

## news of engineering forensics


 MDE Inc.

## THE USE OF RATED WALL BOARD PRIMERS AS VAPOR BARRIERS

**Dale C. Mann, Senior Forensic Chemist**

Moisture trapped within the exterior envelope/walls of a residence can lead to mold, rot and decrease the life of the structure. Moisture can penetrate into the wall as a solid, liquid or vapor. Solid water in the form of ice is easily understood and corrected. Liquid intrusion often stems from rain or leaks and has been attributed to poor construction practices. Water vapor intrusion is often a complex issue and not well understood by many in the construction defect field.

Water vapor can penetrate into the exterior walls via either convection or diffusion. Convection of warm moist air in the winter through a wall receptacle or wall/floor interface can deposit large quantities of condensed water on the cold side of the insulation. Convection of moist air leaking from a faulty air duct (such as a dryer duct)

can also result in excess water vapor in the interstitial wall or ceiling cavities. Diffusion of water vapor through the intact drywall can also occur but it has been shown to be a relatively minor factor compared to convection, particularly in our Puget Sound climate.

To prevent water vapor diffusion into the exterior envelope, Washington State Energy Code requires the use of a vapor retarder on the warm side of insulation in walls separating conditioned (living) space from unconditioned space. A vapor retarder is defined as a layer of low moisture transmissivity membrane material that allows a minimal amount of water vapor to penetrate over a period of time. These membranes are tested using an ASTM standard for this purpose. The Energy Code requires the interior wall membrane to have less than a 1.0 perm value. The Code also specifically states, "vapor retarding paints listed for this application, also complies with this code".

Over the past couple of years, Condominium Homeowner Associations (HOAs) have begun to litigate against drywall/painting contractors for the perceived lack of presence of the required vapor retarder membrane. In some cases the symptoms were extreme, such as mold and decayed OSB in the exterior walls. In other instances, there was absolutely no symptom of excessive moisture in the walls. Typically, intrusive investigations were conducted to expose the internal components of the walls. The absence of either polyethylene sheeting or kraft-backed insulation batting was noted, the condition of the wall components was documented, moisture readings were collected to determine if there was a problem and wallboard samples were collected to determine if a vapor retarder primer was applied.

Perm ratings of the primer/paint were measured by the HOA experts and ranged from 5-40 perms; all exceeded that allowed by the Energy Code. Chemical analysis of the interior paints by the HOA experts also failed to demonstrate the presence of the chemical formulation of a vapor retarder primer. Demands for repair and remediation were made and lawsuits were filed.

MDE Inc. was retained to help defend against the allegations of no vapor barrier (in some instances) or lack of "proper" vapor barriers as defined by the Energy Code (in other cases). The characterization of individual paint layers is not trivial. MDE developed special isolation methods and utilized innovative analytical techniques in its approach to the issues at hand. In each investigation MDE identified the presence of a styrene butadiene resin (SBR) primer. SBR primers are rated as vapor retarder primers by paint manufacturers. Perm values of full thickness primed and painted drywall samples were also carefully measured. Although no samples met the required 1.0 perm rating, all values were found to be significantly lower than those presented by the HOA experts. The differences were thought to be due to the manner in which the samples were prepared for the testing.

Numerous exemplar primer products were applied to wall board according to manufacturer thickness specifications and were tested. These studies demonstrated

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### MDE's Educational Speakers

If you are in need of an educational speaker, please call MDE today. Part of MDE's mission is to inform and educate affected parties in insurance, legal, engineering and other scientific issues. MDE professionals schedule speaking engagements locally and nationwide. Continuing education credits are available for some classes. Talks presently scheduled include:

- **Noel Putaansuu**, Alternative Sampling Methods to Collect Ignitable Liquid Residues From Non-porous Areas Such As Concrete, Fire and Materials Conference, San Francisco, CA, January 31, 2007
- **Dale Mann**, The Role of Scientific Method in Criminal Defense, Washington Defense Association, Spring 2007 Meeting, Winthrop, WA, April 27, 2007
- **Paul Moore and Noel Putaansuu**, Electrical and Fuel Gas Fire Investigation, IAAI and NW Fire Investigators Association Fire Investigation Conference, Leavenworth, WA, May 16, 2007


