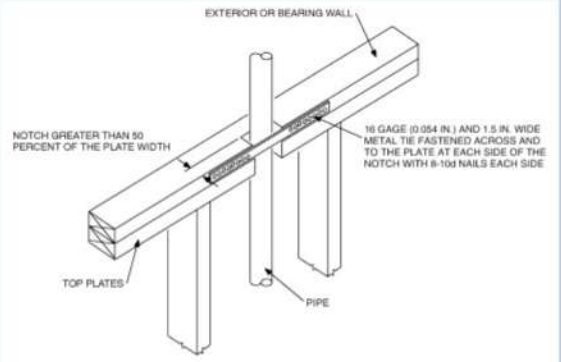



### Engineered wood products.

"Cuts, notches and holes bored in trusses, structural composite lumber, structural glue-laminated members, cross-laminated timber members or I-joists are prohibited except where permitted by the manufacturer's recommendations or where the effects of such alterations are specifically considered in the design of the member by a registered design professional."

### Drilling and notching of top plate.

"When piping or ductwork is placed in or partly in an exterior wall or interior load-bearing wall, necessitating cutting, drilling or notching of the top plate by more than 50 percent of its width, a galvanized metal tie of not less than 0.054inch thick (1.37mm) (16ga) and 1½ inches (38mm) wide shall be fastened across and to the plate at each side of the opening with not less than eight 16d (0.128 inch diameter) nails having a minimum length of 1½ inches (38mm) at each side or equivalent. See Figure R602.6.1.




Exception: When the entire side of the wall with the notch or cut is covered by wood structural panel sheathing".



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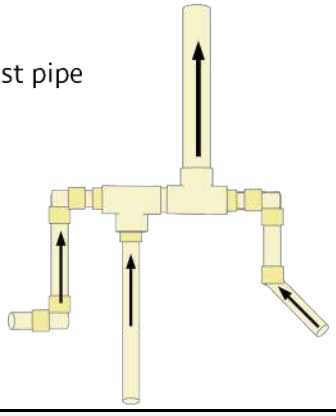
## 6.3 *ASD* Pipe Sizing

### 6.3.4 *Equivalent cross-sectional area*

BACK

Example of multiple smaller pipes joined in parallel to a larger exhaust pipe



Note—Three 2-inch (50-mm) pipes in parallel are necessary to meet this requirement when connecting to a single 3-inch pipe

### 6.3.8 *Air velocities*

BACK

*Informative advisory* 1—Maximum airflow speed

Air speed/velocity within duct piping should be less than 2,000 feet per minute (fpm) (610 m/min) to prevent condensed vapor from being drawn upward within piping rather than naturally falling by virtue of gravity to its intended destination (e.g., soil).

In addition, air rushing noise will usually reach an objectionable threshold at ASD exhaust locations with air velocities of about 1,600 fpm (488 m/min) or faster.

- **Air velocities of 1,600 fpm (488 m/min) result when air is driven at:**
  - a) 80 cfm (2.3 $m^3$/min) through: 3-inch (75-mm) pipe or 3 x 4 inch (75 x 100 mm) downspout
  - b) 140 cfm (4.0 $m^3$/min) through: 4-inch (100-mm) pipe or 4 x 5 inch (100 x 127 mm) downspout
  - c) 315 cfm (8.9 $m^3$/min) through: 6-inch (150-mm) pipe or 5 x 6 inch (127 x 152 mm) downspout
  - d) 35 cfm (1.0 $m^3$/min) through: 2-inch (50-mm) pipe or 2 x 3 inch (50 x 75 mm) downspout

*Informative advisory* 2—Minimum airflow speed

Air speed/velocity at the system exhaust that is much lower than 300 feet per minute (fpm) (92 m/min) should be considered a benchmark that might indicate:

- more work to enhance PFE may be needed to achieve mitigation goals;
- enhanced expectations of exhaust icing or freeze-up during extreme cold weather;
- expectations of premature fan failure, if the cause is poor PFE; or
- a high vacuum fan is not aiding PFE but may cause adverse effects, such forcing liquid from U-tube manometers or forcing sand under the building out the exhaust of a system.

- **300 fpm (92 m/min) equates to:**
  - a) 20 cfm (0.6 $m^3$/min) through a 3-inch (75-mm) pipe;
  - b) 26 cfm (0.7 $m^3$/min) through a 4-inch (100-mm) pipe;
  - c) 60 cfm (0.7 $m^3$/min) through a 6-inch (150-mm) pipe; and
  - d) 9 cfm (0.2 $m^3$/min) through a 2-inch (50-mm) pipe.



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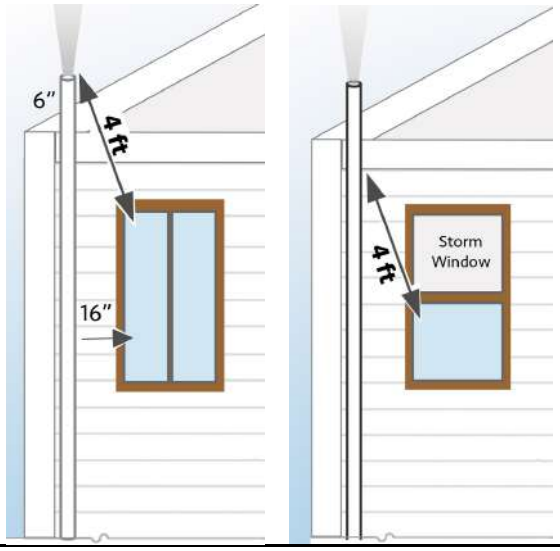
## 6.4 ASD Exhaust Discharge

6.4.6 *Separation from operable openings in structures* (approximate distances)

BACK

**Gable End**



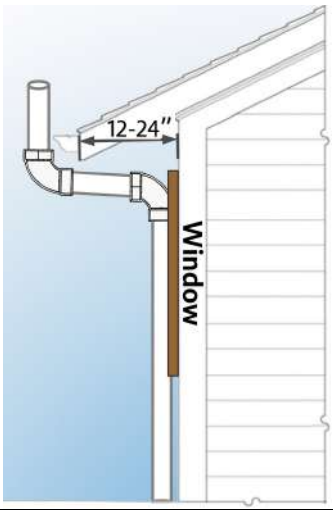

Distance requirements mimimize the duration of events where discharged air containing radon and other airborn contaminants might enter a building. The primary concerns are portions of windows operated for ventilation with outdoor air (as in gable end grapic).

Blowing discharged air away from the building and any ventilation opening is critical.

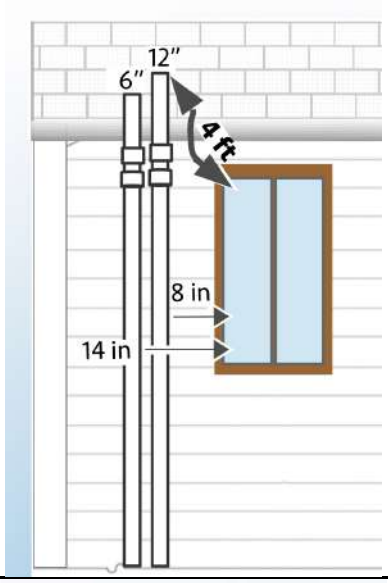
Meanhile, during times of slow outdoor wind, even slowly exhausted air can enter ventilation openings within 4 feet any direction away from the point of exhaust.

Graphics portray how to maintain 4-foot distances while retaining sensible designs.

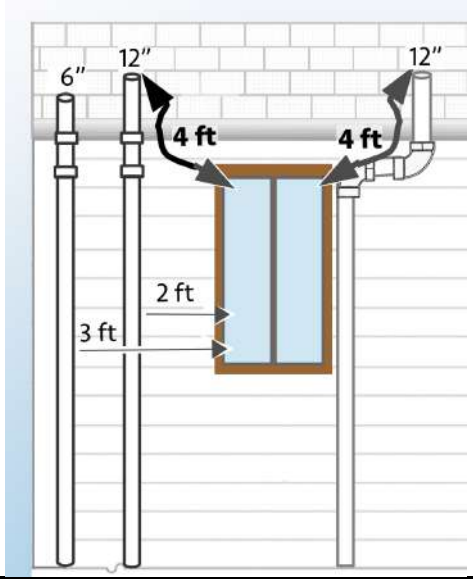
**Around Eave**



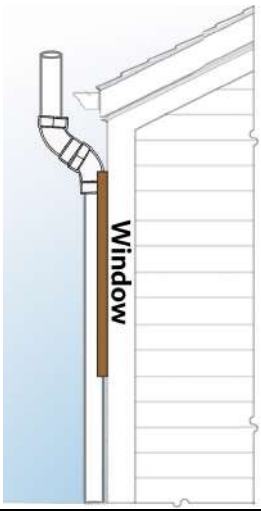

24" Eave

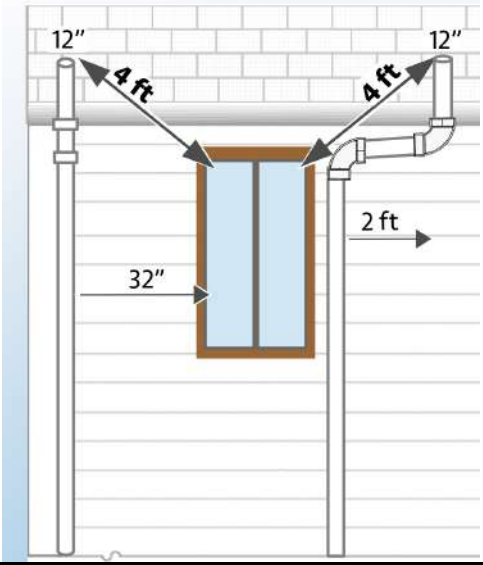


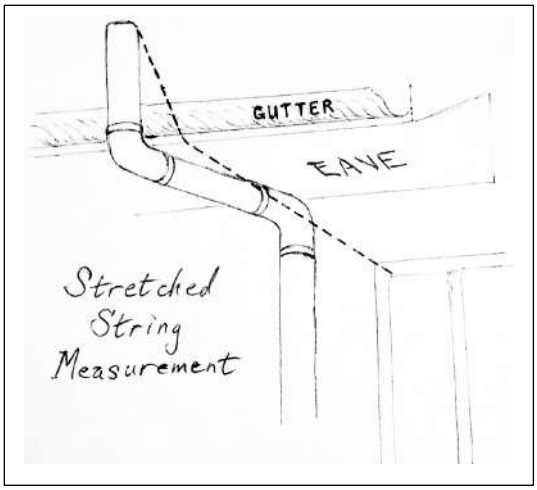

16" Eave




**No Eave**



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6.4.12 *Horizontal trajectory*

6.4.12.1 90-Degree Horizontal Discharges

BACK

*Informative advisory*—Exhausts at a 90-degree angle are prone to form icicles during freezing weather that can fall to cause harm to property or individuals.

6.4.14 *Protection from the elements*

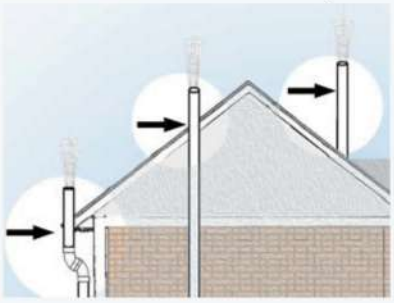
BACK

6.4.14.1 **Installation of an ASD system should include efforts to:**

a) Provide support directly below fan locations and the discharge location. For example, a physical support should be provided within 3 feet (91 cm) of the point of exhaust or within 18 inches (46 cm) above and below fans located in attics and when pipe might otherwise allow lateral or vertical movement of piping;

b) Locate or configure the exhaust assembly in a manner that avoids blockage or damage to the exhaust piping as a result of snow, ice curl or other forces; and

c) Secure and meet code requirements for any piping that extends high enough to require tethering or other means of lateral stability.

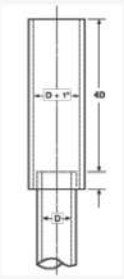


6.4.14.2 **Icing**

The exhaust should be designed and installed to minimize significant airflow blockages from ice.

6.4.14.3 **Rain and Debris**

In locations that experience blockage from debris or pervasive torrential rain or high winds each season, rain caps may sometimes be warranted. For concerns of debris or small animals that may enter the piping, the best choice is usually wire mesh described in Section 6.4.14.4. For torrential rain, a better choice is often a rain diverter as shown in this the diagram.



6.4.14.4 **Wire Mesh or Equivalent**

Rodent/insect screen (mesh not smaller than 1/2 in. [13 mm]) is permitted and recommended where the contractor or client is concerned that debris or small animals might enter the point of exhaust, or that fan blades might cause injury to occupants. The resulting configuration required by Section 7.3.5 would not substantially diminish whole-system air volume capacity of the ASD system.

## 6.5 *ASD* Fan Installation

6.5.1 *Fan design*

BACK

Note 1—Choosing a fan designed to minimize objectionable noise is also an important consideration.

Note 2—Fan models that are listed by the manufacturer as having ASD as one of their intended uses can aid in confidence when choosing products designed for ASD mitigation.



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## 7.0 SEALING

### 7.2 Sealant Materials

Informative advisory—The chances of adverse effects on occupants from exposure to curing compounds are likely to increase with increased volumes of product application. It is recommended to use products that emit low volumes of chemical vapors for protection all occupants and prospective occupants. It is recommended to leave notices for occupants about related hazards, such as illustrated in Exhibit A.

7.2.6 *Vapor Intrusion sealants*

Note—Curing compounds, including constituent chemicals identified for mitigation that have not stabilized to a benign or minimal state, can corrupt post-mitigation chemical vapor intrusion tests.

### 7.3 Accessible Slab Cracks

Note—Accessible cracks across a slab that are greater than 1/16 inch (1.6 mm) in width should also be sealed. It is also recommended to seal accessible expansion or control joints in a slab.

### 7.4 Other Openings to Soil

7.4.2 *Basement de-watering systems*

*Informative advisory*—The vacuum extension needed under a slab will often not occur if the suction point is drawing most of its air from nearby openings in the slab. The suction point location compared to nearby openings in a slab must be considered for achieving mitigation system goals. Consistent with this concern, it is best to close any exposed block wall foundation openings that are above the floor adjacent to a depressurized de-watering system.

### 7.5 Sumps and Pits

7.5.1.1 Sump Pit Access

*Informative advisory*—It is recommended that sump covers are designed to allow visual access to permit observations of conditions in the sump by way of a lid window, transparent lid, or similar method.

### 7.6 Membranes Over Exposed Soil

7.6.6 *Surface water relief*

Informative advisory—When observing indications that water is likely to collect on the surface of a membrane, it is best to inform the client of observations, and to include any maintenance recommendations in OM&M documentation. Recommended solutions to consider include installing drainage for surface water in the lowest location in accordance with guidance in Section 7.8.1.

### 7.7 Sub-Membrane Depressurization (SMD)

7.7.2 *SMD—Pipe penetrations*

Note—Gasket fittings, pipe clamps, roof flashing or an appropriate sealant are commonly used to close openings around pipe penetrations.

7.7.4 *SMD—Sealing the membrane perimeter*

Note—The larger the area addressed by sub-membrane depressurization, the greater the effectiveness of soil gas control while minimizing adverse effects of energy penalties and moisture within the crawl space.

7.7.4 Exception

*Informative advisory*—Designs that leave portions of the membrane open do not resist soil gas movement between the soil and air above the membrane. Such designs inevitably combine sub-membrane depressurization (SMD) with crawl space depressurization (CSD) or soil gas dilution.



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## 7.8 Drains

### 7.8.1 *Drains to soil*

BACK

*Informative advisory*—Where a drain represents an opening between soil gas and living spaces or outside air, considerations include radon entry or loss of PFE. Where either poses concern, it is recommended that a one-way flow drain or equivalent method with adequate water flow capacity be installed. This can be applicable for any drain that discharges directly into the soil beneath the slab or membrane, through solid pipe to a dry well, or other drainage pathway that is open to the soil.

Considerations to weigh regarding use of one-way flow valves include: (1) potential for debris to clog the valves and designed capacity of the valve to drain adequate volumes of water, and (2) whether the airflow leaks between soil and indoor air could defeat efforts to establish PFE or contribute to backdraft of atmospherically vented combustion appliances.

