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NRMRL-RTP-460

Environmental and Sustainable Technology Evaluation: Mold-Resistant Lonseal Flooring - Lonseal, Inc., Lonwood Natural

Prepared by
Research Triangle Institute

For
U.S. Environmental Protection Agency
Office of Research and Development- Environmental Technology Verification Program

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THE ENVIRONMENTAL TECHNOLOGY VERIFICATION PROGRAM
Environmental and Sustainable Technology Evaluation (ESTE)

U.S. Environmental Protection Agency

Research Triangle Institute

ESTE Joint Verification Statement

TECHNOLOGY TYPE:	**Mold-Resistant Flooring Product**
APPLICATION:	**Flooring**
TECHNOLOGY NAME:	**Lonseal Lonwood Natural**
COMPANY:	**Lonseal, Inc.**
ADDRESS:	**Carson, California**

The U.S. Environmental Protection Agency (EPA) has created the Environmental Technology Verification (ETV) Program to facilitate the deployment of innovative or improved environmental technologies through performance verification and dissemination of information. The goal of the ETV Program is to further environmental protection and sustainability by accelerating the acceptance and use of improved and cost-effective technologies. ETV seeks to achieve this goal by providing high quality, peer-reviewed data on technology performance to those involved in the purchase, design, distribution, financing, permitting, and use of environmental technologies. This verification was conducted under the Environmental and Sustainable Technology Evaluation (ESTE) element of the ETV Program that was designed to address agency priorities for technology verification.

This ESTE project involved evaluation of the mold resistance of Lonseal Lonwood Natural flooring. Tests for emissions of VOCs and formaldehyde were also performed. For this project Research Triangle Institute (RTI) was the responsible contractor for EPA Office of Research and Development, National Risk Management Research Laboratory (NRMRL).

This verification statement provides a summary of the test results for Lonseal Lonwood Natural flooring.

TECHNOLOGY DESCRIPTION

The following description of the product was provided by the vendor and was not verified. Lonwood Natural flooring is a sheet vinyl product with an embossed wood-grain texture. Constructed in multiple layers and embossed with distinctive wood grains, it is composed of resin, plasticizers, fillers, and pigments. The co-calendered wear layer is formulated to provide maximum resistance to foot traffic in most commercial and health care applications. The middle layer provides dimensional stability, sound-absorbing properties, and resiliency under foot. The backing layer provides strength and stability of the flooring and enhances the bonding strength of the adhesive. Mold resistance is conveyed by the addition of a proprietary chemical as a top layer formulation that is applied to the surface of the sheet vinyl through a calendering process. Figures S-1 and S-2 show the front and back surfaces of the material.

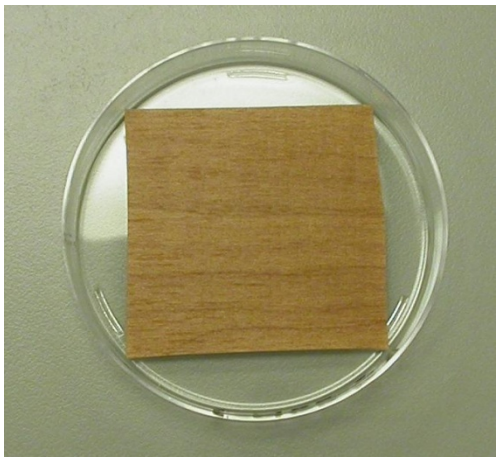

Figure S-1. Front surface of material

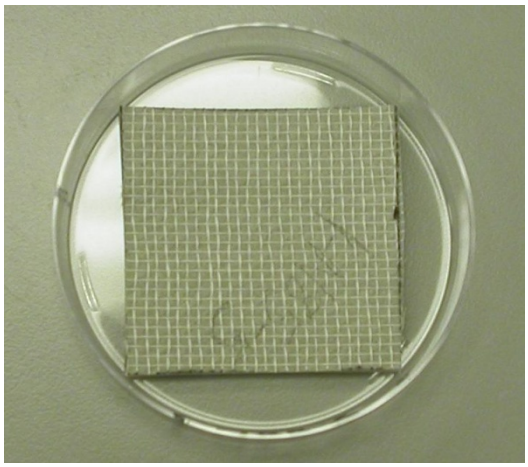

Figure S-2. Back surface of material

VERIFICATION TEST DESCRIPTION

Verification testing of the Lonseal Lonwood Natural flooring began on December 9, 2008 at the microbiology laboratories of RTI International and was completed on March 3, 2009. All tests were performed according to the ETV Program's "Test/QA Plan for Mold-Resistant Building Material Testing." Mold resistance testing was performed following the guidelines outlined in ASTM 6329. ASTM 6329 provides a quantitative endpoint for growth in a well-controlled, static chamber environment. The method has been successfully used to evaluate fungal resistance on a variety of materials including ceiling tiles and HVAC duct materials.