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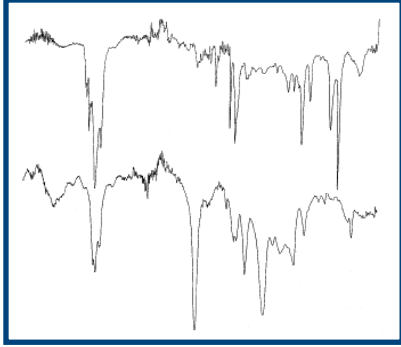
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that none of the applied primer products met the Washington State Energy Code requirement of 1.0 perm when applied to wall board. In fact, the values in these carefully controlled laboratory settings were very similar to the values obtained on the subject samples removed from the condominium walls.



**Fourier Transform infrared spectrometry (FTIR) of a vapor barrier SBR primer resin (top) and a non-vapor barrier PVA wall board primer (bottom).**

Paint manufacturers have options when testing the perm ratings for their products. To achieve the 1.0 perm value, and hence qualify as a vapor barrier product, the manufacturer tests the primer as a film, not as applied to drywall. A survey of the specifications of wall board primers advertised as vapor retarder products showed that none were tested as an applied product on wall board. However, all met the Washington State Energy Code requirement as a film and were marketed as "Vapor Barrier" primers.

In the investigations where extensive moisture existed within exterior wall cavities, mechanisms other than vapor penetration

were found. MDE found moist air leaking into ceiling and wall spaces from poorly connected air ducts, inoperative fans, wind-driven rain through vinyl siding and reverse lapped exterior paper, and leaking roofs and gutters. In condominiums which were properly constructed no excessive moisture was documented within the exterior wall cavities. Each condominium project had a properly applied vapor barrier primer applied to the interior walls.

Note: In each investigation to date, the HOA has settled the lawsuit against the drywall/painting contractor by dropping the demand for remediation or addition of an additional vapor barrier.

### **MDE HAS UPGRADED SEM CAPABILITIES**

MDE is proud to announce a significant upgrade to our analytical capabilities. Our scanning electron microscope (SEM) has been updated with a complete Oxford Instruments energy dispersive spectrographic (EDS) package, including a high resolution INCA X-sight™ Si(Li) detector, an INCA X-stream™ signal pulse processor and an MICS digital image capture system.

Fancy acronyms are great for engineers and scientists, but the technology and extended capabilities of our upgraded system means better results for you, our clients. Analytical data can be captured and evaluated with incredible detail and flexibility giving MDE increased ability to evaluate materials and compare samples during our investigations.

An effective SEM/EDS evaluation involves capturing images of fractures, deposits and other microscopic features and combining

an elemental analysis that can pinpoint critical features indicating contamination and corrosion that can be the vital factor in an investigation. MDE's upgraded capability is second to none.

The INCA system allows MDE to re-evaluate captured data long after it is collected. This is important since information may become available long after the SEM/EDS evaluation has been performed. INCA's data analysis capabilities allow MDE to glean new insights from stored data and perform new analyses quickly and efficiently.

Enhanced graphical capabilities means enhanced ability to present our data clearly and powerfully communicate our technical findings. The best data and analysis is rendered irrelevant if it cannot be used to demonstrate key points of an expert opinion. Our upgraded system gives our clients the confidence that they are receiving the best available to make critical decisions.

### **MDE Featured Service:**

#### **Laboratory Analyses**

MDE has extensive laboratory analysis capabilities to meet your needs. These services broadly cover material fatigue, corrosion and failure, drug and chemical testing, microbiologically influenced corrosion, and ignitable residue. We utilize a variety of equipment including optical stereo microscopy and an environmental Scanning Electron Microscope with an upgraded EDS system, FTIR and gas chromatography. For material properties, we can test the melting points of materials, perform thermogravimetric analysis and hardness.



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