### 7.8.3 *Drains to daylight*

BACK

*Informative advisory*—A one-way flow valve or other mechanical means should be installed when a mitigation system is designed to draw soil gas from drain tiles or (internal or external) that discharge water to daylight. This prevents outside air from entering the ASD system while allowing an unobstructed flow of drain water to drain out of the water control system.

## 7.9 Sealed Isolation Assemblies

BACK

Note—*Sealed isolation assemblies* are often employed to help break the connection between soil air and living spaces to isolate an airspace for depressurization or pressurization. A *sealed isolation assembly* might be the entire building shell; an isolated airspace such as a crawl space or a false floor, wall, or ceiling; or other room below or adjacent to occupied spaces. Sealing can include gaskets on hatches or doors; sealed partition walls, floors, or ceilings; and other configurations that resist air migration across a partition or any component of the isolation assembly.

# 8.0 FOR ALL SYSTEMS AND METHODS

## 8.2 System Monitors

### 8.2.2 *Active notification monitors*

BACK

Note—Sensors that trigger active notification are typically air pressure sensors, airflow sensors or circuits that detect electrical flow. Each method has its strengths and weaknesses. Product features that deserve strong considerations include:

a) Lasting service: For example, products that expose electrical or sensitive components to humid airflow within ASD piping can be prone to premature failure;
b) False notifications: Examples are temporary or seasonal conditions that can result in power outages, low pressure, or low airflow. Delayed notification in terms of hours or days is an example of methods that circumvent false notifications; and
c) Use restrictions: Monitors that can reliably detect fan failure for ASD systems that inherently generate weak pressure or airflow.



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## 8.3 Electrical

Safety guidance garnished from NFPA 70 2020 (The National Electric Code® as published by NFPA)

All electrical wiring and electrical components are to be supported and firmly secured in place. Installed cables and conductors exposed on the surfaces of ceilings and sidewalls are to be supported by the building structure such that cables and conductors will not be damaged by normal building use. In locations where electrical components are likely to be exposed to physical damage, enclosures or guards are to be so arranged and of such strength as to prevent such damage.

Where encountering fans, equipment, or exposed wiring operating at 50 volts or more that are located outdoors and energized by an exterior plugged receptacle outlet connection, the wiring configuration for these components would normally require modification or GFCI protection.

## 8.4 Labeling

8.4.4 *Label duct piping*

Note—For ASD systems, duct piping labels should be affixed at intervals not greater than 10 feet (3 m) along the developed length of piping.

8.4.5 *Label electrical disconnects*

Note—Best practice would include that circuit breaker(s) protecting the mitigation system fan circuit(s) would also be labeled with the text such as "Radon Fan" or "Soil Gas Fan."

## 8.5 Inspection for Compliance

8.5.2 *Review with clients*

*Informative advisory*—After installation(s), it is recommended that the contractor provide an educational review of the mitigation system(s) to the client. The review should include operating principles of the system(s), operation, and maintenance of the systems(s) and all other components of the plan for OM&M.

## 8.6 Retention of Records

*Informative advisory*—Health and safety records should be maintained for a minimum of 20 years.

# 9.0 POST-MITIGATION

## 9.1 Functional Evaluations

9.1.3 *ASD systems*

9.1.3. a Depressurization Performance

Note—Choices for actions based on results of this pressure measurement, which may include further investigations, are at the discretion of the system designer.

9.1.4 *Vapor intrusion and ASD*

Note—Other evidence pertinent to validating system performance relative to effective mitigation of chemical vapor intrusion can include peer reviewed methods for evaluating performance, where deemed necessary or acceptable.

## 9.2 Radon Test After Mitigation

9.2.4 *Contractor obligations (Single family homes)*

9.2.4.1 Exception:

*Informative advisory*—The contractor should also instruct the independent laboratory to forward a copy of the test results to the contractor for retention in the contractor's records.



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## 11.0 HEALTH AND SAFETY

### 11.2 Safety Training

*Informative advisory*—Confirmation of jobsite worker knowledge of the safety management program should be logged in QC records with the jobsite worker's signature and date after each educational or briefing event.

### 11.3 Hazardous Building Conditions

11.3.3 *Flue Gas Spillage*

*Informative advisory*—Altering air pressure in a building, intentionally or unintentionally, may cause flue gas spillage. A potentially serious unintentional air pressure alteration occurs for ASD when the volume of air needed to achieve mitigation goals is mostly coming from a relatively small, confined airspace that contains an atmospherically-vented combustion device.

*Informative advisory*—Because a spot check for backdraft cannot determine the true potential for backdraft under different building operating conditions, such as at night or in different seasons, it is recommended that a carbon monoxide sensor be installed to alert occupants to flue gas spillage.

### 11.5 Chemical Vapor Mitigation

11.5.1 *Chemical vapor Intrusion (VI)*

*Informative advisory*—Confirmation of jobsite worker knowledge of the safety plan should be logged in QC records with the jobsite worker's signature and date after each educational or briefing event.



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SGM-SF 2023

AARST CONSORTIUM

# Vapor Intrusion Companion Guidance

Note—Guidance provided herein was compiled by the SGM-SF consensus body committee members in 2017. Though editorially reorganized, work to refine this guidance is expected for future publications.

| Vapor Intrusion Companion Guidance | | |
|---|---|---|
| A | **Understanding Chemical Exposure Concerns** | CG-VI 1 |
| B | **Guidance for Teams** | CG-VI 2 |
| C | **Monitoring Events and Stewardship** | CG-VI 5 |
| D | **Design Installation Guidance/Advisories** | CG -VI 10 |

Advisory—The information contained in this guidance document is not part of this ANSI/AARST American National Standard (ANS) and does not contain requirements necessary for conformance to the SGM-SF standard. The information contained in this guidance document has not been processed in accordance with ANSI's requirements for an ANS. As such, this guidance document may contain material that has not been subjected to public review or a consensus process.

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# Section A Understanding Chemical Exposure Concerns

A-1.1 *Health Risks*

The risk of adverse health effects from exposure to a toxic chemical or substance depends on the nature, frequency, and duration of exposure to the chemical(s). Variables for the nature of the exposure include:

a) the concentrations of chemicals present;

b) the environmental medium in which the chemicals are present (e.g., indoor air, liquids or solid, including soil and/or groundwater); and

c) the route of exposure:

- Inhalation of vapor-phase contaminants or particulate matter containing sorbed contaminants (or hazardous building material particulates) that result in absorption of contaminants or adverse effects in the respiratory system. Note that some chemicals are more toxic via inhalation compared to other routes of exposure because chemicals that are absorbed from the respiratory system are not passed through the liver first where some degree of detoxification can otherwise occur.
- Dermal contact resulting in absorption of contaminants through the skin
- Ingestion resulting from hand-to-mouth actions following dermal contact
- Ingestion of particulate matter as a result of inhalation and then swallowing of particulates

A-1.2 *Site classifications*

Formal site classifications or listings are based upon state requirements and/or information obtained by firms that have provided assessment of a site.

A-1.3 *Informational description of site classifications*

| |
|---|
| *Class 3: Continuous or Chronic Risk*<br>Concerns of harmful effects from average low-level exposure (e.g., ≥ 26 years) or repeated exposure events to somewhat higher concentrations to result in a similar degree of hazardous exposure. |
| *Class 2: Subchronic Risk*<br>Concerns of harmful effects with average exposure across 10% of a life span or repeated exposure events to higher concentrations that can result in a similar degree of hazardous average exposure. |
| *Class 1: Acute Risk*<br>Concerns of harmful effects from immediate or short-term exposure (e.g., < 30 days). |
| *Rapid Response*<br>Situations with immediate concern when estimated exposure concentrations exceed health-protective concentrations for short-term or acute exposure. |

A-1.4 *Partial list of chemicals commonly associated with contaminated soil*

| Advisory Note 1<br>Lists provided herein are intended to shed light on some of the more common contaminants found at contaminated residential sites. | |
|---|---|
| Arsenic | naturally occurring; industrial discharges |
| Cadmium | |
| Hexavalent chromium | |
| Mercury | |
| Lead | naturally occurring; industrial discharges; older paint residues |
| Polynuclear aromatic hydrocarbons (PAHs) | products of combustion (such as creosote, soot); petroleum constituents (diesel fuel, fuel oils) |



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A-1.5 *Partial list of chemicals commonly associated with contaminated indoor air (and potential sources)*[1]

| Advisory Note 2<br>There are many thousands of contaminants in commerce and others that occur naturally. Compiling a definitive list that might be encountered at a contaminated property is not feasible. | |
|---|---|
| Benzene | (Collectively known as BTEX; gasoline, diesel fuel, #2 fuel oil) |
| Toluene | |
| Ethylbenzene | |
| Xylenes | |
| Carbon tetrachloride | (tetrachloromethane; chemical releases from cleaning fluids or other industrial discharges) |
| Tetrachloroethylene | (perchloroethylene, or PCE; chemical releases at dry cleaning facilities; other industrial discharges) |
| Trichloroethylene | (TCE; degradate of PCE; other industrial discharges) |
| cis-1,2-Dichloroethylene | (cis-1,2-DCE; degradate of TCE; other industrial discharges) |
| trans-1,2-Dichloroethylene | (trans-1,2-DCE; degradate of TCE; other industrial discharges) |
| Vinyl chloride | (VC; degradate of cis-1,2-DCE and trans-1,2-DCE; other industrial discharges) |

## Section B Guidance for Teams

B-1.1 *Roles and responsibilities*

Efforts to reduce occupant exposures to hazardous soil gas often begin with decisions made by persons responsible for possible vapor intrusions into a property. This Responsible Party (RP) can be the property owner(s) or extend to include private businesses and/or governmental agencies.

Commissioning

When achieving an objective requires persons qualified in varied disciplines with different skill sets, a commissioning process first engages identification of roles and responsibilities of an Overseeing Team. The overseeing team will normally include:

a) The Responsible Parties;
b) Regulatory Authorities when compliance with local, state or federal regulatory standards is required; and
c) An Overseeing Professional to assemble and coordinate a qualified team of professionals of diverse skill sets.
   Qualified contracting or management teams for vapor intrusion normally include at least one qualified Environmental Consultant (EC).

Soil Gas Mitigation

Design, implementation, and stewardship of techniques to reduce soil gas entry require technical knowledge and skills specific to:

a) fluid mechanics of building air pressure and its dynamic interaction with distribution and entry of both soil gas and outdoor air; and
b) building construction practices.

[1] States or local jurisdictions often publish more complete guidance and jurisdictional requirements.

For further information, see the U.S. Environmental Protection Agency (EPA). 2015a. Vapor Intrusion Screening Level (VISL) Calculator, User's Guide at: www.epa.gov/oswer/vaporintrusion/guidance.html

For worker health guidance, see: The NIOSH pocket guide to chemical hazards: www.cdc.gov/niosh/npg/



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Table B-1.1 Example Commissioning Structure for Team Interactions

| Activity | Deliverable | |
|---|---|---|
| **Initiate Project** | **Document Roles and Responsibilities** | Commissioning Team |
| *This event is a decision of property owner(s) in coordination with health departments and/or the commissioning team.* | *Owner and overseeing parties.* | |
| | *The need for a Qualified Soil Gas Mitigation Professional should be identified at this time.* | |
| **Decide Project Requirements** | **Document Owner's Project Requirements** | |
| *Normally includes short-term and long-term health protection and, if applicable, site cleanup.* | *All goals and specific details* | |
| **Develop Commissioning Process** | **Documented Commissioning Process** | |
| *General site plan* | *Oversight process* | |
| **Set Contractor Requirements** | **Documented Specifications** | Includes Qualified Soil Gas Mitigation Professional |
| *As applied to staff and subcontractors* | *Minimum education, credentials, etc.* | |
| **Design Approach to Requirements** | **Documented Basis of Design** | |
| *Overseeing parties should include a Qualified Soil Gas Mitigation Professional during this phase.* | *Rationale* | |
| **Review Design to Requirements** | **Design Review Report** | |
| *Installation details compared to goals.* | *Conclusion of review* | |
| **Review Submittals** | **Submittal Review Report** | |
| *Overseers* | *Overseers* | |
| **Observe and Test** | **Construction Checklists and Reports** | |
| *1) Site assessment, 2) Building diagnostics, and 3) Post-installation test* | *1) Site assessment, 2) Building diagnostics, and 3) Post-installation test* | |
| **Resolve Issues** | **Issues and Resolution Log** | |
| *As needed* | *Document as needed* | |
| **Assemble Systems Manual** | **Systems Manual** | |
| *OM&M Plan* | *Completed OM&M Plan* | |
| **Conduct Training** | **Training Plans and Records** | Commissioning Team |
| *For long-term staff and OM&M personel* | *Document training and establish retention of logs* | |
| **Post-occupancy Operation** | **End of Warranty Commissioning Report** | |
| *First year or two testing to establish baseline for effectiveness.* | *As established for each contractor and, if applicable, if decommissioning the installation.* | |
| **Assemble Commissioning Report** | **Deliver Report** | |
| *Overseers* | *Overseers* | |



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B-1.2 *Mitigator needs*

When commissioning goals include reduction of soil gas entry, needs of mitigation professionals include:

a) A specific Scope of Work;
b) Overall remediation goals with current strategy and rationale for design and objectives;
c) Known Hazards for each building being mitigated to include, among others:
   - chemical(s) of concern, regulatory action levels for site classification and toxicology standards.
   - a determination for any need, or if there is not a need, for special considerations during removal, handling and control of hazardous substances;
d) Information needed to achieve appropriate system design and implementation.
e) Quantifiable Goals and Objectives, including the extent of reductions for soil gas entry needed to achieve mitigation goals; and
f) Project Management Specifications, such as contractor qualification requirements, deliverable and reporting schedules, and payment terms.

B-1.3 *Communication plan*

A written plan should be developed in coordination with the overseeing team (i.e., senior staff, RP, oversight staff and communications staff) for communicating throughout the process to all affected parties. As appropriate, regulatory authorities and owners of affected properties that are not owner-occupied residences should participate in developing the plan. Recommended components include:

a) Specify which management staff member is responsible for onsite activities.
b) Specify the structure of additional communication paths between senior staff, facilitating staff, maintenance staff, measurement service provider(s) and the qualified soil gas mitigation professional.
c) Identify and provide contact information for those individuals who are authorized to respond to inquiries from owners, occupants, and the public.
d) Develop notices (with instructions, general information, and information on whom to contact for inquiries) that may be specific for each affected audience, including:
   1. facilitating staff that might normally include oversight staff, building managers, maintenance managers and other supervisors.
   2. occupants of the building.
e) Develop timetables and means for distribution of notices.

B-1.4 *Guidance to mitigators regarding proposals*.

In addition to proposal requirements in SGM-SF Section 4.2:

a) If not already provided in a Request for Proposal received, the contractor should request of the client information as to whether the site is listed as classified by the state or other jurisdiction;
b) The contractor should include any additional limits the contractor places on the stated scope of work relative to degree of participation in an operations, maintenance, and monitoring plan (OM&M) and any handling and control of hazardous substances.

Note—It is customary practice that contractors limit their scope of work and transfer certain obligations in writing to the client or Responsible Party. Common examples include significant or incidental handling, capture, disposal and management of contaminated substances such as contaminated soil, groundwater, condensate, and vapor that exceed regulatory limits.



