POST-INSTALLATION VAPOR INTRUSION MITIGATION SYSTEM VERIFICATION CHECKLIST

The purpose of this checklist is to provide the user with a selection of tools to verify that the appropriate system components for the vapor intrusion mitigation system (VIMS) were installed and the system is operating as designed. This information applies to the four most common active mitigation systems: sub-slab depressurization, sub-slab ventilation, sub-membrane depressurization, and crawl-space ventilation. Passive systems are described in their associated fact sheets and technology information sheets. It is recommended that the user of this checklist review the VIMS design or as-built documentation prior to completing this checklist.

This document was prepared with multiple types of VIMS in mind. Not all of the information presented below is necessary to document system operation for all types of systems on all types of buildings. The user should be able to identify which criteria below best represent effective operation for their specific VIMS and which criteria will validate the conceptual site model for which the VIMS was implemented. Timing on when to collect post-installation verification data may vary and more than one event may be reasonable. See the **Vapor Intrusion Mitigation Systems Post-Installation Verification Fact Sheet** for additional information on timing a post-installation verification site visit.

Instructions for Use: As-built drawings and performance criteria are needed when conducting inspections of VIMS. Major system components are grouped below for this checklist, and one or more of these groups may not apply to a particular VIMS design. Those groups can be marked as Not Applicable by selecting the 'X' box on the right side of the page.

This checklist is intended to serve as a guide for design considerations and as documentation for VIMS installation. This list can be modified for a specific project or program if needed or can be used as shown. The list should be submitted along with the final project as-builts and/or installation oversight verification documentation and reporting.

1. SITE INFORMATION:

Address Inspected: _____

City, State, ZIP: _____

Inspector's Name: _____ Date/Time Inspected: _____

Inspector's Email: _____ Inspector's Phone No.: _____

Inspector's Company Name: _____

Name of Building Contact: _____Phone No.: _____

2. BUILDING TYPE:

☐ Existing Building ☐ New Construction

3. TYPE OF SYSTEM:

ACTIVE	PASSIVE
☐ Sub-slab depressurization (SSD)	☐ Sub-slab VIMS membrane only
☐ Sub-slab ventilation (SSV)	☐ Interior floor slab coating only
☐ Sub-membrane depressurization (SMD)	☐ Passive sub-slab venting only
☐ Crawl-space ventilation (CSV)	☐ Passive venting and membrane/sealant

4. SYSTEM DESIGN COMPONENTS AND INSTALLATION DOCUMENTATION:

4.1 Site Conditions / Conceptual Site Model:

☐ Contaminant concentrations at the site have been reviewed and compared to generic or building-specific screening levels. In large buildings, the VIMS target treatment area may not include the entire footprint but should allow for adequate capture of vapors to mitigate the potential for unacceptable risk to the occupants of the building.

☐ Slab conditions should be verified/inspected for cracks / voids / utility penetrations / potential preferential pathways (if known/observed) and identified on a diagram, sealed to the extent practical, and visually inspected during the post-installation verification event.

☐ Mitigation system design has been reviewed by a vapor intrusion mitigation specialist, professional engineer, or professional with demonstrated mitigation design experience.

4.2 Extraction Point(s): ☐ N/A

☐ Suction point location, diameter, and sealing documented.

☐ Pipe and manifold location, materials, diameter, slope, and sealing documented.

☐ Sample port, shutoff valve, and access have been identified.

☐ U-tube manometer (or similar vacuum gauge) installed, and target vacuum level clearly marked.

4.3 Collection Piping: ☐ N/A

☐ As-built collection piping diagrams have been provided.

☐ Riser pipe located in an interior wall where possible and does not penetrate firewalls or shear walls.

☐ Fire collars installed on pipes where firewalls are penetrated.

☐ Vent piping system designed by a qualified individual with VIMS design experience.

☐ All vent stack piping is identified as solid, rigid pipe.

☐ All pipe joints and connections are permanently sealed.

☐ Foundation penetration sleeves installed as approved by the structural engineer.

☐ All exhaust pipes are supported and secured in a permanent manner consistent with building codes.

