



CONCLUSIONS: Primary Property Assessment

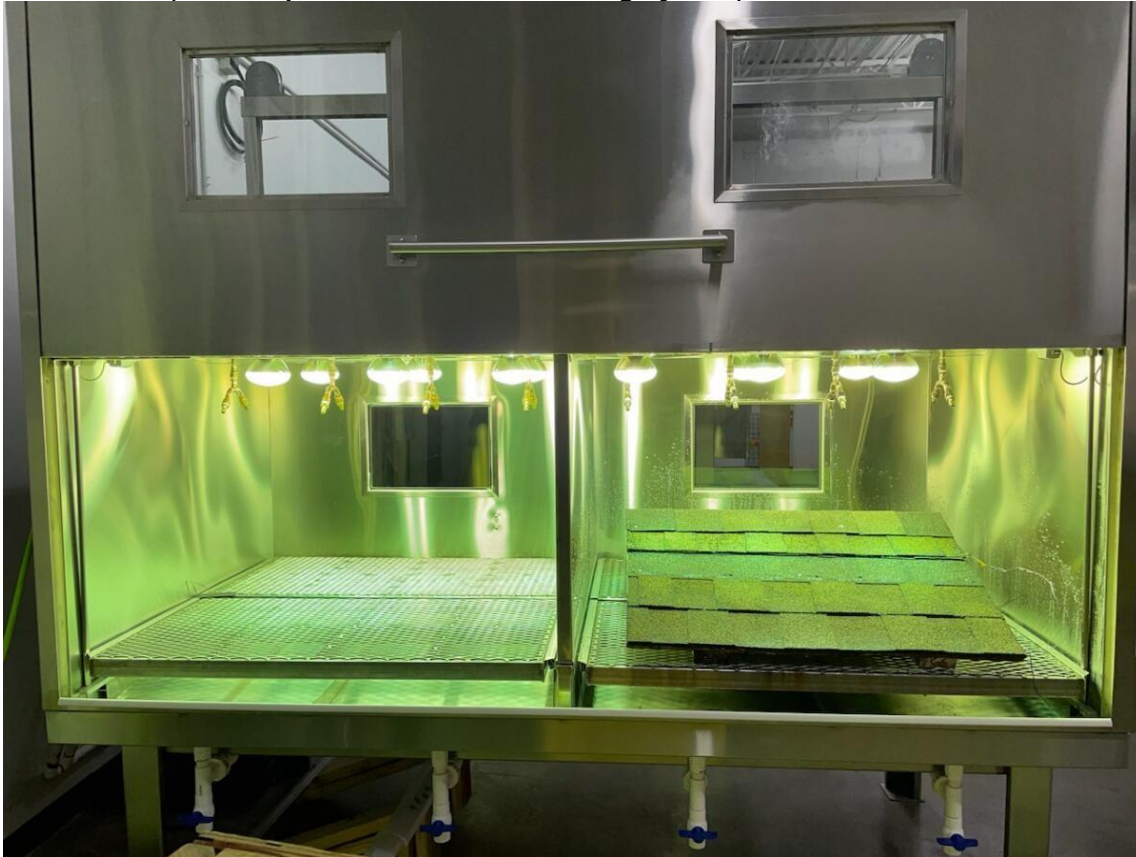
- **Mass Loss:** Mass loss in asphalt shingles is due to both the oxidative aging of the binder and granular loss during the accelerated weathering process.
 - After 1,500 hours of exposure the mass loss of the un-treated shingles was 5.4% compared to 0.5% for the Roof Rejuvenate USA rejuvenator.
 - **Roof Rejuvenate USA Rejuvenator performs 10.8 times better than un-treated shingles**
- **Wash off Material:** The exposure cycles consistently contained particulate material and shingle granules that were washed off by the accelerated weathering process.
 - After 1,500 hours of exposure the mass of the collected particulate from the un-treated shingles was 4.08g compared to 0.70g for the Roof Rejuvenate USA' rejuvenator.
 - **Roof Rejuvenate USA Rejuvenator performs 5.8 times better than un-treated shingles**
- **Oxidative Aging** (Measured by Carbonyl Indices): Oxidative aging in asphalt-based products can be quantified by a peak in a specific position on an FT-IR spectrum.
 - After 1,500 hours of exposure the un-treated shingles exhibited a 30.7% increase in carbonyl index, compared to Greener Shingle's 7.8% increase.
 - **Roof Rejuvenate USA Rejuvenator performs 3.9 times better than un-treated shingles**
- **Shingle Flexibility:** After 1,500 hours of exposure, 5RRI5HMDWH86 Rejuvenator improved low temperature flexibility from -22°F to -31°F.
- **Shingle Color and Appearance:** After 1,500 hours of exposure, the shingles treated with 5RRI5HMDWH86 Rejuvenator exhibit a significantly different appearance than those left untreated.
 - Un-treated shingles show a clear increase in the roofing granules lost. (Appendix A-4)



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APPENDIX

APPENDIX A-3 (PRI – Asphalt Pavement Weathering System):



DISCUSSION:

An open view of PRI's Asphalt Pavement Weathering System with the roof deck positioned in the front chamber (right).