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Table B-1.2 Content Mitigators Often Need In "Requests for Proposals" (RFP)

**1.0 RFP Universal Provisions**

- 1.1 Project Overview
  - 1.1.1 Project Summary
  - 1.1.2 Chemical Information—*Chemical of concern, sub-slab levels, IA levels, regulatory levels for site classification, mobile lab site characterization, toxicology standards, pathway, and source identification*
  - 1.1.3 Quantifiable Goals and Objectives—*What is the measure of success? (i.e. verified pressure differential, IA level reduction, specific mitigation area)*
  - 1.1.4 Project Schedule—*Specific deliverable dates for each phase of the project*
  - 1.1.5 Additional Information—*Bid schedule, site access, consultant POC, other concurrent remedial actions*
  - 1.1.6 Progress Reporting, Final Reporting—*Pilot testing, system design, system as-built, post-mitigation verification testing, photos, drawings, component specs sheets, MSDS info*
  - 1.1.7 Additional Project Requirements—*Onsite supervision, meetings, risk communication, RP communication*
  - 1.1.8 Payment, Submittals—*Phase definition, budget deliverables (i.e. fixed price, performance contract), payment terms and conditions, schedule of values and mobilization*
- 1.2 Contractor Requirements
  - 1.2.1 Insurance—*Minimum requirements*
  - 1.2.2 Health and Safety—*OSHA, HAZWOPER, health, and safety program (to include hazardous communication program), site-specific health and safety program*
  - 1.2.3 Additional Contractor Requirements—*Responsible parties*
- 1.3 Appendices
  - 1.3.1 Sampling Data, Boring Logs
  - 1.3.2 Previous Pilot Testing Data
  - 1.3.3 Site Map, Drawings

**2.0 RFP for Mitigation Design**

- 2.1 Universal Provisions *(All components of 1.0)*
- 2.2 Mitigation Standards, Regulatory Requirements—*Applicable ANSI standard, applicable regulatory requirements*
- 2.3 Pilot Testing, Building Characterization—*Deliverables, such as PFE, vacuum and airflow testing, HVAC assessment*
- 2.4 Power consumption analysis
- 2.5 Analog or digital controls, onsite or remote monitoring

**3.0 RFP for Mitigation Installation**

- 3.1 Universal Provisions *(All components of 1.0)*
- 3.2 System Design Specs and Additional Specs—*Permitting, material characterization, soil testing and disposal specs, post-mitigation verification criteria, QC and startup procedures, decontamination, and containment specs*
- 3.3 Warranty—*Performance, system components, roof bonding, length of warranty*

**4.0 RFP for Operation and Maintenance**

- 4.1 Universal Provisions (All components of 1.0)
- 4.2 Summary of logistical aspects for this work *(e.g., inspection/maintenance frequency and deliverable dates)*
- 4.3 System maintenance procedures *(e.g., analog or digital controls, onsite or remote monitoring, PFE, system tuning)*
- 4.4 Inspection reporting and maintenance logs
- 4.5 General Pricing Estimate Examples:
  - 4.5.1 Mobilization (Crew Travel) $ _____
  - 4.5.2 Mobilization (Single staff member) $ _____
  - 4.5.3 Additional Suction Location (per) $ _____
  - 4.5.4 Vapor retarder materials $ _____



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## Section C Monitoring Events and Stewardship (2017)

Guidance provided herein was compiled by the SGM-SF consensus body committee members in 2017. Though editorially reorganized, work to refine this guidance is expected for future publications.

Considerations included that once baselines are established, ongoing monitoring and stewardship activities can be better defined.

Table C-1 **2017 Guidance: Post-mitigation Monitoring Events for Chemical Vapor Intrusion**

| | | Rapid Response indicated if estimated exposure exceeds health protective concentration for short-term or acute exposure | |
|---|---|---|---|
| **No prior assessment** | **Class 3 Continuous or Chronic Risk** | **Class 2 Subchronic Risk** | **Class 1 Acute Risk** |
| If suspected concerns exist, ***Preemptive mitigation*** may be warranted. | Concerns of harmful effects from average low-level exposure across many years (e.g., ≥ 26 years) or repeated exposure events to somewhat higher concentrations | Concerns of harmful effects from average exposure across 10% of a life span or repeated exposure events to higher concentrations | Concerns of harmful effects from immediate or short-term exposure (e.g., < 30 days) |
| **Initial Post-mitigation Monitoring Events** | | | |
| For Preemptive mitigation: Initial PFE and system pressure measurements. Indoor air measurements recommended but not required | Initial Frequency for a minimum of 1 year: Seasonally until a baseline is established that indicates successful effectiveness. | Initial Frequency for a minimum of 1 year: Seasonally (or more frequently) until a baseline is established that indicates successful effectiveness. | Initial Frequency for a minimum of 2 years: Seasonally (or more frequently) until a baseline is established that indicates successful effectiveness. |
| | Each monitoring event includes measurements of indoor air (contracted by responsible party) and measurements of PFE, system pressure and review for fan and mechanical systems. | | |
| | Note: Longer durations or more frequent monitoring may be warranted dependent upon:<br>a) the degree to which measured concentrations exceed the action level, or<br>b) the degree of observed variability above the action level especially post-mitigation.<br>Note: Radon testing is recommended pre-mitigation. Include in all initial monitoring events If concentrations found can aid evaluations of system effectiveness and confirm a health benefit. | | |
| | **Monitoring Events Thereafter**<br>Every year: Mechanical inspection (PFE, system pressure and mechanical systems.)<br>Every 2 years: Indoor air measurements<br>Increase frequency of monitoring events based on observed variability or evidence of plume movement. | | |
| | In addition, concentrations should be retested if changes occur for the building structure, HVAC, openings to soil, or if earthquakes, construction blasting, fracking, or formation of sink holes nearby. | | |
| | **Cessation of biennial indoor air measurements:**<br>Biennial Indoor air measurements can be replaced with 5-year test cycles only for those buildings where:<br>a) Systems have shown continued effectiveness; and<br>b) The mitigation systems are operated under a written operation and maintenance (O&M) plan that includes regular monitoring of mechanical equipment and requires a professional's signature verifying that systems continue to function in the same manner as the last test. | | |



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## C-1 Initial Post-mitigation Testing

Each post-*mitigation* monitoring event should include: (1) measurement of indoor air; (2) *PFE* measurements; (3) system pressure measurements; and (4) review of fan and mechanical systems.

To provide an initial measure of mitigation effectiveness, the first post-mitigation monitoring event should be conducted no sooner than 2 weeks after mitigation unless specified differently by a regulatory authority (e.g., when acute risks are present). The 2-week delay period is warranted for reducing influences on indoor test results due to chemicals that may have adsorbed into building materials and finishings. This also allows chemical vapors and gasses to reach a state of equilibrium with indoor air that is more representative of future expectations when mitigation systems are active.

For acute risk situations, more frequent or multiple monitoring events should be considered prior to or in concurrence with seasonal post-mitigation monitoring.

### C-1.1 *Initial seasonal verification*

To account for seasonal variations, monitoring events sufficient to evaluate effectiveness under each of the following conditions should, at a minimum, be considered:

a) Heating Season Conditions.
This is when the highest outdoor air temperatures are at least 10˚ F colder than indoor air—e.g., when outdoor temperatures are less than 65˚ F (18˚ C).

If seeking to help characterize temporary worst-case pressure-driven entry of soil gas and stressed mitigation system conditions, at least one monitoring event should be conducted when outdoor temperatures are within 10˚ F (5˚ C) or colder than the average for coldest local temperatures;

b) Cooling Season Conditions.
This is when outdoor air temperatures are at least 10˚ F warmer than indoor air for a significant portion of the daytime—e.g., when daytime outdoor temperatures are more than 85˚ F (29˚ C).

This monitoring event helps evaluate if consistent activity of HVAC blowers temporarily enhance soil gas entry across this season; and

c) Mild Weather Conditions.
This is when the outdoor temperatures are similar to indoor temperatures of about 74˚ F (23˚ C).

This monitoring event helps evaluate if HVAC blowers temporarily inhibit soil gas entry during other seasons.

C.1.2 An additional monitoring event should be considered to evaluate effectiveness under other concerning condition(s) that can include:

a) During Low Water Table (dry soil conditions)
This monitoring event helps characterize if soil gas entry is temporarily enhanced due to a larger than normal volume of soil gas under a building.

b) During High Water Table (wet soil conditions)
Note that soil gas entry is typically inhibited during high water table conditions. However, other considerations may warrant this testing, such as when hazardous substances in liquid or aqueous form that are highly concentrated and reside in close proximity to the building.

### C-1.3 *Seasonal Evaluations*

Any one of these seasonal conditions can result in enhancement or virtual cessation of soil gas entry for temporary or seasonal durations, depending upon building characteristics and mechanical systems.
It is recommended to continue seasonal monitoring events until a baseline is established for yearlong effectiveness. Restarting the regimen of seasonal monitoring events is recommended if system alterations are found to be warranted for improving system effectiveness. A longer duration or more frequent monitoring may be warranted dependent upon:

a) the degree to which measured concentrations exceed the action level, or

b) the degree of observed variability above the action level, especially post-mitigation.



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C-1.3.1 Use of Seasonal Information

Information gained by the initial seasonal monitoring events can be used to guide protective stewardship choices for subsequent monitoring events by identifying conditions that represent average or worst-case conditions. If radon testing was included in seasonal monitoring and indicated consistency with other soil gas entry, inexpensive radon testing, if deemed acceptable, can sometimes suffice for future monitoring events.

## C-2 Soil Gas Measurements

Soil gas measurements are often conducted in association with the initial site characterization. Soil gas measurements under the building and within ASD duct piping can be compared with measurements taken during initial ASD commissioning to help characterize evidence of a shifting or depleted source. Soil gas measurements within ASD duct piping are also employed to evaluate regulatory compliance with limits on discharged hazardous vapors.

Monitoring for changes of soil gas concentrations within duct piping is one procedure employed for chemical vapor intrusions sites when there is reason to believe that the system might eventually not be needed. However, check with your state regulatory agency for conditions that would fully warrant possible decommissioning.

## C-3 Indoor Air Testing

To reproducibly account for testing variables such as natural day-to-night variability in soil gas entry and dilution after entry, it is recommended to:

a) Conduct short-term indoor air measurements under closed-building conditions for durations that should be no less than about 2 days;

b) Conduct at least one measurement in the lowest occupiable location within the home for use as the most reproducible measurement when evaluating seasonal measurement differences;

c) Follow appropriate guidance for sampling and laboratory analysis, such as EPA TO-15 and TO-17[2];

d) Conduct measurements of ambient outside air sufficient to characterize the influence of ambient concentrations on indoor measurement results; and

e) Take care to reduce influences on test results such as chemicals contained in household cleaning products.

C-3.1 *Discussion: Surrogate post-mitigation testing methods*

Surrogate methods to monitor continued effectiveness of mitigation are commonly employed in lieu of an ardent regimen of indoor testing. PFE testing is the most common example. Indoor measurements of soil gases other than the chemical(s) of concern can also be an effective supplement.

Radon is also well suited for evaluating continued reduction of soil gas entry. Testing for radon before and after mitigation can establish a baseline for surrogate correlation by comparing results with other indoor measurements.

Naturally occurring radon is found everywhere on earth regardless of what survey maps might suggest. Initial indoor measurements as low as 2.5 pCi/L are common anywhere and can provide evidence for a difference between pre- and post-mitigation. Concentrations of 4 pCi/L or greater are even more helpful for estimating percentages of reduced soil gas entry and evidence of enhanced benefits to occupants.

C-3.2 *Reproducible testing*

When possible, testing should be made under reproducible conditions

[2] EPA/600/4-90/010 1990 Compendium of Methods for the Determination of Air Pollutants in Indoor Air, and EPA/625/R-96/01b 1999 Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air - Second Addition



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**Sample of closed-building protocol essentials**

SAMPLE DOOR HANGER NOTICE

# AIR TEST IN PROGRESS

**Required closed-building conditions**
(12 hours prior the test and during the test).

| | |
|---|---|
| **Keep closed** | **Windows & Exterior doors** *(except for momentary use)* |
| **Set to normal** | **Heating & Cooling systems** *(kept between about 65˚ - 80˚ F)* |
| **Operate normally** | **Bathroom fans** |
| | **Other ventilation units that are used in all seasons** |
| **Avoid excessive operation** | **Exhaust systems** such as from laundries or for control of fumes from community kitchens |
| **Outside air dampers closed** | **Window air conditioners and unit ventilators** |
| **Do not operate** | **Window fans, whole building fans or other** systems that temporarily bring air into or out of the building for seasonal energy savings or comfort |
| | **Fireplaces that burn solid, liquid or gas fuels,** unless they are the primary sources of heat for the building |

**Sample of chemical product guidance**

SAMPLE DOOR HANGER NOTICE

# AIR TEST IN PROGRESS

**48-72 hours prior the test and during the test**

| | |
|---|---|
| **Do not use** | **Pesticides, glues, sealants, paints, thinners or varnishes** |
| | **Cleaning compounds for bathrooms, appliances, furniture, floors, and other all-purpose cleaning products.** |
| | **Bleach, disinfectants, air fresheners or odor eliminators** |
| | **Cosmetics such as hair spray, nail polish remover, nail polish and perfume.** |
| **Do not** | **Smoke in the house** |
| | **Operate or store automobiles in an attached garage** |
| | **Store swimming pool products in the house or attached garage** |
| | **Store gasoline, oil, brake fluid, lubricants or solvents in the house or attached garage** |

For details see householdproducts.nlm.nih.gov



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## C-4 Ongoing stewardship

C-3.1 *Mechanical Systems*

It is recommended that inspection be conducted yearly for mechanical operations and system integrity, to include PFE and system pressure measurements and related mechanical systems and components.

C-4.2 *Indoor Air Measurements*

It is recommended that the monitoring events include measurements of indoor air at least every 2 years.

C-4.3 *Cessation of Biennial Indoor Air Measurements*

It is recommended that biennial retests for mitigated buildings be maintained for as many years as the system is operational unless replaced with 5-year test cycles for only those buildings where:

a) systems have shown continued effectiveness to the satisfaction of jurisdictional authorities; and

b) the mitigation systems are operated under a written operation and maintenance (O&M) plan that includes regular monitoring of mechanical equipment and requires a professional's signature verifying that systems continue to function in the same manner as the last test.

C-4.4 *Additional Monitoring Events*

Informative advisory—It is recommended to conduct additional monitoring events:

a) based on observed variability or evidence of plume movement; and

b) if any of the following circumstances occur:

- ✓ a new addition is constructed or alterations for building reconfiguration or rehabilitation occur;
- ✓ heating or cooling systems are altered with changes to air distribution or pressure relationships;
- ✓ ventilation is altered by extensive weatherization, changes to mechanical systems or comparable procedures;
- ✓ sizable openings to soil occur due to:
  - — groundwater or slab surface water control systems are added or altered (e.g., sumps, drain tiles, shower/tub retrofits, etc.); or
  - — natural settlement causing major cracks to develop;
- ✓ earthquakes, construction blasting or formation of sink holes nearby; or
- ✓ an installed mitigation system is altered or repaired.

## C-5 Decommissioning systems

In certain instances, the source of hazardous soil gas can be found to have migrated away from a building or found to be depleted in hazardous concentrations, either naturally or as a result of remediation and related efforts. In such circumstances, considerations can include discontinued operation of soil gas mitigation systems and ongoing stewardship.

C-5.1 *Decommission Decisions*

Decisions to decommission a system due to evidence of a shifting or depleted source are beyond the scope of this document but normally include documented measurements of soil gas from under the building with the system inactive for an adequate period of time prior to the measurement. A test for radon gas should also be conducted at this time to inform the property owner if there are other reasons to warrant continued system operation.

