This document references Chapters and Sections from the ITRC Vapor Intrusion Technical and Regulatory Guidance, and Fact Sheets and Technology Information Sheets from the ITRC Vapor Intrusion Toolkit, published January 2026. These resources can be accessed at: **https://itrcweb.org/vapor-intrusion-toolkit**.

COMPOSITE MEMBRANES TECHNOLOGY INFORMATION SHEET

Technology Description

The primary component of a passive composite membrane (CM) vapor intrusion mitigation system (VIMS) is a continuous, seamless layer of spray-on asphalt latex material (ALM). CM materials used for VIMS should be water based and free from vapor-forming chemicals (VFCs) and used in combination with other layers to create a barrier to vapor intrusion (VI). A typical CM passive VIMS consists of a base layer (also referred to as a carrier layer), a continuous seamless layer of spray-applied asphalt, and a cap sheet (also referred to as a protective layer).

CMs are applied to a base layer that consists of a geotextile, a geotextile-backed plastic film, or a single-sheet membrane (SSM). The base layer serves as a carrier substrate for the spray-on ALM layer. It increases the tensile strength of the system and, in some cases, increases the system's resistance to chemical attack or vapor diffusion. The materials commonly used in CMs for the base layer and protective cap sheet will not be classified as SSMs as defined in the **Single-Sheet Membranes Technology Information Sheet**, but they can incorporate the same materials. For increased VFC protection, SSMs can be incorporated into CMs.

The ALM layer is applied at a specified mil thickness to the base layer. The ALM is an asphalt emulsion and latex polymer blend that is mixed with a catalyst material at the tip of a spray wand. This creates a reaction resulting in the instantaneous formation of a uniform seamless membrane. The membrane typically reaches 90 percent of its full properties within 15 minutes. After the spray-applied asphalt has been applied and sufficiently cured, a cap sheet is applied on top of the spray-on membrane. This is typically referred to as the cap layer or protective layer. The cap layer protects the spray-applied ALM membrane from construction damage that might be caused by subsequent work. Additionally, nonwoven fibers of the cap geotextile become embedded into the concrete that is poured on top of the CM. This allows the CM to integrally bond to the concrete, providing protection from VI even if the soils settle away from the bottom of the slab. **Figure 1** provides an illustration of a typical CM passive barrier and passive venting system.

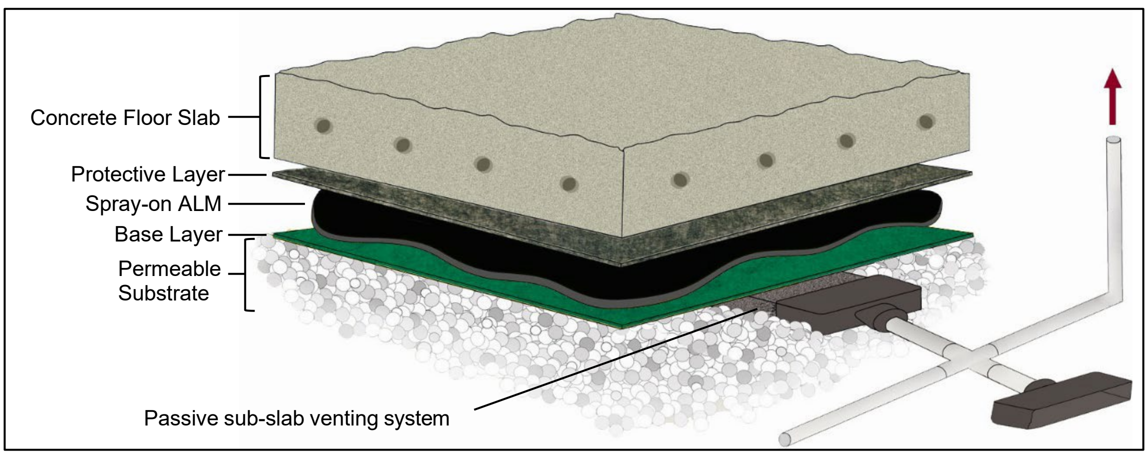

Figure 1. Illustration of a typical composite membrane passive barrier and passive venting system.

Source: Adapted from CETCO, used with permission.