In overview, the Lonwood Natural flooring sheet was cut aseptically with a razor blade into a number of small test pieces (at least 4 cm x 4 cm). The material was not autoclaved or sterilized prior to inoculation. Therefore, in addition to the test organism inocula, any organisms naturally on both the top and bottom surfaces of the material had the opportunity to grow if conditions were favorable for growth. The test organisms were inoculated by pipette directly onto the surface of each test material piece in sufficiently high numbers to provide an adequate challenge, but at a level that is realistic to quantify. The tests ran for 12 weeks. During the 12 week test period, data from four test dates, labeled Day 0, Week 1, Week 6, and Week 12, were evaluated. Day 0 samples provided the baseline inoculum level. A sufficient number of test pieces were inoculated simultaneously for all four test dates. All pieces for one material and one test organism were put in the same static chamber. Because Lonseal is a flooring material, the reference material chosen for comparison was wood.

Two test organisms, *Stachybotrys chartarum* and *Aspergillus versicolor* were used. The static chambers were set to 100% equilibrium relative humidity (ERH) for the tests with *S. chartarum* and to 85% ERH for *A. versicolor*. On each test date (including Day 0), five replicates of the test material pieces were removed from the chamber, each was placed separately in a container with sterile buffer, and extracted by shaking. The resulting suspension of eluted organisms was plated and microbial growth on materials was quantified by manually enumerating colony-forming units (CFU).

The numbers of CFU eluted on test dates Weeks 1, 6, and 12 were compared to the baseline at Day 0. The numbers of CFU were expressed as $\log_{10}$. The results are reported as the $\log_{10}$ change in CFUs between Day 0 and Week 1, Day 0 and Week 6, and Day 0 and Week 12. An extra test date was included to enable the QA review. The review had been scheduled for week 6, however scheduling difficulties made the review impossible on week 6 so additional samples were processed on week 7 for the audit.

Additional measurements included VOC and aldehyde emissions; these were performed by RTI following ASTM D5116-06.

VERIFICATION OF PERFORMANCE

The results for the Mold Resistance tests are presented in the Figures S-3 and S-4. Growth is measured by sporulation and is defined as at least a 1 $\log_{10}$ increase in culturable organism over the baseline which was determined on Day 0.

Figure S-3 shows the log change from the inocula on Day 0 from *A. versicolor* and Figure S-4 shows the log change in the naturally occurring fungi that were on the surface of the material.

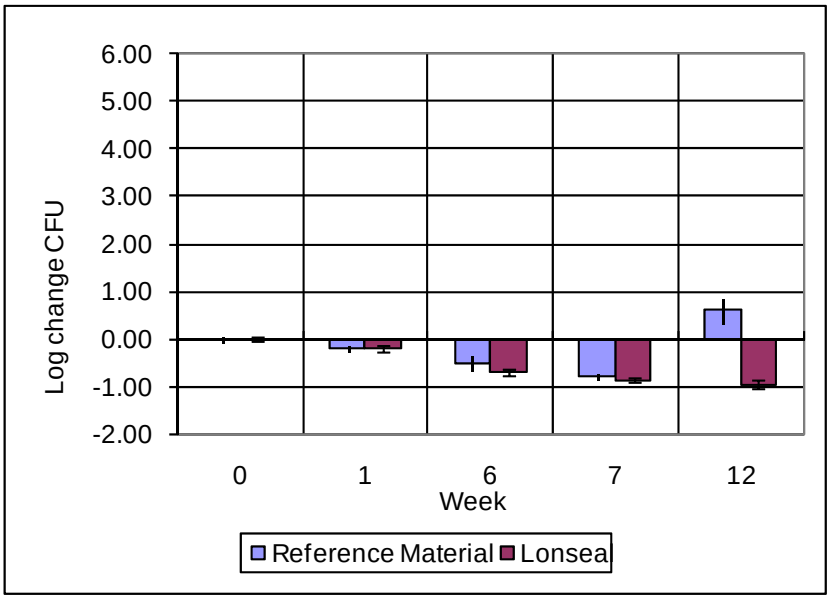

Figure S-3. Log change in *Aspergillus versicolor* inoculated on the test material over 12 weeks on reference material and Lonseal.