C-5.2 *Advise Property Owner*

It is recommended to advise the owner that a resident can continue his/her own testing for continued verification



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## Section D Design Installation Guidance/Advisories

| SGM-SF | Discussion/Advisories |
|---|---|
| **1.0 Scope**<br>1.2.3 *Combustible gas* | Complete details on system design for mitigating the hazards of flammable gas are beyond the scope of SGM-SF. See discussion below (6.5) regarding explosion proof fans flammable substances. |
| **5.0 System Design**<br>5.1.3 *Permanent systems required* | There are limits on temporary solutions. Section 13.2 in ANSI/AARST SGM-MFLB provides requirements and guidance relative to use and duration for temporary and rapid response mitigations systems or methods. |
| **5.2 Nondestructive Investigation** | Ground Water Control<br>Contaminated water from below ground can be an ongoing hazard.<br>Where grading, roof downspouts or failed sump pumps do not flow rainwater or groundwater away from a building, the tremendous weight of water collecting in the soil will drive water below grade to forcefully intrude into a structure.<br>Where observed, an experienced ground water control specialist should be contracted or consulted when ground water control is needed. |
| **5.3 Diagnostic investigation** | Pressure field extension (PFE) analysis is required for VI systems and includes that test ports be provided for future verification of PFE. |
| **6.0 ASD Systems**<br>6.2.7 *Secure duct piping* | Greater care is needed to help prevent water from escaping the piping. Durability of pipe joint configurations is important to prevent condensed chemical compounds from escaping the pipe within a home. |
| **6.4 ASD Exhaust Discharge** | Approved processes and designs associated with federal, state, or local requirements when exhausting potent vapor concentrations are beyond the scope of SGM-SF. |
| **7.0 Sealing**<br>Sealant material and Soil gas retarder materials | Considerations are required regarding chemicals of concern include:<br>1) slow curing of compounds in sealants that might interfere with measurements of indoor concentrations, and<br>2) soil gas retarders that resist degradation because of chemicals in the soil. |
| **8.2 System Monitors** | Enhanced fan monitor choices can sometimes be warranted, and labels require for appropriate verbiage. |


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| | |
|---|---|
| **11.0 Health and Safety**<br>**11.5 Chemical Vapor Mitigation**<br>11.5.3.1 Jobsite Hazards | Seeking responses to mitigator inquiries about chemical hazards is important. Responsibility is inherently owned by the mitigation professional for safe practices during work. |
| | Handing contaminated soil and liquids can be hazardous. Approved processes for handling and disposing of contaminated soil are beyond the scope of SGM-SF |
| **6.5 ASD Fan Installation**<br>6.5.1 *Fan design* d) 3 | Fan choices and spark resistance features must comply with the National Electric Code (NEC) where flammable gases or vapors are present in quantities sufficient to produce explosive or ignitable mixtures.<br>It is extremely important to limit the concentration of chemicals in the airstream of an Active Soil Depressurization to well below the Lower Explosion Limit (LEL) for that gas. Failure to maintain gas concentrations below 10% of LEL could result in a fire, explosion, and serious injury. |

**Examples of Explosion Proof Fan Classifications**

| Class | Definitions |
|---|---|
| Class I | Locations: Are those in which flammable gases or vapors are or may be present in the air in quantities sufficient to produce explosive or ignitable mixtures. |
| Class II | Locations: Are those which are hazardous due to the presence of combustible dust. |
| Class III | Locations: Are those which are hazardous due to the presence of easily ignitable fibers or flyings, but in which such fibers or flyings are not likely to be in suspension in the air in quantities to produce ignitable mixtures. |
| Division | |
| Division I | Locations in which hazardous concentrations in the air exist continuously, intermittently, or periodically under normal operating conditions. |
| Division II | Locations in which hazardous concentrations are handled, processed, or used but are normally within closed containers or closed systems from which they can escape only in case of accidental rupture or breakdown. |
| Group (Class I) | |
| Group A | Atmospheres containing acetylene. |
| Group B | Atmospheres containing hydrogen, or gases (or vapors) of equivalent hazard, such as manufactured gas. |
| Group C | Atmospheres containing ethyl-ether vapors, ethylene or cyclo propane. |
| Group D | Atmospheres containing gasoline, hexane, naptha, benzine, butane, alcohol, acetone, benzol, lacquer solvent vapors, or natural gas. |
| Group (Class II) | |
| Group E | Atmospheres containing metal dust, including aluminum, magnesium and their commercial alloys and other metals of similarly hazardous characteristics. |
| Group F | Atmospheres containing carbon black, coal, or coke dust. |
| Group G | Atmospheres containing flour, starch, or grain dust. |

*The next pages provide Lower Explosion Limits (LEL) for certain common chemicals*



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## Flammable / Combustible / Explosive Gases and Vapors
## A reference for Lower Explosion Limits (LEL) for certain common chemicals

| A reference chart of Lower Explosion Limits (LEL) Gases and Vapors | LEL in % by volume of air | NFPA Class | Flash point |
|---|---|---|---|
| Acetaldehyde | 4.0 | IA | -39°C |
| Acetic acid (glacial) | 4 | II | 39°C to 43°C |
| Acetic anhydride | | II | 54°C |
| Acetone | 2.6-3 | IB | -17°C |
| Acetonitrile | | IB | 2°C |
| Acetyl chloride | 7.3 | IB | 5°C |
| Acetylene | 2.5 | | -18°C |
| Acrolein | 2.8 | IB | -26°C |
| Acrylonitrile | 3.0 | IB | 0°C |
| Allyl chloride | 2.9 | IB | -32 °C |
| Ammonia | 15 | IIIB | 11°C |
| Arsine | 4.5 – 5.1 | IA | Flammable gas |
| Benzene | 1.2 | IB | -11°C |
| 1,3-Butadiene | 2.0 | IA | -85°C |
| Butane, n-Butane | 1.6 | IA | -60°C |
| n-Butyl acetate, Butyl acetate | 1 – 1.7 | IB | 24°C |
| Butyl alcohol, Butanol | 1 | IC | 29°C |
| n-Butanol | 1.4 | IC | 35°C |
| n-Butyl chloride, 1-chlorobutane | 1.8 | IB | -6°C |
| n-Butyl mercaptan | 1.4 | IB | 2°C |
| Butyl methyl ketone, 2-Hexanone | 1 | IC | 25°C |
| Butylene, 1-Butylene, 1-Butene | 1.98 | IA | -80°C |
| Carbon disulfide | 1.0 | IB | -30°C |
| Carbon Monoxide | 12 | IA | -191°C Flammable gas |
| Chlorine monoxide | | IA | Flammable gas |
| 1-Chloro-1,1-difluoroethane | 6.2 | IA | -65°C Flammable Gas |
| Cyanogen | 6.0 – 6.6 | IA | Flammable gas |
| Cyclobutane | 1.8 | IA | - 63.9° C [11] |
| Cyclohexane | 1.3 | IB | -18°C - - 20°C |
| Cyclohexanol | 1 | IIIA | 68°C |

| A reference chart of Lower Explosion Limits (LEL) Gases and Vapors | LEL in % by volume of air | NFPA Class | Flash point |
|---|---|---|---|
| Cyclohexanone | 1 – 1.1 | II | 43.9 – 44°C |
| Cyclopentane | 1.5 – 2 | IB | - 37 to - 38.9°C |
| Cyclopropane | 2.4 | IA | -94.4°C |
| Decane | 0.8 | II | 46.1°C |
| Diborane | 0.8 | IA | -90°C Flammable gas |
| o-Dichlorobenzene, 1,2-Dichlorobenzene | 2 | IIIA | 65°C |
| 1,1-Dichloroethane | 6 | IB | 14°C |
| 1,2-Dichloroethane | 6 | IB | 13°C |
| 1,1-Dichloroethene | 6.5 | IA | -10°C Flammable gas |
| Dichlorofluoromethane | | | Non flammable, - 36.1°C |
| Dichloromethane, Methylene chloride | 16 | | Non flammable |
| Dichlorosilane | 4 – 4.7 | IA | -28 °C |
| Diesel fuel | 0.6 | IIIA | >62°C (143°F) |
| Diethanolamine | 2 | IB | 169°C |
| Diethylamine | 1.8 | IB | -23°C to – 26°C |
| Diethyl disulfide | 1.2 | II | 38.9°C |
| Diethyl ether | 1.9 – 2 | IA | -45°C |
| Diethyl sulfide | | IB | -10°C |
| 1,1-Difluoroethane | 3.7 | IA | -81.1°C |
| 1,1-Difluoroethylene | 5.5 | | -126.1°C |
| Diisobutyl ketone | 1 | | 49°C |
| Diisopropyl ether | 1 | IB | -28°C |
| Dimethylamine | 2.8 | IA | Flammable gas |
| 1,1-Dimethyl hydrazine | | IB | |
| Dimethyl sulfide | | IA | -49°C |
| Dimethyl sulfoxide | 2.6 – 3 | IIIB | 88 – 95°C |
| 1,4-Dioxane | 2 | IB | 12°C |
| Epichlorohydrin | 4 | | 31°C |
| Ethane | 3 | IA | -135 °C Flammable gas |

*Continued A reference for Lower Explosion Limits (LEL) for certain common chemicals*



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| A reference chart of Lower Explosion Limits (LEL) Gases and Vapors | LEL in % by volume of air | NFPA Class | Flash point |
|---|---|---|---|
| Ethanol, Ethyl Alcohol | 3 – 3.3 | IB | 12.8°C (55°F) |
| 2-Ethoxyethanol | 3 | | 43°C |
| 2-Ethoxyethyl acetate | 2 | | 56°C |
| Ethyl acetate | 2 | IA | -4°C |
| Ethylamine | 3.5 | IA | -17 °C |
| Ethylbenzene | 1.0 | | 15-20 °C |
| Ethylene | 2.7 | IA | |
| Ethylene glycol | 3 | | 111°C |
| Ethylene oxide | 3 | IA | −20 °C |
| Ethyl Chloride | 3.8 | IA | −50°C |
| Ethyl Mercaptan | | IA | |
| Fuel oil No.1 | 0.7 | | |
| Furan | 2 | IA | -36°C |
| Gasoline (100 Octane) | 1.4 | IB | < −40°C (−40°F) |
| Glycerol | 3 | | 199°C |
| Heptane, n-Heptane | 1.05 | | -4°C |
| Hexane, n-Hexane | 1.1 | | -22°C |
| Hydrogen, dihydrogen, molecular H with two protons together | 4 | IA | Flammable gas |
| Hydrogen sulfide | 4.3 | IA | Flammable gas |
| Isobutane | 1.8 | IA | Flammable gas |
| Isobutyl alcohol | 2 | | 28°C |
| Isophorone | 1 | | 84°C |
| Isopropyl alcohol, Isopropanol | 2 | IB | 12°C |
| Isopropyl chloride | | IA | |
| Kerosene Jet A-1 | 0.6 – 0.7 | II | >38°C (100°F) as jet fuel |
| Lithium Hydride | | IA | |
| 2-Mercaptoethanol | | IIIA | |
| Methane (Natural Gas) | 4.4 – 5 | IA | Flammable gas |
| Methyl acetate | 3 | | -10°C |
| Methyl Alcohol, Methanol | 6 – 6.7 | IB | 11°C |
| Methylamine | | IA | 8°C |
| Methyl Chloride | 10.7 | IA | -46 °C |
| Methyl ether | | IA | −41 °C |
| Methyl ethyl ether | | IA | |
| Methyl ethyl ketone | 1.8 | IB | -6°C |
| Methyl formate | | IA | |

| A reference chart of Lower Explosion Limits (LEL) Gases and Vapors | LEL in % by volume of air | NFPA Class | Flash point |
|---|---|---|---|
| Methyl mercaptan | 3.9 | IA | -53°C |
| Methyl-t-Butyl Ether (MTBE) | 1.6 | IB | -10°C |
| Morpholine | 1.8 | IC | 31 – 37.7°C |
| Naphthalene | 0.9 | IIIA | 79 – 87 °C |
| Neohexane | 1.19 | | −29 °C |
| Nickel tetracarbonyl | 2 | | 4 °C |
| Nitrobenzene | 2 | IIIA | 88°C |
| Nitromethane | 7.3 | | 35°C |
| Octane | 1 | | 13°C |
| iso-Octane | 0.79 | | |
| Pentane | 1.5 | IA | -40 to -49°C |
| n-Pentane | 1.4 | IA | |
| iso-Pentane | 1.32 | IA | |
| Perchloroethylene (PERC) | 13 | | none |
| Phosphine | | IA | |
| Propane | 2.1 | IA | Flammable gas |
| Propyl acetate | 2 | | 13°C |
| Propylene | 2.0 | IA | -108°C |
| Propylene Oxide | 2.3 | IA | |
| Pyridine | 2 | | 20 |
| Silane | 1.5 | IA | |
| Styrene | 1.1 | IB | 31 – 32.2°C |
| Tetrachloroethene (PCE) | | | none |
| Tetrafluoroethylene | | IA | |
| Tetrahydrofuran | 2 | IB | -14°C |
| Toluene | 1.2-1.27 | IB | 4.4°C |
| Trichloroethene (TCE) | 6 | | none |
| Triethylborane | | | -20°C |
| Trimethylamine | | IA | Flammable gas |
| Trinitrobenzene | | IA | |
| Turpentine | 0.8 | IC | 35°C |
| Vegetable oil | | IIIB | 327°C |
| Vinyl acetate | 2.6 | | −8 °C |
| Vinyl chloride | 3.6 | | |
| Xylenes | 0.9 – 1.0 | IC | 27 – 32°C |
| m-Xylene | 1.1 | IC | 25°C |
| o-Xylene | | IC | 17 °C |
| p-Xylene | 1.0 | IC | 27.2°C |



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AARST CONSORTIUM ANSI

SGM-SF 2023

# Soil Gas Mitigation Standards for Existing Homes

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**SECTION 01 2000**

**PRICE AND PAYMENT PROCEDURES**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

### 1.02 SCHEDULE OF VALUES

A. Form to be used: HUD-51000.

B. Forms filled out by hand will not be accepted.

C. Submit Schedule of Values in triplicate within 15 days after date of Owner-Contractor Agreement.

### 1.03 APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Monthly.

B. Form to be used: HUD-51001.

C. Forms filled out by hand will not be accepted.

D. Execute certification by signature of authorized officer.

E. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.

F. Submit three copies of each Application for Payment.

G. Include the following with the application:
   1. Transmittal letter as specified for Submittals in Section 01 3000.
   2. Application for Payment (HUD-51001)
   3. Construction progress schedule, revised and current as specified in Section 01 3000.
   4. Schedule of Change Orders (HUD-51002)
   5. Schedule of Materials Stored (HUD-51003)
   6. Summary of Materials Stored (HUD-51004)
   7. Construction Progress Schedule (HUD-5372)
   8. Contractor Payment Certification (HUD-5370, clause 27e)
   9. Copy of approved Schedule of Values (HUD-51000)
   10. Copy of the previous Payment Application (first page only)

H. Certified Payrolls - must be submitted on a weekly basis to the owner. Applications for payment will not be approved without all certified payrolls submitted.

### 1.04 MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect or Owner will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
   1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
   2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within two days.

D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the Work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and

a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 6000.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
   1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Mitigation Company's price quotation as approved by the Architect.
   2. For change requested by Contractor, the amount will be based on the Mitigation Company's request for a Change Order as approved by Architect.
   3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.
   4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Mitigation Company's substantiation of costs as specified for Time and Material work.

F. Substantiation of Costs: Provide full information required for evaluation.
   1. Provide the following data:
      a. Quantities of products, labor, and equipment.
      b. Taxes, insurance, and bonds.
      c. Overhead and profit.
      d. Justification for any change in Contract Time.
      e. Credit for deletions from Contract, similarly documented.
   2. Support each claim for additional costs with additional information:
      a. Origin and date of claim.
      b. Dates and times work was performed, and by whom.
      c. Time records and wage rates paid.
      d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
   3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.
      a. The Owner or Engineer shall verify all Time and Materials used on a daily basis.

G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

H. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

I. Promptly enter changes in Project Record Documents.

**1.05 APPLICATION FOR FINAL PAYMENT**

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:
   1. All closeout procedures specified in Section 01 7000.
   2. Release of Certification of Final Payment.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION**

**SECTION 01 3000**

**ADMINISTRATIVE REQUIREMENTS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Preconstruction meeting.

B. Progress meetings.

C. Construction progress schedule.

D. Progress photographs.

E. Coordination drawings.

F. Submittals for review, information, and project closeout.

### 1.02 RELATED REQUIREMENTS

A. Section 01 3216 - Construction Progress Schedule: Form, content, and administration of schedules.

B. Section 01 3300 - Submittals

C. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

D. Section 01 7800 - Closeout Submittals: Project record documents.

### 1.03 PROJECT COORDINATION

A. Cooperate with the Owner in allocation of mobilization areas of site; for field offices and sheds, for storage areas, access, traffic, and parking facilities.

B. During construction, coordinate use of site and facilities through the Owner.

C. Comply with Owner and Architect's procedures for intra-project communications; submittals, reports and records, schedules, coordination drawings, and recommendations; and resolution of ambiguities and conflicts.

D. Comply with instructions of the Owner for use of temporary utilities and construction facilities.

E. Coordinate field engineering and layout work under instructions of the Architect.

F. Make the following types of submittals to Architect:
   1. Requests for interpretation.
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

### 1.04 ADMINSTRATIVE AND SUPERVISORY PERSONNEL

A. General: In addition to its full-time on site Project Superintendent, the Mitigation Company shall provide other administrative and supervisory personnel, as required for proper performance of the work. Include special personnel required for coordination of operations with the Mitigation Company.

B. Project Coordinator: The Mitigation Company shall provide a fulltime Superintendent/Project Coordinator, experienced in administration and supervision of building construction, including plumbing, mechanical, and electrical work. The Superintendent/Project Coordinator shall be

authorized to act as the coordinator of construction activities between the separate Mitigation Company.

