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ANALYSIS OF BARRIER MATERIAL PERFORMANCE

Nitrile-Advanced Asphalt Latex

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BRIEF OVERVIEW:

Land Science vapor membranes are always installed using a latex-modified spray-applied asphalt to improve the constructability of the barriers and to create a continuous seal between adjacent sheets and around penetrations. Given the essential role that the spray-applied asphalt plays within the vapor barrier, extensive research and development were conducted to evaluate if the type of latex modifier used in the asphalt has an impact on the ability of the asphalt layer to resist contaminant vapor diffusion. This study compared the chemical resistance of a nitrile-modified asphalt material (Nitrile-Advanced Asphalt Latex) to that of a generic, styrene butadiene-modified asphalt material (SBR) used in many vapor barrier systems. Using a custom-made testing apparatus consisting of top and bottom chambers separated by the material to be tested, the two cured asphalt cores were evaluated for their relative ability to resist the diffusion of trichloroethylene (TCE) vapors. To compare the two materials, the cured asphalt cores were tested under identical conditions, where the challenge TCE vapor concentration was held constant in the bottom chamber and the amount of contaminant that diffused through the asphalt core barrier into the top chamber was measured. The results of the tests showed a significant difference between the two formulations, with up to 10-fold lower amounts of TCE diffusing through the nitrile-modified asphalt material than through the SBR-modified asphalt material of the same thickness. These results indicate that the use of Nitrile-Advanced Asphalt Latex will result in a safer vapor barrier than when a generic (SBR) asphalt is used.

EXPERIMENTAL METHODS:

Vapor Barrier Testing Apparatus:

The vapor diffusion testing apparatus is shown in **Figure 1.** To create the challenge vapor, the bottom chamber was filled with a solution of TCE in water, which was allowed to naturally equilibrate between the liquid and vapor phases. The challenge concentration was held constant throughout the test at 10 mg/L of TCE in water, which correlated to ~700 ppmV TCE in the vapor phase of the bottom chamber. While this high concentration of TCE was an exaggeration of what would be encountered below an inhabited building, the elevated concentration allowed experiments to be completed in a short period of time and offered an understanding of the relative vapor protection provided by the materials tested.

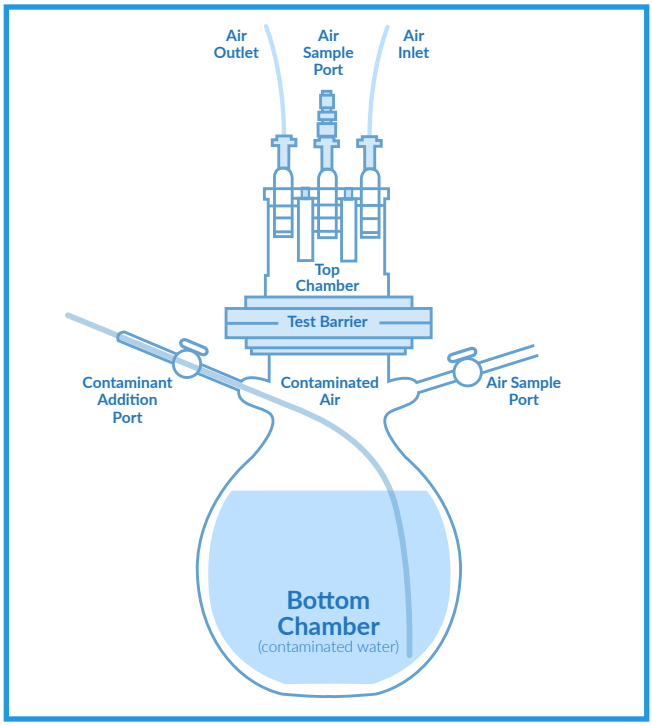

Figure 1: *Vapor Barrier Diffusion Testing Apparatus*

The sample material was secured between the bottom and top chambers, which effectively separated the chambers such that the only path from the lower chamber to the top chamber was to diffuse through the barrier. Continuous airflow (2.5 mL/min), mimicking an HVAC unit within a building, was maintained in the top chamber throughout the lifetime of the experiment. The continuous airflow also created test conditions that would result in upper bound (worst-case) results.