Neither the test material nor the reference material inoculated with *A. versicolor* and incubated at 85% ERH showed growth during the 12 weeks of the test. It was important to check that none of the changes made to the test material to make it mold resistant actually enhanced the ability of mold to grow over the reference material.

It was not possible to accurately assess whether or not the test material was resistant to the growth of *S. chartarum*. The growth of a variety of fungal species (naturally occurring on the sample) masked any *S. chartarum* growth on Lonseal and on the reference material.

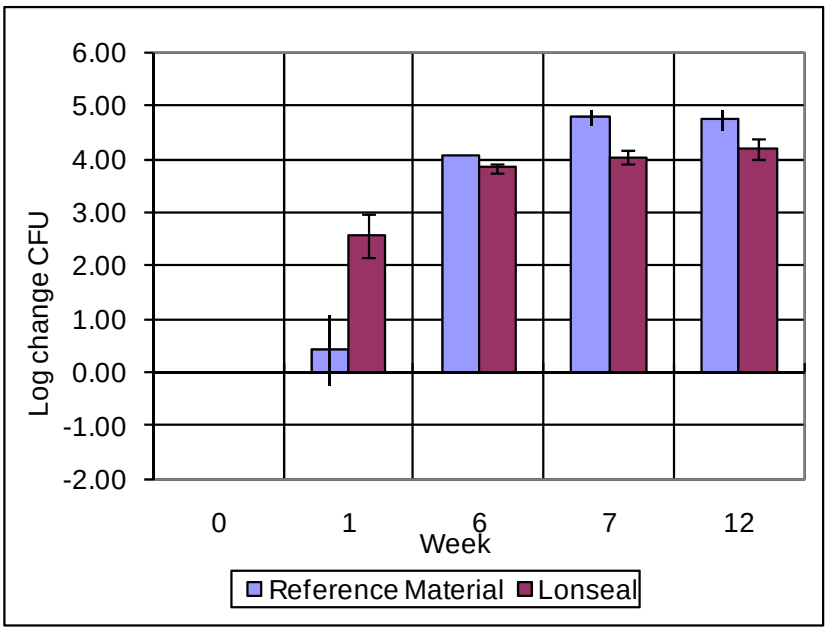

Figure S-4. Log change in *naturally occurring fungi* over 12 weeks on reference material and Lonseal.

The quality assurance officer reviewed the test results and the quality control data and concluded that the data quality objectives given in the approved test/QA plan were attained.

The emissions of VOCs and formaldehyde test results are presented in Table S-1.

Table S-1. Test results for VOCs and formaldehyde emissions from Lonseal

VOCs and Formaldehyde Emissions*	
Emission Types	Minimum emission results
Total VOCs	< 0.5 mg/m^3
Formaldehyde	<0.1 ppm
Individual VOCs	< 0.1 TLV

*Individual pollutants must produce an air concentration level no greater than 1/10 the threshold limit value (TLV) industrial workplace standard (Reference: American Conference of Government Industrial Hygienists, 6500 Glenway, Building D-7, Cincinnati, OH 45211-4438.

This verification statement discusses two aspects of Mold-Resistant Building Material Testing, mold resistance and emissions of VOCs and formaldehyde. Users of this technology may wish to consider other performance parameters such as fire resistance, service life, and cost when selecting a building material. According to the test/QA plan, this verification statement is valid for 3 years following the last signature added on the verification statement.

Details of the verification test design, measurement test procedures, and Quality Assurance/Quality Control Procedures can be found in the Test Plan titled *Test/QA Plan for Mold-Resistant Building Material Testing* (RTI 2008). Detailed results of the verification are presented in the Final Report titled *Environmental and Sustainable Technology Evaluation: Mold-Resistant Lonseal Flooring - Lonseal, Inc., Lonwood Natural* (NRMRL-RTP-460). Both can be downloaded from the ETV Program website (http://www.epa.gov/etv/este.html#mrbmgw).

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