1. Construction activities requiring coordination by the Project Coordinator include, but are not limited to, the following:
    a. Scheduling and sequencing the Work.
    b. Sharing access to work spaces.
    c. Installations.
    d. Protection of each other's work.
    e. Cutting and patching.
    f. Selections for compatibility.
    g. Coordination drawings.
    h. Inspections and tests.
    i. Temporary services and facilities.
    j. Daily project clean up activities.
    k. Quality Control.

C. Staff Names: Within 5 calendar days of commencement of construction operations, each Prime Mitigation Company shall submit a list of its principal staff assignments, including the Superintendent and other personnel in attendance at the Project Site. Identify individuals and their duties and responsibilities. List their addresses and telephone numbers.

**1.05 MITIGATION COMPANY COORDINATION**

A. The Mitigation Company is designated as the Lead Contractor for the Project. Each contractor shall coordinate its construction activities with those of the other contractors and other entities involved to assure efficient and orderly installation of each part of the work. The Mitigation Company shall coordinate its operations with operations included under different Sections of the Specifications that depend on each other for proper installation, connection, and operation.

B. The Mitigation Company shall schedule its construction operations in the sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.

C. Where availability of space is limited, the Mitigation Company shall coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

D. The Mitigation Company shall make adequate provisions to accommodate items scheduled for later installation.

E. The Mitigation Company shall participate in these coordination requirements. The Mitigation Company shall advise the Owner and Engineer of overall coordination progress. When necessary, such as in congested spaces where multiple prime contracts are involved, the prime Mitigation Company shall meet with the Owner and Engineer and all other contractors involved to resolve critical coordination areas. Specific responsibilities are assigned to each prime Mitigation Company. The Mitigation Company and other contractors shall prepare Coordination Drawings as necessary to verify conflicts prior to installation.

F. In the event of coordination disputes or questions, the Mitigation Company shall submit the question or dispute to the engineer. The engineer will provide specific direction relating to the question or dispute. Direction provided to the Mitigation Company in response to questions or disputes shall be adhered to by all contractors. The Owner will not consider requests for additional time or coordination, questions, or disputes. In all matters pertaining to coordination, the decision of the engineer shall be final.

G. Where necessary, prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

1. Prepare similar memoranda for the Owner and separate contractors where coordination of their Work is required.

H. Administrative Procedures: The Mitigation Company shall coordinate scheduling and timing of its required administrative procedures with other construction activities and activities of other prime Mitigation Company to avoid conflicts and assure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of schedules.
   2. Installation and removal of temporary facilities.
   3. Delivery and processing of submittals.
   4. Progress meetings.
   5. Project closeout activities.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION**

**3.01 PRECONSTRUCTION MEETING**

A. Owner will schedule a meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Prime Mitigation Company.

C. Agenda:
   1. Execution of Owner-Mitigation Company Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Designation of personnel representing the parties to Contract, Owner and Architect.
   5. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   6. Scheduling.

D. Owner will record minutes and distribute copies within five days after meeting to participants, with copies to Architect, Owner, Mitigation Company, and those affected by decisions made.

**3.02 SITE MOBILIZATION MEETING**

A. Schedule meeting at the Project site prior to Mitigation Company occupancy.

B. Attendance Required:
   1. Mitigation Company.
   2. Owner.
   3. Architect.
   4. Mitigation Company's Superintendent.

C. Agenda:
   1. Use of premises by Owner and Mitigation Company.
   2. Owner's requirements and occupancy prior to completion.
   3. Construction facilities and controls provided by Owner.
   4. Security and housekeeping procedures.
   5. Schedules.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

**3.03 PROGRESS MEETINGS**

A. Owner will make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

B. Attendance Required:
   1. Mitigation Company.
   2. Owner.
   3. Architect.

4. Special Consultants.
5. Mitigation Company's Superintendent.

C. Agenda:
1. Review minutes of previous meetings.
2. Review of Work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of off-site fabrication and delivery schedules.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to Work.

D. Mitigation Company shall provide a written report on past weeks work at each job conference.

E. Mitigation Company shall provide a written report on projected work for the next week at each job conference.

F. Owner will record minutes and distribute copies within two days after meeting to participants, with copies to Architect, Owner, Mitigation Company, and those affected by decisions made.

**3.04 CONSTRUCTION PROGRESS SCHEDULE**

**3.05 PROGRESS PHOTOGRAPHS**

A. Submit new photographs at least once a month, within 3 days after exposure.

B. Photography Type: Digital; electronic files.

C. Provide photographs of site and construction throughout progress of Work produced by an experienced photographer, acceptable to Architect.

D. In addition to periodic, recurring views, take photographs of each of the following events:
1. Completion of site clearing.
2. Excavations in progress.
3. Foundations in progress and upon completion.
4. Structural framing in progress and upon completion.
5. Final completion, minimum of ten (10) photos.

E. Views:
1. Provide non-aerial photographs from four cardinal views at each specified time, until Date of Substantial Completion.
2. Consult with Architect for instructions on views required.
3. Provide factual presentation.
4. Provide correct exposure and focus, high resolution and sharpness, maximum depth of field, and minimum distortion.
5. Point of View Sketch: Provide sketch identifying point of view of each photograph.

F. Digital Photographs: 24 bit color, minimum resolution of 1024 by 768, in JPG format; provide files unaltered by photo editing software.
1. Delivery Medium: Via email.
2. File Naming: Include project identification, date and time of view, and view identification.
3. Point of View Sketch: Include digital copy of point of view sketch with each electronic submittal; include point of view identification in each photo file name.
4. PDF File: Assemble all photos into printable pages in PDF format, with 2 to 3 photos per page, each photo labeled with file name; one PDF file per submittal.

**3.06 COORDINATION DRAWINGS**

A. Provide information required by Architect for preparation of coordination drawings.

B. Review drawings prior to submission to Architect.

C. Provide input from all Prime Mitigation Company involved.

D. The General Mitigation Company shall coordinate their work to ensure that the project progresses without interruption. Conflicts of equipment shall be resolved prior to installation, and the required clear equipment working spaces shall be maintained (and applicable building codes shall be met). The engineer shall be notified immediately of any discrepancies.

**3.07 SUBMITTALS FOR REVIEW - REFER TO SECTION 01 3300 SUBMITTALS**

**END OF SECTION**

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**SECTION 01 3213**

**SCHEDULING AND PHASING**

## PART 1 GENERAL

### 1.01 SUBSTANTIAL COMPLETION

A. Total time for **Substantial Completion** of the contract is **75 calendar days per site** from the written notice to proceed.

B. Substantial Completion is the stage in the progress of the Work when the Work is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use. The intended use of this project is delivering apartments ready for occupancy and rent by the owner.

### 1.02 FINAL COMPLETION

A. Total time for Final Completion of the contract is **89 calendar days per site** from the written notice to proceed. **365 days** for all sites

B. Final Completion is the stage when all Work is complete in accordance with the Contract Documents, the owner and architect have accepted the Work, and all Closeout documents have been completed and accepted by the owner.

### 1.03 LIQUIDATED DAMAGES

A. The damages incurred by the Owner due to the Mitigation Company's failure to complete the Work, or portions thereof, designated in the Contract Documents, including any extensions thereof under the Contract Documents, shall be in the amount set forth below for each consecutive calendar day beyond each Specific Date (Sunday and all holidays included) for which the Mitigation Company shall fail to complete the Work or designated portion thereof designated in this section.

B. The amount of liquidated damages provided in the Contract Documents shall not be considered a penalty and shall compensate the Owner only for the Owner's inability to use or otherwise have available, the Project or any portion thereof for its intended purpose by the Dates set forth in the Contract Documents.

C. If, during the course of the Mitigation Company's performance of the Work, the Mitigation Company shall fail to complete the Work, or portions thereof, in accordance with Specific Dates or the Contract Time, the Owner may retain the estimated amount of liquidated damages for which the Mitigation Company shall be liable to the Owner under the Contract Documents, from amounts which become payable or are otherwise certified as payable to the Mitigation Company under the Contract Documents.

D. In the event that the Work must be conducted beyond the normal working hours specified or if the Project is not completed within the specified duration, the Mitigation Company shall reimburse the Consultants (A/E, etc.) for all of their expenses. Expenses shall be calculated at the cost times 2.75 on labor, and costs times 1.15 on all other items.

E. Liquidated Damages will be assessed as follows:
   1. Substantial Completion = **$250.00 per day** for each day the project is not substantially complete beyond the date established for Substantial Completion.
   2. Final Completion = **$250.00 per day** for each day the project is not at Final Completion beyond the date established for Final Completion.
   3. If the project is not Substantially complete and Final completion is not achieved in the specified times, then both liquidated damage costs shall apply simultaneously.
   4. If the owner incurs additional damages as a result of the project not being either Substantially Complete or achieving Final Completion within the required dates, the Mitigation Company shall also be liable for these costs.

## 1.04 SCHEDULING

A. The General Mitigation Company must provide a detailed project schedule indicating all the work activities in accordance with Section 01 3216.

B. The schedule must be reviewed and approved by the owner and engineer prior to beginning construction.

## 1.05 WEATHER DELAYS

A. Mitigation Company shall expect and incorporate into the schedule delays due to weather.

B. In extreme cases, such as natural disasters, weather delays may be accepted as justification for a contract time extension, however time extensions will not be accepted for normal weather conditions.

## 1.06 WORK HOURS

A. Mitigation Company shall include all necessary overtime, weekend, holiday, and second and/or third shift work to complete the project within the specified project duration.

B. No extension of contract length or contract cost will be allowed for Mitigation Company to work additional hours.

## PART 2 PRODUCTS – NOT USED

## PART 3 EXECUTION – NOT USED

**END OF SECTION**

**SECTION 01 3216**

**CONSTRUCTION PROGRESS SCHEDULE**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Preliminary schedule.

B. Construction progress schedule, with network analysis diagrams and reports.

### 1.02 RELATED SECTIONS

A. Section 01 1000 - Summary: Work sequence.

B. Section 01 3213 - Scheduling and Phasing

### 1.03 SCHEDULE COORDINATION

A. The Mitigation Company shall establish the overall schedule.

B. The Mitigation Company is responsible for maintenance and updates to the schedule throughout the project.

### 1.04 SUBMITTALS

A. Within 5 days after date of Agreement, submit preliminary schedule to the Engineer for review.

B. If preliminary schedule requires revision after review, submit revised schedule within 5 days.

C. Within 5 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

D. Within 5 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment, or as requested by the Owner or Engineer.

F. Submit under transmittal letter form specified in Section 01 3000 - Administrative Requirements.

### 1.05 QUALITY ASSURANCE

A. Mitigation Company Administrative Personnel: 5 years minimum experience in using and monitoring CPM schedules on comparable projects.

### 1.06 SCHEDULE FORMAT

A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.

B. Scale and Spacing: To allow for notations and revisions.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 PRELIMINARY SCHEDULE

A. Prepare preliminary schedule in the form of a preliminary network diagram.

### 3.02 CONTENT

A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.

B. Identify each item by specification section number.

C. Identify work of separate stages and other logically grouped activities.

D. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.

E. Provide separate schedule of submittal dates for shop drawings, product data, and samples, owner-furnished products, and dates reviewed submittals will be required from Architect. Indicate decision dates for selection of finishes.

F. Provide legend for symbols and abbreviations used.

**3.03 NETWORK ANALYSIS**

A. Prepare network analysis diagrams and supporting mathematical analyses using the Critical Path Method.

B. Illustrate order and interdependence of activities and sequence of work; how start of a given activity depends on completion of preceding activities, and how completion of the activity may restrain start of subsequent activities.

C. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15 day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; float time shall accrue to Owner and to Owner's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

D. Analysis Program: Capable of compiling monetary value of completed and partially completed activities, accepting revised completion dates, and recompilation of all dates and float.

E. Required Reports: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.
   2. By amount of float, then in order of early start.
   3. Listing of activities on the critical path.

**3.04 REVIEW AND EVALUATION OF SCHEDULE**

A. Participate in joint review and evaluation of schedule with Architect at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise as necessary as result of review, and resubmit within 5 days.

**3.05 UPDATING SCHEDULE**

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity.

C. Update diagrams to graphically depict current status of Work.

D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

E. Indicate changes required to maintain Date of Final Completion.

F. Submit reports required to support recommended changes.

G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect including the effects of changes on schedules of separate contractors.

**3.06 DISTRIBUTION OF SCHEDULE**

A. Distribute copies of updated schedules to Mitigation Company project site file, to subcontractors, suppliers, Architect, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

**END OF SECTION**

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**SECTION 01 3300**

**SUBMITTALS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Project Submittal Log.

B. Approval of Manufacturers, Suppliers and subcontractors.

C. Approval of Samples.

D. Approval of Shop Drawings.

E. Substitutions.

### 1.02 PROJECT SUBMITTAL LOG

A. The Mitigation Company shall furnish to the Architect, within thirty (30) days after the contract award date, one (1) copy of a Project Submittal Log, in chart form. The Project Submittal Log form shall be coordinated with the construction schedule to prevent any delays. The schedule shall prioritize materials and take into account manufacturing lead times. Failure to submit and maintain the submittal schedule must be identified in writing to the Owner/Architect and may result in holding payment to the Contractor.

1. The Project Submittal Log shall be comprehensive to include, but not be limited to, the following types of submittals:
    a. Shop Drawings
    b. Catalog Data
    c. Samples
    d. Schedules
    e. Charts
    f. Equipment Lists
    g. Mock-Up Panels
    h. Tests and Test Reports
    i. Local, State, and Federal Agency Permits
    j. Local, State, and Federal Agency Approvals
    k. Independent Agency Reports and Approvals
    l. Miscellaneous Items
    m. Operating and Maintenance Instructions
    n. Certificates
    o. Warranties and Guarantees
    p. Project Record Documents
    q. Final Documents
    r. Owner's Manual
    s. Certification Forms
    t. Applications for Payments
    u. Performance Bonds
    v. Payment Bonds
2. The Project Submittal Log shall include, but not limited to, the following chart columns:
    a. Specification Number
    b. Description
    c. Number of copies
    d. To A/E
    e. Date from A/E
    f. Date to Contractor
    g. Actions Taken
    h. Remarks

## 1.03 APPROVAL OF MANUFACTURERS, SUPPLIERS AND SUB- CONTRACTORS

A. Submit for approval within ten (10) days after the contract award, on the Contractor's letterhead, a complete list of manufacturers, suppliers and sub-contractors for all major items of material, equipment, or systems to be used, including complete and accurate name, address and telephone numbers.

## 1.04 SUBMITTAL PROCEDURES

A. Each submittal shall include a single item or element of construction. A Submittal Cover Sheet, on attached form, shall be completed, signed and certified by the Mitigation Company for EACH submittal. The Architect will not accept submittals including multiple items or elements of construction. Submittals not meeting this procedure requirement may be returned with No Action Taken. No extension of Contract Time will be authorized due to failure to comply with this procedure.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities. Transmit each submittal sufficiently in advance of performance of related construction activities to avoid delays.
   1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   2. Coordinate transmittal of different types of submittal for related elements of the work so processing will not be delayed by the need to review submittals concurrently for coordination.
      a. The Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until all related submittals are received.
      b. Be advised that all interior finishes will be reviewed together and finally determined after receipt of all shop drawings, product data and samples which pertain to the interior finish color selections and related equipment.
      c. Be advised that all exterior finishes and site elements will be reviewed together and finally determined after receipt of all shop drawings, product data and samples which pertain to the exterior finish color selections and related equipment.
   3. Processing: To avoid the need to delay installation as a result of the time required to process submittals, allow sufficient time for submittal review, including time for submittals.
      a. Allow a minimum of thirty (30) working days for review. Addition time may be required for further review and/or coordination with consultants and subsequent submittals as determined by Architect.
      b. If a resubmittal is necessary, process the same as the original submittal.
      c. No extension of Contract Time will be authorized because of failure to transmit submittals to Architect sufficiently in advance of Work to permit processing.

C. Submittal Preparation: The Architect will not accept submittals received without the attached Submittal Cover Sheet. The Mitigation Company shall stamp the Submittal Cover Sheet with a uniform action stamp. The Mitigation Company shall mark the stamp appropriately to indicate the action taken. Submittal shall be pre-reviewed by the Mitigation Company PRIOR to submittal to Architect for review.
   1. Use the Submittal Cover Sheet attached at the end of this Section for all submittals.
   2. Complete all information required on Submittal Cover Sheet failure to do so may result in return of the submittal with No Action Taken. No extension of Contract Time will be authorized because of failure to comply with this procedure.
   3. Contractor's Transmittal: The Architect will not accept submittals received from sources other than the Contractor.
   4. Contractors shall provide all submittals electronically in PDF format.
   5. Following approval of submittals, the Mitigation Company shall provide hard copies of the approved submittals to the owner.