Preparation Of The Barrier Component Samples:

To prepare the asphalt barriers for this test, both the asphalt emulsion source and the weight ratio of asphalt to polymer were held constant, whereas the type of polymer modifier was varied: One sample used a styrene-butadiene (SBR) polymer, and the second used an acrylonitrile butadiene (nitrile) polymer. Both asphalt layers were sprayed to 20 mil thickness on an identical geotextile fabric (the geotextile fabric has no effect on contaminant diffusion) using calcium chloride to break the emulsion. The layers were cured for over two weeks before cutting the samples to the appropriate size to fit within the test chamber.

Sampling Procedure:

Triplicate vapor samples were taken from the top and bottom chambers at each timepoint throughout the experiment using an air-tight sample-lock syringe, and the TCE concentrations were analyzed on an Agilent GC-ECD. The concentrations measured in the top chamber were used to calculate the total mass of TCE that had diffused through the barriers within the test timeframe and compare the performance of the barriers. Samples of contaminated air in the bottom chamber were analyzed to ensure that the concentration remained constant throughout the lifetime of the experiment and to confirm that the challenge concentration was identical between experiments. If a decrease in the target concentration was observed, additional TCE was added to the bottom chamber to re-establish the target concentration.

RESULTS AND DISCUSSION:

This test was conducted to determine if the type of polymer used in a polymer-modified spray-applied asphalt coating would impact the ability of a spray-applied asphalt layer to resist the diffusion of contaminant vapors. **Figure 2** shows the total mass of TCE diffused through the asphalt barriers in this accelerated test over time. The nitrile-modified asphalt coating provided better protection than the SBR-asphalt, with up to ten times less total TCE mass diffusing through the barrier at various points in the experiment. The trends observed in this study at a high challenge concentration are expected to extend to more relevant contaminant concentrations.

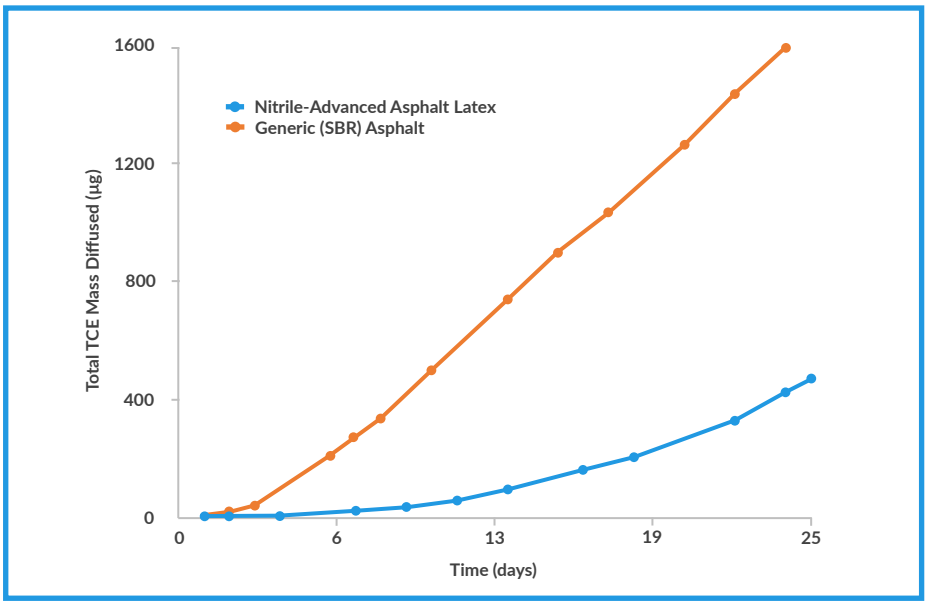

Figure 2: *TCE vapor diffusion test results comparing two latex-modified asphalt materials: A nitrile-modified asphalt (Nitrile-Advanced Asphalt Latex) vs. a generic SBR-modified asphalt. This accelerated test was conducted under exaggerated conditions that allowed the experiment to be completed in a short period of time. These conditions included using a challenge TCE concentration that is much higher than would be expected under a building and testing a thinner asphalt sample than what is typically used within a vapor barrier. The trends observed in this study are expected to extend to lower contaminant concentrations and thicker asphalt layers.*

CONCLUSION:

The results of this testing indicated that the type of latex polymer used in a spray-applied asphalt does impact the protection that the asphalt layer can provide when used within a vapor barrier. The nitrile-modified asphalt material employed in Nitrile-Advanced Asphalt Latex from Land Science provided up to ten times more protection against TCE vapors than a generic SBR-modified asphalt.

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