☐ Horizontal piping runs are sloped to ensure condensation drains into the ground beneath the slab.

☐ Vertical piping runs drain naturally or can be verified to be free of water or moisture.

4.4 Piping Completion Specifications: ☐ N/A

☐ Primary wind flow direction from nearby weather stations has been reviewed.

☐ Pipes are completed with an exhaust stack and are an appropriate height above the roof.

☐ Point(s) of discharge are an appropriate distance away from any air intake location, opening (door, chimney flue, window, vent, etc.), or occupied spaces including adjacent buildings.

☐ To enhance dispersion and direct vapors upward and away from receptors, confirm that the point of discharge from vent stack pipes is vertical and upward, outside the building. Consider wire mesh to deter birds and small animals.

4.5 Blower/Fan: ☐ N/A

☐ Blower/fan number, location, size, model number and performance specifications documented.

☐ Blower/fan securely mounted outdoors with discharge locations far from building intake locations.

☐ Electrical components and wiring installed by a licensed electrician in accordance with applicable building codes.

☐ Intrinsically safe or explosion-proof components installed where specified in the project plans.

☐ Diagnostic testing and results documented and summarized to meet design criteria.

☐ Audible and/or visual alarm set to alert as indicated in the design (e.g., low vacuum, high vacuum, power) is installed, tested, and separately powered (e.g., battery).

☐ Controller system (where present): model number, location, operation, maintenance, and monitoring (OM&M) manual documented.

☐ Telemetry system (where present): model number, location, OM&M manual.

4.6 Monitoring Probes: ☐ N/A

☐ Sub-slab vapor probes, if needed, installed in accordance with design (appropriate number and location(s)).

☐ Surface completion provides a seal to the subsurface and passed leak check test.

☐ Level to grade to minimize trip hazard.

4.7 Post-Installation Diagnostic Testing: ☐ N/A

☐ System flow and vacuum documented in vent pipe(s) and data meet design criteria. (The system flow and vacuum readings may vary slightly from the assumption developed in the design phase of the project. Pressure field extension (PFE) or other monitoring approaches may be needed to supplement system flow and vacuum readings to evaluate system performance.)

☐ PFE testing documented to meet design criteria across targeted areas.

☐ Additional diagnostics performed as appropriate where data do not meet required values.

☐ Effluent concentrations measured and calculated discharge meet design criteria/permit limits, if needed.

☐ Non-sealed combustion appliances checked for back drafting/CO_2 levels.

4.8 System Monitors and Labeling: ☐ N/A

☐ System labels are placed on the mitigation system, riser piping, electrical panel breaker, and junction box, and other prominent locations including the exterior venting locations.

☐ Descriptions of signage and locations are provided.

☐ Signage is present and contains language indicating the mitigation vent may contain volatile organic compounds.

☐ Figure provided, if needed, identifying locations of signs.

☐ Name and contact information for operator clearly visible with instructions to notify operator in the event of alarm conditions, damage to any system component, power failure, etc.

☐ Documentation states a notice has or will be provided to tenants who will be occupying the building.

4.9 System Design and Specification: ☐ N/A

☐ As-built project plans and specifications have been prepared by the designer and reviewed by a Professional Engineer.

☐ Electrical design plans have been prepared by an electrical engineer and reviewed by a licensed electrician.

☐ Dewatering has been considered and, if necessary, incorporated into the design.

☐ Engineer or design firm is identified.

☐ Building/fire codes: Document states mitigation systems is designed and installed to conform to applicable building and fire codes and to maintain the function and operation of existing equipment and building features including doors, windows, access panels, etc.

☐ Permits: Documentation provided that the system passed required permit inspections.

☐ On-site installation oversight and documentation by the design firm.

4.10 Sumps: ☐ **N/A**

☐ Floor drains are designed to allow water to flow into sumps while sealing out soil vapor from entering the indoor air space from the sub-floor area (e.g., Drainjer-style drain).

☐ Sumps connected to drain tile or to the sub-slab environment have fully sealed lids, and the lids are labeled to indicate that they must remain sealed as part of the VIMS.