## 1.05 SUBMITTALS

A. SHOP DRAWINGS

1. Submit newly prepared information drawn accurately and to scale. Highlight, encircle, or otherwise indicate deviations from the Contract Documents or copy standard information as the basis of Shop Drawings. Standard information prepared without specific reference to the Project is not a Shop Drawing.
2. Shop Drawings include fabrication and installation drawings, setting diagrams, schedules, patterns, templates and similar drawings. Include the following information:
    a. Dimensions.
    b. Identification of products and materials included by sheet and detail number.
    c. Notation of dimensions established by field measurement.
    d. Sheet Size: Except for templates, patterns and similar full-size Drawings, submit Shop Drawings on sheets at least 8 ½ by 11 inches but no larger than 30 by 42 inches.
    e. Maintain a complete set of shop drawings on site during construction.
    f. Maintain a set of marked up Shop drawings as part of the project record documents to be turned over to the Owner at Contract Closeout.
    g. Do not use Shop Drawings without an appropriate final stamp indicating action taken.

B. PRODUCT DATA
1. Collect Product Data into a single submittal for each element of construction or system. Product Data includes printed information, such as manufacturers installation instructions, catalog cuts, standard color charts, roughing-in diagrams and templates, standard wiring diagrams. And performance curves.
2. Mark each copy to show applicable choices and options. Where printed Product Data includes information on several products that are not required, mark copies to indicate the applicable information. Include the following information:
    a. Manufacturer's printed recommendations.
    b. Compliance with trade association standards.
    c. Compliance with recognized testing agency standards.
    d. Application of testing agency labels and seals.
    e. Notation of dimensions verified by field measurement.
    f. Notation of coordination requirements.
    g. Maintain a complete set of Product Data on site during construction.
    h. Maintain a set of marked up Product Data as part of project record documents to be turned over to Owner at Contract Closeout.
    i. Do not use Product Data without an appropriate final stamp indicating action taken.

C. Action Stamp: The Mitigation Company will stamp each sheet of Submittal with a uniform, action stamp. The Mitigation Company shall mark the stamp appropriately to indicate the action taken.

D. Distribution: Furnish copies of final approved Submittal to installers, subcontractors, suppliers, manufacturers, fabricators, an all others required for performance of construction activities.

E. All required shop drawings and catalog data must be submitted within 30 days of the first official job meeting.

**1.06 SAMPLES**

A. Where required by individual specification sections, submit full-sized, fully fabricate Samples cured and finished as specified and physically identical with the material or product proposed. Samples include partial sections of manufactured or fabricated components, cuts or containers of materials, color range sets, and swatches showing color, texture, and pattern.
1. Mount or display Samples in the manner to facilitate review of qualities indicated. Prepare Samples to match the Architect's sample. Include the following:
    a. Specifications Section number and reference.
    b. Generic description of the Sample.
    c. Sample source.
    d. Product name or name of manufacturer.
    e. Compliance with recognized standards.

f. Availability and delivery time.
g. Submit Samples for review of size, kind, color, pattern, and texture. Submit Samples for a final check of these characteristics with other elements and a comparison of these characteristics between the final submittal and the actual component as delivered and installed.
    1) Where variation in color, pattern, texture, or other characteristic is inherent in the material or product represented, submit at least 3 multiple units that show approximate limits of the variation.
    2) Refer to other Specification Sections for requirements for Samples that illustrate workmanship, fabrication techniques, details of assembly, connections, operation, and similar construction characteristics.
    3) Samples not incorporated into the Work, or otherwise designated as the Owner's property, are the property of the Mitigation Company and shall be removed from the site prior to Substantial completion.
h. Submittal: Submit a full set of choices where Samples are submitted for selection of color, pattern, texture, or similar characteristics from a range of standard choices.
i. The Architect will review and return preliminary submittals with the Architect's notation, indicating selection and other action.
    1) Refer to Submittals Procedures for coordination of sample Submittals.

**1.07 ARCHITECT'S ACTION**

A. Except for submittal for record or information, where action and return is required, the Architect will review each submittal, mark to indicate action taken, and return promptly.
    1. Compliance with specified characteristics is the Contractor's responsibility.

B. Action Stamp: The Architect will stamp each submittal with a uniform, action stamp. The Architect will mark the stamp to indicate the action taken, as follows:
    1. “NO EXCEPTION TAKEN”: The Work covered by the submittal may proceed without further submittal provided it complies with requirements of the Contract Documents. Final payment depends on that compliance.
    2. REJECTED": Do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery or other activity. Do not resubmit a revised copy; prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action
    3. “SUBMIT SPECIFIED ITEM”: Do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery or other activity. Prepare a new submittal indicating specified material; resubmit without delay.
    4. “MAKE CORRECTIONS NOTED”: Mitigation Company shall address all notations and proceed with work provided it complies with the Contract Documents. Final payment depends on that compliance.
    5. "REVISE AND RESUBMIT”: Do not proceed with Work covered by the submittal, including purchasing, fabrication, delivery or other activity. Revise or prepare a new submittal according to the notations; resubmit without delay. Repeat if necessary to obtain different action mark.
    6. “RESUBMISSION NOT REQUIRED”: The Work covered by the submittal may proceed provide it complies with notations or corrections on the submittal and requirements of the Contract Documents. Final payment depends on that compliance.

C. Unsolicited Submittals: The Architect will take no action on unsolicited submittals.

**1.08 SUBSTITUTIONS**

A. Substitutions: Products considered to be able to perform the same function but not necessarily have the same design, arrangement, details, utility requirements and/or dimensions. Changes in products, materials, and equipment required by the Contract Documents proposed by the Mitigation Company after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
    1. Revisions to the Contract Documents requested by the Owner or Architect.

2. Specified options of products or “approved equals” as permitted and included in the Contract Documents.
3. The Contractor's determination of and compliance with governing regulations and orders issued by governing authorities.

B. Substitutions

1. Substitution Request: The Architect will consider requests for substitutions if received within 60 days after Notice to Proceed. Requests received more than 60 days after Notice to Proceed may be considered or rejected at the discretion of the Architect. The Architect will only consider requests for substitution submitted by the Prime Mitigation Company whose work is involved. No substitution requests will be considered from manufacturer’s representatives or product vendors unless submitted through a prime contractor. No substitution requests will be considered during the bid period. Bids shall be based on products from one of the manufacturers specified or an “or equal” product. Bidders shall submit products not indicated in the Specifications at their own risk. The Architect shall determine if a proposed product is equal to a specified product. Furthermore, regardless as to whether or not a manufacturer is listed in the Specification, that manufacturer or product is not relieved of its obligations to meet the technical requirements of the specified intent.
    a. Transmit each request for substitution for consideration to the Architect’s FTP Site; if hard copies or samples must be submitted as part of the substitution request, transmit a minimum of two (2) duplicate copies. Requests shall be on the Substitution Request Form found at the end of this Section. Requests not meeting this procedural requirement will be returned with no action taken.
    b. Identify the product to be substituted in each request. Include related Specification Section and Drawing numbers.
    c. Respond to all of the following items. Attach to the Substitution Request Form:
        1) Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by the Owner and/or separate Contractors, that will be necessary to accommodate the proposed substitution.
        2) A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements, such as performance, weight, size, durability, and visual effect.
        3) Product Data, including Drawings and descriptions of products.
        4) Samples, where applicable or requested.
        5) A statement indicating the substitution's effect on the Contractor's Construction Schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on the overall Contract Time.
        6) Cost information, including a proposal of the net change, if any in the Contract Sum.
        7) The Contractor's certification that the proposed substitution conforms to all requirements of the Contract Documents in every respect and is appropriate for the applications indicated.
        8) The Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
            (a) The Contractor's Certification that all costs of other Prime Contractors which are covered by the substitution will be borne by the substituting Contractor.
    d. Architect's Action: The Architect will notify the Mitigation Company of acceptance or rejection of the substitution within two (2) weeks of receipt of the request. If necessary, the Architect will request additional information or documentation for evaluation within one (1) week of receipt of a request.
        1) Use the product specified if the Architect cannot make a decision on the use of a proposed substitute within the time allocated. Following acceptance of the

substitution, the Mitigation Company shall submit related information and product data in accordance with Section 01300- Submittals.

2. Conditions for Consideration: The Architect will receive and consider the Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by the Architect. Requests will be returned with no action taken if none of the following conditions are satisfied.
   a. Extensive revisions to the Contract Documents are not required.
   b. Proposed changes are in keeping with the general intent of the Contract Documents.
   c. The specified product cannot be provided within the Contract Time. The Architect will not consider the request if the product cannot be provided as a result of the Contractor's failure to pursue the Work promptly.
   d. The requested substitution offers the Owner a substantial advantage, in cost, time, or energy conservation.
   e. The specified product cannot receive necessary approval by a governing authority.
   f. The specified product cannot be provided in a manner that is compatible with other materials and where the Mitigation Company certifies that the substitution will overcome the incompatibility.
   g. The specified product cannot be coordinated with other materials and where the Mitigation Company certifies that the proposed substitution can be coordinated.
   h. The specified product cannot provide a warranty required by the Contract Documents and where the Mitigation Company certifies that the proposed substitution provides the required warranty.
3. Conditions for Acceptance: Following evaluation by the Architect and in accordance with a Change Order, the Mitigation Company may make a substitution only with the consent of the Owner.

**PART 2 PRODUCTS**

**2.01 NOT USED.**

**PART 3 EXECUTION**

**3.01 NOT USED.**

**END OF SECTION**

**SECTION 01 3500**

**SAFETY**

## PART 1 - GENERAL

### 1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

### 1.02 SUMMARY

A. General: This Section specifies the required safety procedures for this Project.

B. It is recognized that the safety of all personnel is the responsibility of the Mitigation Company involved in the construction of this Project. It is the contractual obligation of the Mitigation Company to adhere to all requirements of the Occupational Health and Safety Act (OSHA), as well as Local, State, and Federal safety rules and regulations. The Mitigation Company shall assure the safety of their personnel by providing all protection and safety devices, covers, etc. as they relate to the safe conduct of their work in accordance with all Local, State and Federal regulations. The Mitigation Company is responsible for any safety requirements that are contractually those of any Contractor.

C. The Mitigation Company shall be designated as the “Lead Contractor” with respect to jobsite safety. Responsibilities and authority of the Mitigation Company shall be as follows:

1. This Mitigation Company will be responsible to inspect and maintain safe working conditions on the jobsite.
2. This Mitigation Company will maintain a “competent person” on site at all times designated to make safety inspections and to serve as the designated representative in charge of safety during the inspection by OSHA employees.
3. This Mitigation Company may direct and make corrections in the event of a safety violation. Failure of the Mitigation Company to take prompt action (within 24 hours following written notice) to correct a safety violation will empower the Mitigation Company to make the necessary corrections and to receive full compensation for such corrections directly from the Owner. The Owner will verify and provide documentation of time and material expended to make corrections and in turn will recover the amount of expense from the offending Mitigation Company through a deduct Change Order.
4. The Mitigation Company’s responsibilities and corresponding authority will be as defined in the General Conditions of the Contract for Construction.
5. The Mitigation Company shall provide regular and periodic safety inspections and reports. Inspections and reports shall be performed on a Daily basis.
6. The Mitigation Company shall provide a safety representative who is trained in First Aid and CPR.

## PART 2 - PRODUCTS (NOT APPLICABLE)

## PART 3 - EXECUTION

### 3.01 ACCIDENTS

A. The Mitigation Company shall notify the Owner of any personal injury that could require medical treatment of any Mitigation Company employee at the project site. Also, any damage to property arising in connection with the Mitigation Company’s performance should be told to the Owner as promptly as possible after the occurrence of such injury or damage but at the maximum 24 hours. Within 48 hours of such occurrence, the Mitigation Company shall furnish to the Owner a complete written report of such injury or damage. Accident Reports shall include specific actions taken by the Mitigation Company to preclude recurrence of similar incidents.

### 3.02 EMERGENCY DATA

A. The Mitigation Company shall provide the Owner with the following emergency data prior to beginning work at the project site:

1. Emergency care facility to be utilized, address and telephone number.
2. Insurance company and local agent/name, address and telephone number.
3. Detailed description of overall corporation or company Safety Program.
4. Employees qualified in type of first aid, list employee and associated skill.
5. Detailed description of specifically tailored job site safety program.
6. Identify corporate and job site safety officer.
7. Submit weekly TOOL BOX SAFETY TALK program/meeting minutes including:
    a. Day of week.
    b. Time of day.
    c. Location.
    d. Attendance record.
    e. Agenda.
    f. Unsafe items previously discussed, date of correction.
    g. Identify on-site personnel with FIRST AID training.
    h. All applicable MSDS Program sheets. (Include numbered pages and Table of Contents.
    i. Submit completed hazardous substance survey form.
    j. Review project “Emergency Response Plan” with the Owner.

**3.03 SAFETY AGREEMENT**

A. The Mitigation Company shall review and comply with the following Safety Agreement before beginning work:
    1. As a Mitigation Company under this Contract, you have, by accepting this Contract, obligated yourself to conduct all your operations within this Safety Agreement.
    2. The Mitigation Company agrees that the prevention of accidents to employees engaged in the Work under this Agreement is the responsibility of the Mitigation Company.
    3. The Mitigation Company agrees to comply with all laws, regulations and codes concerning safety as shall be applicable to the Work and to the safety standards established during the progress of the Work. When so ordered, the Mitigation Company agrees to stop any part of the Work which the “Lead Contractor” or any other applicable agency may deem unsafe until corrective measures satisfactory to the Owner and in accordance with the applicable Federal and/or State regulations have been taken and further agrees to make no claim for damages growing out of such stoppages. Should the Mitigation Company neglect to adopt such corrective measures, the Owner may elect to hire an entity, perform the corrections and deduct the cost from payments due or to become due the Mitigation Company. Failure on the part of the Owner to stop unsafe practices shall in no way relieve the Mitigation Company of his responsibility.
    4. The Contract realizes that an effective accident prevention program is to the mutual benefit of all Contractors through improved employee and public relations and through increased efficiency and production. Further, no accident prevention activity can be truly effective without the sincere cooperation of each Mitigation Company performing on the site. Your attention is directed, but not limited to the following items:

B. Housekeeping
    1. Indiscriminate accumulations of debris, waste or scrap in work areas will not be permitted. (Areas will be designated for storage or disposal). All materials, tools and equipment must be stored in an orderly manner in designated areas.

C. Personal Protection Equipment
    1. Contractors must furnish their employees with the proper type of personal protective equipment as required by the operations being performed, including, but not necessarily limited to the following:
        a. Hard Hats must be furnished to employees and worn at ALL times when on this project, whether or not an overhead hazard exists or what state the project may be in.

b. The Owner requires that appropriate attire be worn at all times while employees are working on-site. Appropriate attire shall be as deemed necessary by the Owner and in accordance with all applicable OSHA regulations.

D. Safety Meetings
   1. The Mitigation Company is required to conduct and all employees are required to attend a "Tool Box" type safety meeting once a week. The meetings may either be presided over by the Contractor's foreman or another competent representative designated by the Contractor.

E. Fire Protection
   1. The Mitigation Company must supply approved fire extinguishers for emergency use within his own immediate area of operation, including the Contractor's office, tool and storage enclosures.

F. Treatment of Injuries
   1. The Mitigation Company shall require that all employees injured (no matter how slight) while working on this project, report immediately for First Aid Treatment. The Mitigation Company shall maintain adequate First Aid Facilities in the field.

G. Cooperation
   1. Any deviation from this course of action will be called to the attention of the Mitigation Company for immediate correction. Conversely, the Mitigation Company should call attention to any unsafe conditions or unsafe practice by other Contractors at the site.

H. Installed Safety Apparatus
   1. Each Mitigation Company is responsible for the reinstallation of safety apparatus installed by other Contractors if removed to facilitate the installation of their own Contract Work.

