Nítra-Core
Nitrile-Modified Asphalt

ANALYSIS OF BARRIER MATERIAL PERFORMANCE

Nitra-Core

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BRIEF OVERVIEW:

Extensive research and development have been conducted to understand the relative chemical resistance of an advanced nitrile-modified spray-applied asphalt material (Nitra-Core) compared to a typical styrene-butadiene-modified asphalt material used in many vapor barrier systems. Using a custom-made testing apparatus consisting of a top and bottom chamber separated by the material to be tested, the relative chemical resistances of the cured asphalt cores to the contaminant trichloroethylene (TCE) were determined. To accomplish this, the cured asphalt cores were evaluated under identical test conditions where the contaminated vapor concentration was held constant in the bottom chamber, and the amount of contamination that diffused through the asphalt core barrier was measured in the top chamber. The testing results of the spray-applied asphalt layers showed the nitrile-modified asphalt material (Nitra-Core) to significantly attenuate the TCE diffusion rate with up to 10-fold lower TCE flux was measured as compared to the styrene-butadiene-modified asphalt material of the same thickness. We can also use this data to estimate the PCE diffusion coefficient for Nitra-Seal to be 1 x 10^{-17} m^2/sec or better.

EXPERIMENTAL METHOD:

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 TCE in water solution and 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, 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 TCE chemical resistance of the materials tested. The samples to be tested were 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.

PREPARATION OF THE BARRIER COMPONENT SAMPLES:

To prepare the asphalt barriers for this test, the asphalt emulsion source and the weight ratio of asphalt to polymer were held constant, and 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 should have no effect on the contaminant diffusion) using calcium chloride to break the emulsion. The layers were cured for over two weeks before testing.

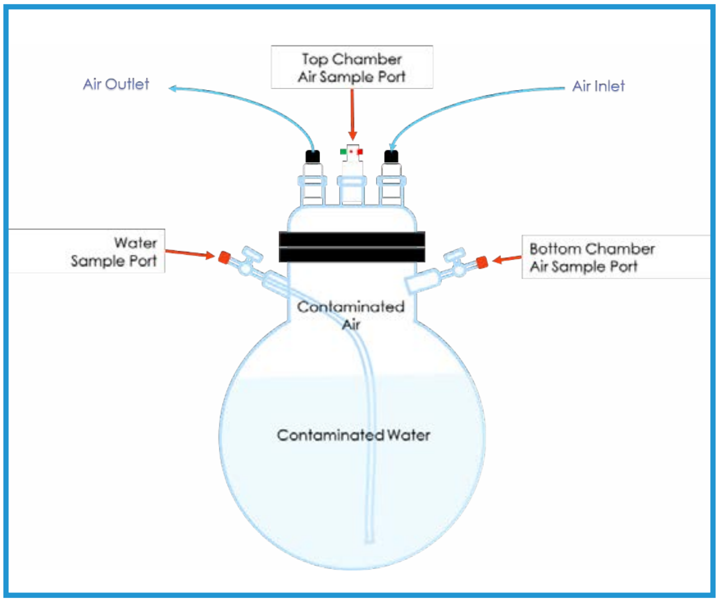

Figure 1. *Vapor-Barrier Testing Apparatus*

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 results from the concentrations measured in the top chamber were used to compare the performance of the barriers. The samples of the contaminated air in the bottom chamber were analyzed to ensure the concentration remained constant throughout the lifetime of the experiment and to confirm the challenge concentration was identical between experiments. If a decrease in the target concentration was observed, additional TCE was added to the bottom to chamber to re-establish the target concentration.

RESULTS AND DISCUSSION:

Spray-Applied Asphalt Coating Results:

This test was conducted to determine if the type of polymer used in a polymer-modified spray-applied asphalt coating would impact the chemical resistance of the asphalt layer. **Figure 2** shows the relative performance of the two asphalt layers over time. The nitrile-modified asphalt coating shows much attenuated rate of TCE diffusion and up to a 10-fold lower TCE flux as compared to the SBR-modified asphalt coating. It is expected that the trends observed in this study at a high challenge concentration will be further extrapolated under more relevant contaminant concentrations.

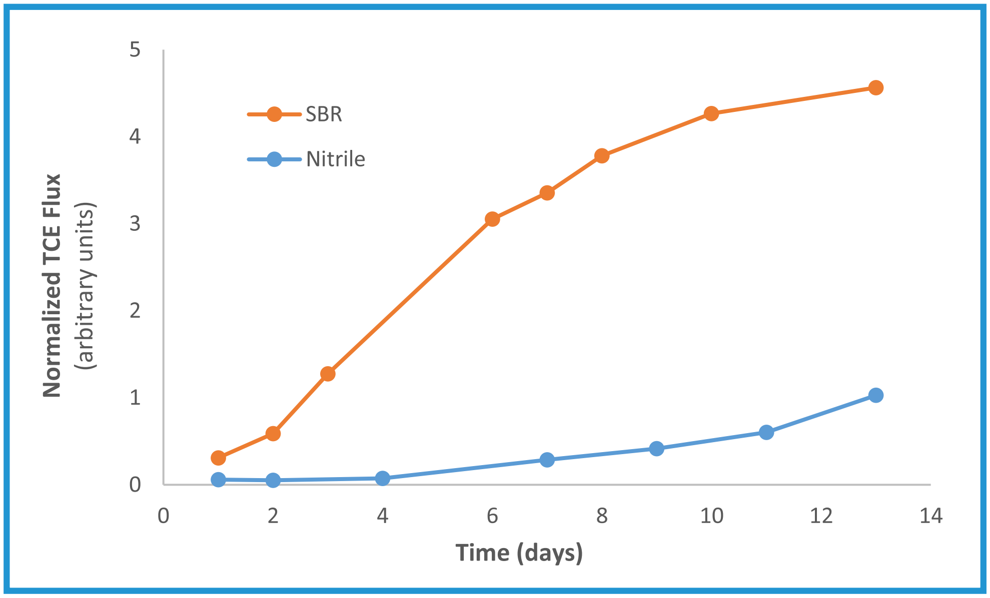

Figure 2. *Accelerated comparison showing relative TCE flux compared to the two polymer-modified spray-applied asphalt layers tested over time. SBR = styrene butadiene modified-asphalt, nitrile = acrylonitrile butadiene-modified asphalt. Both asphalt layers were sprayed to an identical thickness (20 mil) for the test.*

CONCLUSION:

The nitrile-modified asphalt material employed in Nitra-Core proved to be very effective at attenuating the rate of TCE diffusion and exhibited up to a 10X lower TCE flux compared to styrene butadiene modified-asphalt cores. This results, combined with diffusion coefficients available for common vapor systems, provide an estimated PCE diffusion coefficient for Nitra-Seal of 1 x 10^{-17} m^2/sec or better.

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