5. NEW CONSTRUCTION: ☐ **N/A**

5.1 Aggregate Layer: ☐ **N/A**

☐ Delivered sub-slab aggregate grain-size gradation matches project design specifications (geotechnical, sub-slab depressurization).

☐ Aggregate is washed and free of fines that could inhibit vapor flow.

☐ Aggregate is uniformly compacted and rolled flat and is free of protrusions or debris that may be a puncture hazard.

☐ Aggregate thickness measured and documented to meet project specifications.

5.2 Engineered Plenums (e.g., drainage mats): ☐ **N/A**

☐ Engineered plenums supplied and documented to meet project specifications.

☐ Plenum is uniformly laid flat across target treatment area to meet project specifications.

5.3 Collection and Manifold Piping: ☐ **N/A**

☐ Delivered vapor collection piping matches project design specifications.

☐ Vapor collection piping is laid, and pipe joints and connections are permanently sealed.

☐ Solid piping is used in areas adjacent to utilities or trenches or where short-circuiting may occur.

☐ Solid piping is sloped to drain to the subsurface or has holes drilled and oriented downward to enable drainage of condensate or other entrained water.

5.4 Membrane Installation Documentation: ☐ **N/A**

☐ Membrane manufacturer installation requirements are provided.

☐ System was installed by a certified installation contractor, if required by the manufacturer.

☐ Mitigation system as-built drawings are provided.

☐ Photographic log provided for seals/repairs at the following locations:

- ☐ Along foundation edge
- ☐ Around foundation penetrations
- ☐ Along vertical exterior walls
- ☐ Around elevator shafts
- ☐ Where coupons/smoke-testing repairs were made

☐ Verify utility trench dams were installed in all utility trenches leading to the building.

☐ Verify conduit seals were installed in all electrical conduits that extend below the membrane.

5.5 Membrane Design and Specification: ☐ N/A

☐ Documentation specifies barrier and transmission rates and/or diffusion coefficients for contaminants of interest.

☐ Membrane selection and/or thickness considered for potential contaminant concentrations in the subsurface (i.e., chemical compatibility).

☐ Sub-slab screening levels protective of diffusive transport across the slab have been calculated, and monitoring is specified to document sub-slab concentrations after the membrane is placed. Contingencies are in place to modify the system (i.e., potentially activate a passive system) if diffusive transport may become an issue.

☐ Documentation provides details for areas that require specialized completion, including all penetrations and terminations.

☐ Drains that perforate the barrier are designed to allow water to flow into sumps and floor drains while sealing out soil vapor from entering the indoor air space from the sub-floor area (e.g., Drainjer-style drain).

5.6 Quality Assurance / Quality Control Installation Plan Requirements Identified in the Design Document: ☐ N/A

☐ Products and materials installed meet the project design specifications.

☐ Material Safety Data Sheets (MSDS) are available for potential background contaminants (adhesives, glues, etc.).

☐ Installation conducted in accordance with manufacturer's specifications (weather, curing time).

☐ Estimated quantities of the product to be used are provided.

☐ Engineer of record or barrier manufacturer identifies steps to document the effectiveness of the mitigation system.

☐ Coupon sampling:

- ☐ Sample frequency is appropriate to assess integrity of entire barrier.

- ☐ Smoke testing:
  - ☐ Locations are appropriate to assess integrity of the complete area of barrier.
  - ☐ Assessment of barrier integrity based upon visual observation of where smoke has migrated and/or where membrane repairs were made.
- ☐ On-site installation oversight and documentation by the design firm.
- ☐ Documentation verifying the installation and repairs have been completed per project specification and manufacturer's installation instructions.
- ☐ Verification sampling was performed in accordance with the system design plan.
- ☐ Field sampling procedures specified were followed.
- ☐ The correct number and locations of verification samples were collected.
- ☐ Verification samples were collected at the appropriate frequency.
- ☐ Verification samples were analyzed using the appropriate analytical method.
- ☐ Results of the verification samples indicate the VIMS is effectively mitigating the vapor intrusion risk present at the site.
- ☐ Deviations in the verification sampling plan, if needed, are documented with rationale for the change.