I. Weapons Policy
   1. All persons are prohibited from carrying, possessing or storing a handgun, firearm, or weapon of any kind while on the Project site, regardless of whether the person has registered the weapon or is licensed to carry a concealed weapon.
   2. Failure to abide by all terms and conditions of this policy may result in discipline up to and including termination. Further, carrying any weapon onto the Owner's property in violation of this policy will be considered an act of criminal trespass and possession of a weapon will be grounds for immediate removal of the person from the Project Site, and may result in prosecution.

J. Radios
   1. The playing of radios will not be permitted on this Project site.

**END OF SECTION**

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**SECTION 01 4000**

**QUALITY REQUIREMENTS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Quality assurance.

B. Quality Control Plan

C. References and standards.

D. Testing and inspection agencies and services.

E. Control of installation.

F. Mock-ups.

G. Tolerances.

H. Manufacturers' field services.

I. Defect Assessment.

### 1.02 QUALITY ASSURANCE

A. Testing Agency Qualifications:

1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

### 1.03 CONTRACTOR'S QUALITY CONTROL PLAN

A. Quality Control Plan - a written plan describing how the Mitigation Company will evaluate the work to confirm that it complies with the Contract Documents and authorities having jurisdiction. The Plan shall be submitted within 15 days following Notice to Proceed.

B. The Prime Mitigation Company shall employ a Quality Control Inspector whose primary responsibility is to verify that the work in place meets the contract document requirements through inspections, review of testing, and coordination with subcontractors, manufactures, and suppliers. The Inspector's duties shall include, but not be limited to:

1. monitor quality control over suppliers, manufacturers, products, services site conditions, and workmanship, to produce Work of specified quality.
2. ensure work complies with manufacturers' instructions, including each step in sequence.
3. request clarification from the appropriate party's should manufacturers' instructions conflict with Contract Documents.
4. comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
5. ensure work is performed by persons qualified to produce workmanship of specified quality.
6. secure products are in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.
7. ensure testing and inspection agencies are scheduled, proper tests and inspections are performed, and the work is in compliance with the requirements.

C. Quality Control Reports - the Quality Control Inspector shall prepare a weekly Quality Control Report that summarizes all work completed, it's compliance with the Contract Documents, and any deficiencies that exist. The report shall be prepared in digital format and submitted at the weekly project meeting.

## 1.04 REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

## 1.05 TESTING AND INSPECTION AGENCIES AND SERVICES

A. Mitigation Company shall employ and pay for services of an independent testing agency to perform specified testing and inspection.

B. Employment of agency in no way relieves Mitigation Company of obligation to perform Work in accordance with requirements of Contract Documents.

# PART 2 PRODUCTS - NOT USED

# PART 3 EXECUTION

## 3.01 CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

## 3.02 MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Integrated Exterior Mock-ups: construct integrated exterior mock-up as indicated on Drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.

D. Room Mock-ups: Construct room mock-ups as indicated on Drawings. Coordinate installation of materials, products, and assemblies as required in Specification Sections; finish according to

requirements. Provide required lighting and any supplemental lighting where required to enable Architect to evaluate quality of the mock-up.

E. Notify Architect and Owner seven (7) working days in advance of dates and times when mock-ups will be constructed.

F. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

G. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

H. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

I. Obtain Architect's approval of mock-ups before starting work, fabrication, or construction.
   1. Architect will issue written comments within five (5) working days of initial review and each subsequent follow up review of each mock-up.
   2. Make corrections as necessary until Architect's approval is issued.

J. Accepted mock-ups shall be a comparison standard for the remaining Work.

K. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

L. Where possible salvage and recycle the demolished mock-up materials.

**3.03 TOLERANCES**

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

**3.04 TESTING AND INSPECTION**

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:
   1. Provide qualified personnel at site. Cooperate with Architect and Mitigation Company in performance of services.
   2. Perform specified sampling and testing of products in accordance with specified standards.
   3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
   4. Promptly notify Architect and Mitigation Company of observed irregularities or non-conformance of Work or products.
   5. Perform additional tests and inspections required by Architect.
   6. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:
   1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency may not approve or accept any portion of the Work.
   3. Agency may not assume any duties of Contractor.
   4. Agency has no authority to stop the Work.

D. Mitigation Company Responsibilities:
   1. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
   2. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
   3. Provide incidental labor and facilities:

a. To provide access to Work to be tested/inspected.
b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
c. To facilitate tests/inspections.
d. To provide storage and curing of test samples.

4. Notify Architect and laboratory 48 hours prior to expected time for operations requiring testing/inspection services.
5. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Mitigation Company beyond specified requirements.
6. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Mitigation Company beyond specified requirements.

E. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

**3.05 MANUFACTURERS' FIELD SERVICES**

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

**3.06 DEFECT ASSESSMENT**

A. Replace Work or portions of the Work not conforming to specified requirements.

B. If, in the opinion of Owner, it is not practical to remove and replace the Work, Owner will direct an appropriate remedy or adjust payment.

**END OF SECTION**

## SECTION 01 4216
## DEFINITIONS

### PART 1 GENERAL

### 1.01 SUMMARY

A. This section supplements the definitions contained in the General Conditions.

B. Other definitions are included in individual specification sections.

### 1.02 DEFINITIONS

A. Furnish: To supply, deliver, unload, and inspect for damage.

B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products must be new, never before used.

D. Project Manual: The book-sized volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.

E. Provide: To furnish and install.

F. Supply: Same as Furnish.

### PART 2 PRODUCTS - NOT USED

### PART 3 EXECUTION - NOT USED

**END OF SECTION**

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**SECTION 01 5000**

**TEMPORARY FACILITIES AND CONTROLS**

## PART 1 GENERAL

### 1.01. SECTION INCLUDES

A. Sanitary Provisions.
B. Temporary Water.
C. Temporary Power.
D. Temporary Heat
E. Telephone.
F. Safety and Protection.
G. Hoisting Facilities.
H. Storage.
I. Parking.
J. Progress Cleaning and Waste Removal.
K. Removal.

### 1.02. SANITARY PROVISIONS

A. Mitigation Company may use existing public restrooms in the building. Coordinate available locations with the owner and building maintenance personnel.

### 1.03. TEMPORARY WATER

A. Mitigation Company may use existing water service in the building. Coordinate available locations with the owner and building maintenance personnel.

### 1.04. TEMPORARY POWER

A. Mitigation Company may use existing electric service in the building. Coordinate available locations with the owner and building maintenance personnel.

### 1.05. TEMPORARY HEAT

A. Not Required

### 1.06. TELEPHONE

A. The Mitigation Company shall provide cell phone numbers of onsite project superintendent(s), provided that they are onsite at all times work is in progress.
B. The architect and owner shall always have the ability to contact the Mitigation Company at site.

### 1.07. SAFETY AND PROTECTION

A. The Mitigation Company shall:
    1. Furnish all required safety and first aid requirements in complete accord with all OSHA Regulations.
    2. Furnish all necessary enclosures, flares and lights, traffic regulation flag men and traffic signals.
    3. Furnish all necessary bracing, scaffolding, protective covers, drop cloths, and other construction aids.
    4. Erect and maintain proper protection for all equipment and all parts of the building during all stages of construction, alterations, or repairs, and shall correct at their own expense any damage to the same to the satisfaction of the Owner. Special precaution shall be taken to protect the building and grounds from damage during the course of construction of the project.
    5. The Mitigation Company shall take proper and necessary precautions to protect pedestrians, streets, sidewalks, private roads and walks, and will be held responsible for any damage or injury.

6. Provide and maintain guard lights at barricades, railings, obstructions in the streets, or sidewalks.
7. Maintain and enforce regulations covering all fire hazards including smoking and shall provide suitable fire extinguishers and/or other protective measures in proper locations.
8. Adequately protect all utilities and service lines. Services and utilities must not be interrupted without first making necessary and satisfactory arrangements with the proper authorities.
9. Furnish all necessary noise control and dust control measures.
10. Provide for proper storage, removal and disposal of all debris, trash, rubbish and garbage. Comply with all applicable federal, state and local regulations dealing with environmental protection measures and dealing with hazardous materials.
11. Provide all necessary security measures including locked storage, night lights, and temporary enclosures. The Owner may, at any time direct the general Mitigation Company to provide additional security, including fencing and temporary enclosures, and watchman if required.
12. Safety provisions shall be in compliance with Article 10 of the General Conditions.
13. Active work areas shall be fenced with a 4' high orange safety fence. All posts must have protective caps and the fence must be inspected and maintained each work day.

**1.08. HOISTING FACILITIES**

A. The Mitigation Company shall provide, maintain and operate, at no cost to the Owner, all required lifting, jacking or hoisting equipment of capacities as needed to perform all work. Comply with all safety requirements.
B. The Mitigation Company shall provide, maintain and operate, at no cost to the Owner, all required scaffolding, bracing, walkways and support as needed to perform all work. Comply with all safety requirements.

**1.09. STORAGE**

A. No storage of tools, equipment, or materials will be permitted in the building, except in designated work areas during each phase of construction.
B. It shall be the Contractor's responsibility to arrange with the proper authorities, the owner for an assigned space or spaces for any necessary trailers, vans, or sheds for use as material, tool and equipment storage or job office. Locate trailers outside of improvement areas to prevent interference or delays in the project.

**1.10 PARKING**

A. Limited parking for construction workers may be made available on site by pre-arrangement with the Owner, however adequate space for Owner use must be maintained.
B. The Mitigation Company shall be responsible for arranging parking for themself and their sub-contractors.

**1.11 PROGRESS CLEANING AND WASTE REMOVAL**

A. The Mitigation Company shall:
    1. Maintain areas free of waste materials, debris, and rubbish.
    2. Maintain site in a clean and orderly condition.
    3. Remove debris and rubbish from attics, and other closed or remote spaces, prior to enclosing the space.
    4. Daily broom clean work areas.
    5. Collect and remove waste materials, debris, and rubbish daily from site and dispose in a dumpster or off-site.

6. Remove tools, scaffolding and surplus materials at the completion of work.
7. Broom and vacuum clean work areas at the completion of work.

B. The Mitigation Company shall provide for a dumpster on site for his own use and for miscellaneous daily trash. Make special provisions for handling hazardous waste in compliance with all local, state, and federal regulations.
C. The Mitigation Company shall be responsible for proper collection, storage and disposal of waste materials (excepting hazardous materials) resulting from demolition packaging and crating.
D. The Mitigation Company shall clean work area of all construction debris at the end of each workday. The debris shall be placed in a dumpster and removed from the site as soon as the dumpster is full. Debris shall be deposed of in accordance with all Local, State & federal regulations.
E. No burning is permitted.

**1.12. REMOVAL**

A. Remove all temporary facilities completely from the site upon completion of the project.

**PART 2 PRODUCTS**

**NOT USED**

**PART 3 EXECUTION**

**NOT USED**

**END OF SECTION**

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## SECTION 01 5500
## VEHICULAR ACCESS AND PARKING

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Access roads.

B. Parking.

C. Existing pavements and parking areas.

D. Permanent pavements and parking facilities.

E. Construction parking controls.

F. Flag persons.

G. Flares and lights.

H. Haul routes.

I. Traffic signs and signals.

J. Maintenance.

K. Removal, repair.

L. Mud from site vehicles.

### PART 2 PRODUCTS

### 2.01 SIGNS, SIGNALS, AND DEVICES

A. Traffic Cones and Drums, Flares and Lights: As approved by local jurisdictions.

B. Flag Person Equipment: As required by local jurisdictions.

### PART 3 EXECUTION

### 3.01 PREPARATION

A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

### 3.02 ACCESS ROADS

A. Use of existing on-site streets and driveways for construction traffic is not permitted without the approval of the authority having jurisdiction.

B. Tracked vehicles not allowed on paved areas.

C. Provide unimpeded access for emergency vehicles. Maintain 12 foot width driveways with turning space between and around combustible materials.

D. Provide and maintain access to fire hydrants free of obstructions.

### 3.03 PARKING

A. Use of existing parking facilities by construction personnel is not permitted.

B. Use of new parking facilities by construction personnel is not permitted.

C. Arrange for temporary parking areas to accommodate use of construction personnel.

### 3.04 PERMANENT PAVEMENTS AND PARKING FACILITIES

A. The base for permanent roads and parking areas may be used for construction traffic.

B. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

### 3.05 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

C. Prevent parking on or adjacent to access roads or in non-designated areas.

**3.06 FLAG PERSONS**

A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

**3.07 FLARES AND LIGHTS**

A. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

**3.08 HAUL ROUTES**

A. Consult with authority having jurisdiction, establish public thoroughfares to be used for haul routes and site access.

B. Confine construction traffic to designated haul routes.

C. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

**3.09 TRAFFIC SIGNS AND SIGNALS**

A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

B. Install and operate traffic control signals to direct and maintain orderly flow of traffic in areas under Contractor's control, and areas affected by Contractor's operations.

C. Relocate as Work progresses, to maintain effective traffic control.

**3.10 MAINTENANCE**

A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, Products, mud, snow, and ice.

B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

**3.11 REMOVAL, REPAIR**

A. Remove temporary roads when permanent paving is usable.

B. Repair existing facilities damaged by use, to new condition.

C. Repair damage caused by installation.

**3.12 MUD FROM SITE VEHICLES**

A. Provide means of removing mud from vehicle wheels before entering streets.

**3.13 DELIVERY OF EQUIPMENT AND MATERIALS**

A. Mitigation Company must coordinate and arrange for the delivery and staging of materials and equipment to the project site.

B. Equipment and materials may not be stored in the streets, alleys, or adjacent properties without approval of the authority having jurisdiction.

**END OF SECTION**

## SECTION 01 6000
## PRODUCT REQUIREMENTS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Re-use of existing products.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations and procedures.

E. Procedures for Owner-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

### PART 2 PRODUCTS

### 2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by the Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

### 2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by the Contract Documents.

B. DO NOT USE products having any of the following characteristics:
   1. Containing lead, cadmium, asbestos.

C. Where all other criteria are met, Mitigation Company shall give preference to products that:
   1. Are extracted, harvested, and/or manufactured closer to the location of the project.
   2. Have longer documented life span under normal use.
   3. Result in less construction waste.

### 2.03 STANDARD OF QUALITY

A. The various materials and products specified in the specifications by name or description are given to establish a standard of quality and cost for bid purposes. It is not the intent to limit the bidder, the bid, or the evaluation of the bid to any one material or product specified but rather to describe the minimum standard. When proprietary names are used, they shall be followed by the words "or alternatives of the quality necessary to meet the specifications". A bid containing an alternative which does not meet the specifications may be declared non-responsive. A bid containing an alternative may be accepted but, if an award is made to that bidder, the bidder will be required to replace any alternatives which do not meet the specifications.

B. No approval prior to bidding and no listing on Proposal Forms will be required. It will, however, be the responsibility of the Mitigation Company to obtain the Owner/engineer's approval for any product or material not named by submitting adequate data for proper evaluation after contract award and prior to confirmation of order for any such item.

C. Mitigation Company will be responsible for all changes required for installation of any approved equal or accepted substituted item at no additional cost to the Owner.

### 2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

## PART 3 EXECUTION

### 3.01 SUBSTITUTION PROCEDURES

A. Substitutions will only be considered after contract award.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.

C. A request for substitution constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.
   5. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

D. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.

E. Substitution Submittal Procedure (after contract award):
   1. Submit substitution requests by completing the form in Section 01 3300 Submittals, see this section for additional information and instructions.
   2. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
   3. Architect will notify Mitigation Company in writing of decision to accept or reject request.

### 3.02 OWNER-SUPPLIED PRODUCTS

A. Owner's Responsibilities:
   1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
   2. Arrange and pay for product delivery to site.
   3. On delivery, inspect products jointly with Contractor.
   4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
   5. Arrange for manufacturers' warranties, inspections, and service.

B. Contractor's Responsibilities:
   1. Review Owner reviewed shop drawings, product data, and samples.
   2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
   3. Handle, store, install and finish products.
   4. Repair or replace items damaged after receipt.

### 3.03 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

**3.04 STORAGE AND PROTECTION**

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Do not store products directly on the ground.

J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

L. Prevent contact with material that may cause corrosion, discoloration, or staining.

M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

**END OF SECTION**

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## SECTION 01 7000

## EXECUTION AND CLOSEOUT REQUIREMENTS

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition, except removal, disposal, and/or remediation of hazardous materials and toxic substances.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

### 1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 5000 - Temporary Facilities and Controls: Temporary interior partitions.