PRI's APWS was used for accelerated weathering of the roof deck after the application and curing of the rejuvenators. The weatherometer is monitored daily for even light distribution and water spray coverage, while temperature of the chamber, roof surface, water, ambient temperature and relative humidity are all tracked continuously.

ACCELERATED AGING PARAMETERS:

PARAMETER	SETTING
<i>APWS Cycle and Climate Information</i>	
Cycle Reference Method	ASTM D4798, Cycle A
Time of UV Light Exposure, mins	51
Time of UV Exposure with Rain Cycle, mins	9
Average Maximum Shingle Temperature, °F (Note 1)	149.5
Average "Rain Rate", gal/hr	12.6

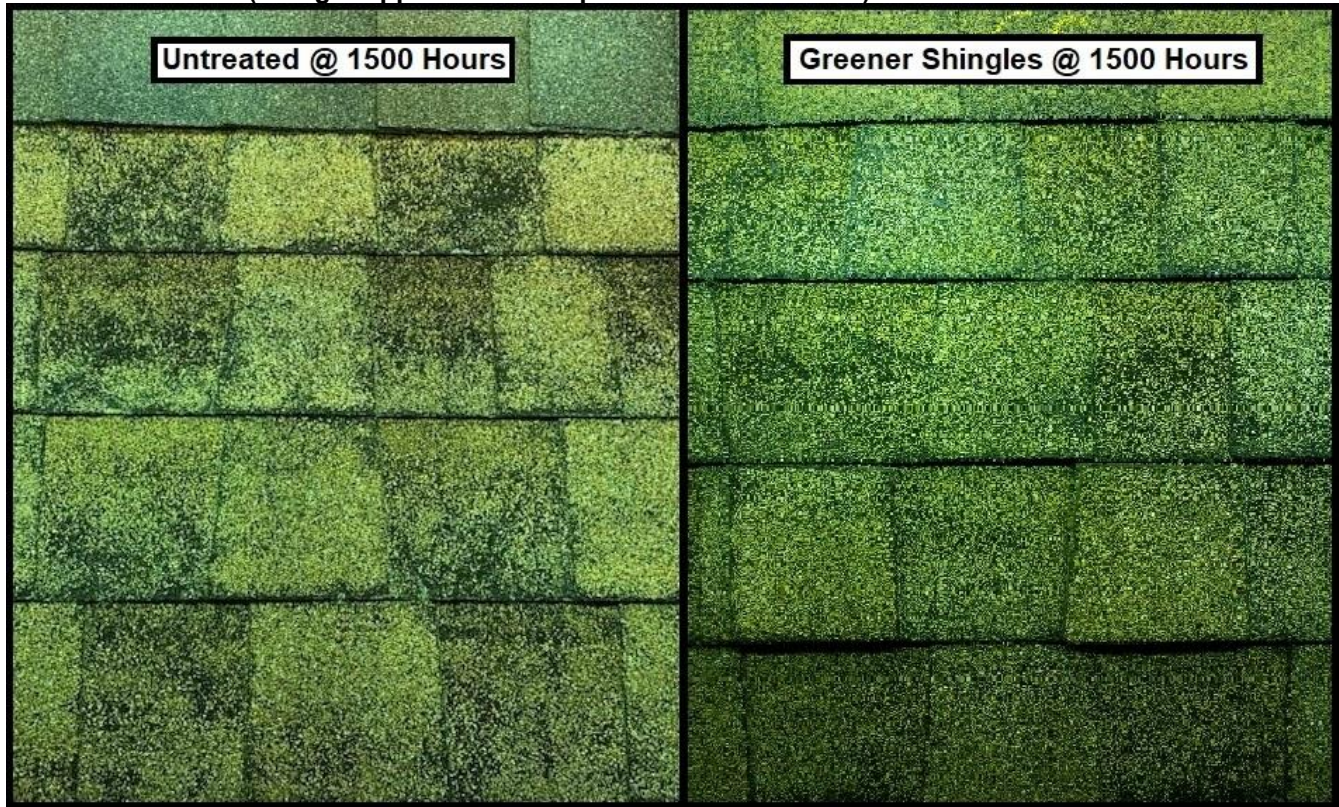
Note 1 – Average Maximum Shingle Temperature is measured by taking the average of the temperature readings immediately before the beginning of the "rain cycle" when the temperature is at its highest level.



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APPENDIX

APPENDIX A-4 (Shingle Appearance Comparison – ~1500 hours):





DISCUSSION:

There is a notable difference in appearance between the untreated and treated shingles after 1500 Hours.



APPENDIX

APPENDIX A-6 (Granular Wash off Comparison – ~1500 hours):

Greener Shingles Rejuvenator	Un-Treated Shingles
 <p data-bbox="363 1081 581 1136">0.70 grams</p>	 <p data-bbox="1040 1081 1258 1136">4.08 grams</p>

DISCUSSION:

Granules and particulate washed from the roof decks after 1500 hours of exposure. Particles have been filtered from the accompanying runoff water and dried for quantification.



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NEXT STEPS:

- Complete 3000 Hours of Aging and subsequent testing.
- Review with Roof Rejuvenate USA.

Tested by:

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Date: July 6, 2023

Reported by:

Steven Loeffler, Client Services Manager

Date: July 6, 2023