When terminating the system to building footings, grade beams, stem walls, etc., the spray-on membrane adheres directly to concrete, thus removing the need for mechanical fastening. The spray-on membrane is also used to seal penetrations without the need for preformed boots. The ability of the membrane to adhere to typical substrates makes it ideal for sealing to penetrations such as polyvinyl chloride (PVC), steel, wood, and concrete terminations at its perimeter. This results in a fast installation by reducing the time spent on detailing.

Advantages

CM VIMSs can be used for a wide range of chemicals of concern due to the variety of base and cap materials available. Advantages of CMs are listed below:

- CMs adhere to most surfaces, which eliminates mechanical fastening and caulking at penetrations and terminations.
- CMs are spray-applied and cure in place and therefore provide a seamless layer of protection. This reduces the risk of a membrane failure at seams, which tend to be the weakest points in SSM systems.
- CMs that use a protective geotextile may bond to the concrete poured on top of them. This ensures protection even in the event of soil settling.
- The base layer (which may consist of a geotextile, a geotextile-backed plastic film, or SSM depending on the selected system) protects the CM from aggregate damage.
- CMs are composed of very low permeability materials, which protect against diffusive and advective flow of vapors. If configured properly, CMs can provide the additional benefit of moisture and waterproofing protection.
- CMs can be combined with SSMs. These combined systems can offer a higher level of protection from chemical diffusion.

Limitations

- CMs are primarily limited to new construction or foundations that do not have an existing slab.
- CMs should not be used if they are expected to be in direct contact with pure liquid-phase solvents.
- Some SSMs may require methods to seam and seal the membrane (e.g., tape, termination bars) that may have more difficulty passing a smoke test than a spray-applied termination using an ALM.
- Some CMs may contain an aluminum foil component that may be susceptible to corrosion if in direct contact with concrete as this can cause corrosion of the foil layer from tears or other punctures in the membrane (NHBC 2023).

Design and Installation Considerations

Contaminant Types

Passive CM VIMSs can be used for a wide range of contaminants because of the wide variety of base and cap materials that are used in conjunction with the spray-on membrane. Manufacturers generally provide suggestions for the contaminant classes that their systems may be appropriate for.

An additional consideration is for the compatibility of the CM with contaminants that are expected to contact the barrier in a separate liquid phase. These chemicals in their pure form may not be compatible with the CM or the base and cap layers. If the barrier is expected to be in contact with these chemicals in their pure liquid phase, other remedial actions may be needed on-site before redevelopment.

Performance

Chemicals move through a barrier by advection and diffusion. Advective flow is dominated by imperfections in the barrier that coincide with cracks or other openings in the slab, illustrating the importance of the installation of the barrier. The rate of chemical diffusion through the barrier is dependent on the material type. Certain types of materials are better at controlling diffusion. A CM that incorporates SSMs in the base layer provides higher reductions in chemical diffusion through the barrier.

> Performance of a CM is a function of the materials that it is made from and the quality of the installation. Selection of the most appropriate CM, based on the contaminant types, concentration, and risk, should consider the performance of the CM.

Quality Assurance / Quality Control

A quality assurance / quality control (QA/QC) plan should be implemented on all CM applications. This may include destructive testing or coupon samples cut at a predetermined frequency to determine the thickness of the spray-applied membrane. Coupon sampling is the collection of samples cut from the CM to verify that the membrane thickness meets the project requirements. Areas that are cut for sampling should be repaired with the appropriate methods.

Additionally, a smoke test should be used to inspect the CM for imperfections. Nontoxic theatrical smoke may be pumped below the membrane prior to placement of concrete to allow for visual identification of deficiencies in the membrane. This allows the entire CM to be inspected for imperfections that are not visible to the naked eye.

Manufacturers can provide standard procedures for conducting these tests. Reports documenting the QA/QC testing should be part of the project records.

Occupant, Community, and Stakeholder Considerations

It is essential to develop and implement a site-specific community involvement plan that addresses how to win trust and gain access to properties, communicate risk to potentially exposed individuals, and minimize the disruption of people’s lives and businesses. For more details see **Chapter 3: Community Engagement**.

REFERENCES

NHBC. 2023. “Hazardous Ground Gas — An Essential Guide for Housebuilders.” May 15. https://www.nhbc.co.uk/insights-and-media/foundation/publications/hazardous-ground-gas-an-essential-guide-for-housebuilders.