F. Section 01 5100 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.

G. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.

### 1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
   1. On request, submit documentation verifying accuracy of survey work.
   2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents.
   3. Submit surveys and survey logs for the project record.

C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
   1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
   2. Identify demolition firm and submit qualifications.
   3. Include a summary of safety procedures.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

### 1.04 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

B. For survey work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of Surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate.

C. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

**1.05 PROJECT CONDITIONS**

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

E. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
   1. Provide dust-proof enclosures to prevent entry of dust generated outdoors.
   2. Provide dust-proof barriers between construction areas and areas continuing to be occupied by Owner.

F. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

G. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
   1. Outdoors: Limit conduct of especially noisy exterior work to the hours of 8 am to 5 pm.

H. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

**1.06 COORDINATION**

A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Notify affected utility companies and comply with their requirements.

C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

F. Coordinate completion and clean-up of work of separate sections.

G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

## PART 2 PRODUCTS

### 2.01 PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

## PART 3 EXECUTION

### 3.01 EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

### 3.02 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

### 3.03 PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect four days in advance of meeting date.

D. Prepare agenda and preside at meeting:
   1. Review conditions of examination, preparation and installation procedures.
   2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with one copies to Architect, Owner, participants, and those affected by decisions made.

### 3.04 LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Control datum for survey is that indicated on Drawings.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

H. Utilize recognized engineering survey practices.

I. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:
   1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.

J. Periodically verify layouts by same means.

K. Maintain a complete and accurate log of control and survey work as it progresses.

**3.05 GENERAL INSTALLATION REQUIREMENTS**

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

**3.06 ALTERATIONS**

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as shown.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
   1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
   1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
   2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.
   1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
   2. Remove items indicated on drawings.
   3. Relocate items indicated on drawings.
   4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
   5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.

2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    b. See Section 01 1000 for other limitations on outages and required notifications.
    c. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

**3.07 CUTTING AND PATCHING**

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.

6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-conforming work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to specified condition.

E. Employ skilled and experienced installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Patching:
1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

## 3.08 PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

## 3.09 PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Prohibit traffic from landscaped areas.

H. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

## 3.10 SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

**3.11 DEMONSTRATION AND INSTRUCTION**

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time, at equipment location.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Provide a qualified person who is knowledgeable about the Project to perform demonstration and instruction of owner personnel.

E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

**3.12 ADJUSTING**

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

**3.13 FINAL CLEANING**

A. Use cleaning materials that are nonhazardous.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

E. Clean filters of operating equipment.

F. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

G. Clean site; sweep paved areas, rake clean landscaped surfaces.

H. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

**3.14 CLOSEOUT PROCEDURES**

A. Make submittals that are required by governing or other authorities.
   1. Provide copies to Architect and Owner.

B. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

C. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

D. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

E. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

F. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

G. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

H. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

**3.15 MAINTENANCE**

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

**END OF SECTION**

**SECTION 01 7800**

**CLOSEOUT SUBMITTALS**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

### 1.02 RELATED REQUIREMENTS

A. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

B. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.

C. Individual Product Sections: Specific requirements for operation and maintenance data.

D. Individual Product Sections: Warranties required for specific products or Work.

### 1.03 SUBMITTALS

A. Project Record Documents: Submit documents to Architect 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all documents as required prior to final submission.

B. Operation and Maintenance Data:
   1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
   2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.
   3. Submit two sets of revised final documents in final form within 10 days after final inspection.
   4. In addition to the hard copy binders, submit a digital (PDF) format copy.

C. Warranties and Bonds:
   1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
   2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
   3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.
   4. In addition to the hard copy binders, submit a digital (PDF) format copy.

## PART 2 PRODUCTS - NOT USED

## PART 3 EXECUTION

### 3.01 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed shop drawings, product data, and samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. All filed markups shall be converted to PDF format using professional software capable of producing legible and detailed notations. A scanned version of the hand drawings is not acceptable.
   6. Details not on original Contract drawings.

G. Final Record Document Set: Submit Final PDF markups both in digital format and two copies of the full size drawing sets.

**3.02 OPERATION AND MAINTENANCE DATA**

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

**3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES**

A. For Each Product, Applied Material, and Finish:
   1. Product data, with catalog number, size, composition, and color and texture designations.
   2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

**3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS**

A. For Each Item of Equipment and Each System:
   1. Description of unit or system, and component parts.
   2. Identify function, normal operating characteristics, and limiting conditions.
   3. Include performance curves, with engineering data and tests.
   4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

D. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

E. Provide servicing and lubrication schedule, and list of lubricants required.

F. Include manufacturer's printed operation and maintenance instructions.

G. Include sequence of operation by controls manufacturer.

H. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

I. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

J. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

K. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

L. Include test and balancing reports.

M. Additional Requirements: As specified in individual product specification sections.

**3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS**

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:
   1. Project Directory.
   2. Table of Contents, of all volumes, and of this volume.
   3. Operation and Maintenance Data: Arranged by system, then by product category.
      a. Source data.
      b. Product data, shop drawings, and other submittals.
      c. Operation and maintenance data.
      d. Field quality control data.
      e. Photocopies of warranties and bonds.

4. Design Data: To allow for addition of design data furnished by Architect or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

**3.06 WARRANTIES AND BONDS**

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

**END OF SECTION**

**SECTION 02 4100**

**DEMOLITION**

## PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Selective demolition of building elements for alteration purposes.

### 1.02 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

D. Section 31 2323 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

### 1.03 REFERENCE STANDARDS

### 1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Site Plan: Showing:
   1. Areas for temporary construction and field offices.

C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

## PART 3 EXECUTION

### 2.01 SCOPE

A. Remove items as indicated on the drawings.

B. Fill excavations, open pits, and holes in ground areas generated as result of removals.

C. Fill holes remaining from demolition through concrete slab with concrete.

### 2.02 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   5. Do not close or obstruct roadways or sidewalks without permit.
   6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

## 2.03 SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
   1. Verify that construction and utility arrangements are as indicated.
   2. Report discrepancies to Architect before disturbing existing installation.
   3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Remove existing work as indicated and as required to accomplish new work.
   1. Remove items indicated on drawings.

C. Services (Including but not limited to Plumbing): Remove existing systems and equipment as indicated.
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
   3. Verify that abandoned services serve only abandoned facilities before removal.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

D. Protect existing work to remain.
   1. Prevent movement of structure; provide shoring and bracing if necessary.
   2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
   3. Repair adjacent construction and finishes damaged during removal work.
   4. Patch as specified for patching new work.

## 2.04 DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION**

## SECTION 03 3000
## CAST-IN-PLACE CONCRETE

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Patching existing floors and slabs on grade.

B. Concrete reinforcement.

C. Joint devices associated with concrete work.

D. Concrete curing.

### 1.02 RELATED REQUIREMENTS

A. Section 07 9200 - Joint Sealants: Products and installation for sealants and joint fillers for saw cut joints and isolation joints in slabs.

### 1.03 REFERENCE STANDARDS

A. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; 1991 (Reapproved 2009).

B. ACI 301 - Specifications for Structural Concrete; 2016.

C. ACI 302.1R - Guide to Concrete Floor and Slab Construction; 2015.

D. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; 2000 (Reapproved 2009).

E. ACI 308R - Guide to External Curing of Concrete; 2016.

F. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2018).

G. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.

H. ASTM A775/A775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2017.

I. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.

J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2020.

K. ASTM C150/C150M - Standard Specification for Portland Cement; 2020.

L. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete; 2016.

M. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a (Reapproved 2016).

N. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2019.

O. ASTM C685/C685M - Standard Specification for Concrete Made by Volumetric Batching and Continuous Mixing; 2017.

P. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2015.

Q. ASTM C1602/C1602M - Standard Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete; 2012.

R. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting; 2015.

S. ASTM D3963/D3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy-Coated Steel Reinforcing Bars; 2015.

T. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2018a.

## 1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

C. Mix Design: Submit proposed concrete mix design.
   1. Indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.
   2. Indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

D. Test Reports: Submit report for each test or series of tests specified.

## 1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

## 1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

# PART 2 PRODUCTS

## 2.01 REINFORCEMENT MATERIALS

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).
   1. Type: Deformed billet-steel bars.
   2. Finish: Epoxy coated in accordance with ASTM A775/A775M, unless otherwise indicated.

B. Steel Welded Wire Reinforcement (WWR): Galvanized, plain type, ASTM A1064/A1064M.
   1. Form: Coiled Rolls.
   2. WWR Style: 4 x 8-W6 x W10.

## 2.02 CONCRETE MATERIALS

A. Cement: ASTM C150/C150M, Type I - Normal Portland type.

B. Water: ASTM C1602/C1602M; clean, potable, and not detrimental to concrete.

## 2.03 ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C260/C260M.

C. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

D. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

E. Retarding Admixture: ASTM C494/C494M Type B.

F. Water Reducing Admixture: ASTM C494/C494M Type A.
   1. Manufacturers:
      a. Euclid Chemical Company; EUCON NW: www.euclidchemical.com/#sle.

## 2.04 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System:
   1. Complying with ASTM C881/C881M and of Type required for specific application.
   2. Manufacturers:
      a. Adhesives Technology Corporation; Crackbond SLV-302, Crackbond LR-321, Crackbond LR-321 LPL, Ultrabond 2100 LPL, Ultrabond 2100, Ultrabond 1, Ultrabond 2, or Ultrabond HS200: www.atcepoxy.com/#sle.
      b. Euclid Chemical Company; DURAL FAST SET LV: www.euclidchemical.com/#sle.

B. Slab Isolation Joint Filler: 1/2 inch thick, height equal to slab thickness, with removable top section that will form 1/2 inch deep sealant pocket after removal.

## 2.05 CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.

B. Curing and Sealing Compound, Low Gloss: Liquid, membrane-forming, clear, non-yellowing acrylic; complying with ASTM C1315 Type 1 Class A.
   1. Vehicle: Water-based.
   2. Manufacturers:
      a. Clemons Concrete Coatings; Super Seal B-25: www.clemonsconcretecoatings.com/#sle.

C. Moisture-Retaining Sheet: ASTM C171.
   1. Curing paper, regular.
   2. Polyethylene film, white opaque, minimum nominal thickness of 4 mil, 0.004 inch.

D. Polyethylene Film: ASTM D2103, 4 mil, 0.004 inch thick, clear.

E. Water: Potable, not detrimental to concrete.

## 2.06 CONCRETE MIX DESIGN

A. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

B. Normal Weight Concrete:
   1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: 3,000 pounds per square inch.
   2. Water-Cement Ratio: Maximum 40 percent by weight.
   3. Maximum Aggregate Size: 5/8 inch.

## 2.07 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C685/C685M. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

B. Adding Water: If concrete arrives on-site with slump less than suitable for placement, do not add water that exceeds the maximum water-cement ratio or exceeds the maximum permissible slump.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

## 3.02 PREPARATION

A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning and applying bonding agent in according to bonding agent manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

B. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Comply with ASTM E1643. Lap joints minimum 6 inches. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions. Repair damaged vapor retarder before covering.

## 3.03 INSTALLING REINFORCEMENT AND OTHER EMBEDDED ITEMS

A. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D3963/D3963M.

B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

C. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

### 3.04 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

### 3.05 SLAB JOINTING

A. Locate joints as indicated on drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

### 3.06 FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. Maximum Variation of Surface Flatness:
   1. Exposed Concrete Floors: 1/4 inch in 10 feet.
   2. Under Seamless Resilient Flooring: 1/4 inch in 10 feet.
   3. Under Carpeting: 1/4 inch in 10 feet.

B. Correct the slab surface if tolerances are less than specified.

C. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

### 3.07 CONCRETE FINISHING

A. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Other Surfaces to Be Left Exposed: Trowel as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

### 3.08 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

C. Surfaces Not in Contact with Forms:
   1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
   2. Final Curing: Begin after initial curing but before surface is dry.

### 3.09 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

### 3.10 DEFECTIVE CONCRETE

A. Defective Concrete: Concrete not complying with required lines, details, dimensions, tolerances or specified requirements.

### 3.11 PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

**END OF SECTION**

## SECTION 07 6200

## SHEET METAL FLASHING AND TRIM

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, and exterior penetrations.

### 1.02 REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021a.

D. CDA A4050 - Copper in Architecture - Handbook; current edition.

E. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

### 1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Samples: Submit two samples, 4 by 4 inches (___ by ___ mm) in size, illustrating metal finish color.

### 1.04 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

### 1.05 DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

### PART 2 PRODUCTS

### 2.01 MANUFACTURERS

### 2.02 SHEET MATERIALS

A. Pre-Finished Aluminum: ASTM B209/B209M, 3005 alloy, H12 or H14 temper; 18 gauge, 0.040 inch (1.02 mm) thick; plain finish shop pre-coated with silicone modified polyester coating.
   1. Silicone Modified Polyester Coating: Pigmented organic powder coating, AAMA 2603; baked enamel finish system.
   2. Color: As selected by Architect from manufacturer's standard colors.

### 2.03 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

## 2.05 FLASHING

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

## 3.02 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil, 0.015 inch (0.38 mm).

## 3.03 INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

## 3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

**END OF SECTION**

**SECTION 07 7100**

**ROOF SPECIALTIES**

## PART 2 PRODUCTS

### 1.01 MANUFACTURERS

A. Pipe and Penetration Flashings:
   1. Lifetime Tool & Building Products LLC, Lifetimetool.com
   2. Substitutions: See Section 01 6000 - Product Requirements.

### 1.02 COMPONENTS

A. Pipe and Penetration Flashing: Kynar Coated Ultimate Pipe Flashing for Shingle Roofs, and capable of accomodating pipes sized between 1.25” Inches PVC and 4” inches PVC.
   1. Pipe Flashing:.

### 1.03 ACCESSORIES

A. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

### 1.04 FINISHES

A. Color Anodized Finish: AAMA 611 AA-M12C22A42/44 Class I integrally or electrolytically colored anodic coating not less than 0.7 mils thick.

## PART 3 EXECUTION

### 2.01 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

### 2.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

**END OF SECTION**

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## SECTION 07 9200

## JOINT SEALANTS - DOW SILICONES CORPORATION

### PART 1 GENERAL

### 1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

### 1.02 REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

C. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

E. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2022.

F. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

G. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

### 1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data for Joint Sealants: Submit manufacturer's technical datasheets for each product to be used, and include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates that product is not compatible with.

C. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

D. Executed warranty.

### 1.04 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. Adhesion Testing: In accordance with ASTM C794.
   2. Compatibility Testing: In accordance with ASTM C1087.
   3. Allow sufficient time for testing to avoid delaying the work.
   4. Deliver sufficient samples to manufacturer for testing.
   5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

C. Field Adhesion Test Procedures:
   1. Allow sealants to fully cure as recommended by manufacturer before testing.
   2. Have a copy of the test method document available during tests.
   3. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
   4. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.

## 1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

# PART 2 PRODUCTS

## 2.01 MANUFACTURERS

A. Joint Sealants:
   1. Dow Silicones Corporation: www.dow.com/#sle.
   2. Substitutions: See Section 01 6000 - Product Requirements.

## 2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to:
      a. Wall expansion and control joints.
      b. Joints between door, window, and other frames and adjacent construction.
      c. Joints between different exposed materials.
      d. Openings below ledge angles in masonry.
      e. Other joints are indicated below.
   2. Do not seal the following types of joints:
      a. Intentional weep holes in masonry.
      b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      d. Joints where installation of sealant is specified in another section.
      e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use nonsag nonstaining silicone sealant, unless otherwise indicated.

C. Joints in EIFS: Sikasil WS295, as manufactured by Sika Corporation, Lyndhurst, New Jersey

Backer Rod: Closed cell, dense, polyethylene, extruded rod.

## 2.03 JOINT SEALANTS - GENERAL

## 2.04 NONSAG JOINT SEALANTS

A. Nonstaining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
   1. Movement Capability: Plus and minus 50 percent, minimum.
   2. Porous Stone: Nonstaining to light-colored natural stone when tested in accordance with ASTM C1248.
   3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
   4. Color: To be selected by Architect from manufacturer's standard range.
   5. Products:

## 2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

# PART 3 EXECUTION

## 3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

**3.02 PREPARATION**

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

**3.03 INSTALLATION**

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install bond breaker backing tape where backer rod cannot be used.

D. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

E. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

F. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

**END OF SECTION**

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