

Robert Heppolette PhD.
Heppolette Consulting
Consultant for Chemicals, Paints & Plastics

16 Herne Hill
Toronto ON
M9A 2X1

416 239 8057
rheppolette@sprint.ca

September 12, 2002

Summary of Accelerated Weathering Testing of Nawkaw Corporation's NECT 90 Stains by Bodycote-Ortech

Bodycote-Ortech

Bodycote-Ortech is one of the world's largest independent testing laboratories. It has facilities to cover most industrialized countries.

The report by Bodycote-Ortech was long and technical. As a consequence this report was reduced to its essential components.

Comments on Accelerated Weathering

The QUV and Atlas UVCon Weatherometers are recognized accelerated weathering units to assist in developing and optimizing coatings formulations. It is widely used in a variety of industries. The report by Bodycote Ortech points out that there is no valid correlation between exposure time or total UV exposure in these machines to actual exterior exposure time (Technical Bulletin LU-8030 Q-Panel Lab. Product, Cleveland, OH, 1944). However, a correlation can be achieved by a comparison with field data.

Nawkaw Corporation's Experience

Nawkaw Corporation has extensive real exposure on buildings in both the United States and Canada. Their experience covers about 25 years. Buildings are available for viewing to confirm the accelerated testing.

There was a product change about 15 years ago to a Waterborne Acrylic Stain with a unique additive package. Acrylic stain technology is accepted by the Coatings Industry to be the currently best available for this class of stains. The quality of Nawkaw Corporation's product was originally checked in a QUV Weatherometer, over a decade ago. This data is available for viewing.

The New Test Conditions

This study was commissioned at an independent commercial laboratory to confirm the original data, from an Atlas Weatherometer, and to examine if modifications were justified to further optimize the product in an UVCon unit. This accelerated UV test was carried out at 60 C during the 16 hour daily cycle (equivalent to the sun being directly over head all the time) and at 50 C during the 8 hour moisture condensation cycle. These are considered as severe test conditions.

Robert Heppolette PhD.
Heppolette Consulting
Consultant for Chemicals, Paints & Plastics

16 Herne Hill
Toronto ON
M9A 2X1

416 239 8057
rheppolette@sprint.ca

The test was carried out using ASTM Designation G 53 – 88 which is standard practice for Operating Light and Water-Exposure Apparatus (Fluorescent: UV-Condensing Type) for Exposure of Nonmetallic Materials. In addition ASTM Designation D 2244 – 89

Standard test Method for Calculations of Color Differences from Instrumentally Measured color Coordinates. The data for color change was Delta E as described in the ASTM document.

The Test Results

The overall conclusion from the study was that no changes were warranted to the current products.

The Primary Organic Yellow AX colorant has been withdrawn due to its low usage

The results are presented in both tabular and graphical forms (see attached) for color change (Delta E units) versus UV energy of exposure for the nine “primary” colors that are used to make the complete color product range. The results were based on duplicate panels and the average of eight readings per panel. The stains were applied in a diluted state and the Primary White, Organic Yellow AX, Green and Blue did not completely hide the substrate. These panels also had a large variability in the average readings but this is partly compensated by the number of readings on each panel.


Sample #	Primary Color	Delta E after 183 M χ m2 of total UV exposure	Comments on Appearance
36	White	2.2	The stain did not hide the substrate
37	Black	1.2	Uniform appearance
38	Organic Yellow AX	3.3	The stain did not hide the substrate
39	Yellow Oxide	0.5	Uniform appearance
40	Red Oxide	035	Uniform appearance
41	Blue	2.4	The stain did not hide the substrate
42	Magenta	1.2	Uniform appearance
43	Green	1.4	The stain did not hide the substrate
44	Brown Burnt	1.3	Uniform appearance

Robert Heppolette PhD.
Heppolette Consulting
Consultant for Chemicals, Paints & Plastics

16 Herne Hill
Toronto ON
M9A 2X1

416 239 8057
rheppolette@sprint.ca

Color changes of 2 Delta E units are considered as not visible to the eye while the change of 3.3 units are considered as exhibiting a very small visual difference when viewed side by side from 25 feet away. However if the samples were separated, any difference was barely noticeable.



Robert Heppolette PhD
Consultant to Nawkaw Corporation
2283 Argentia Road, Unit 23
Mississauga, Ontario
L5N 5Z2

The Accelerated Weathering and Durability Tests

The most recent set of accelerated weathering tests were conducted in an **Atlas UVCon Ultra Violet / Condensation Exposure Cabinet MII**.

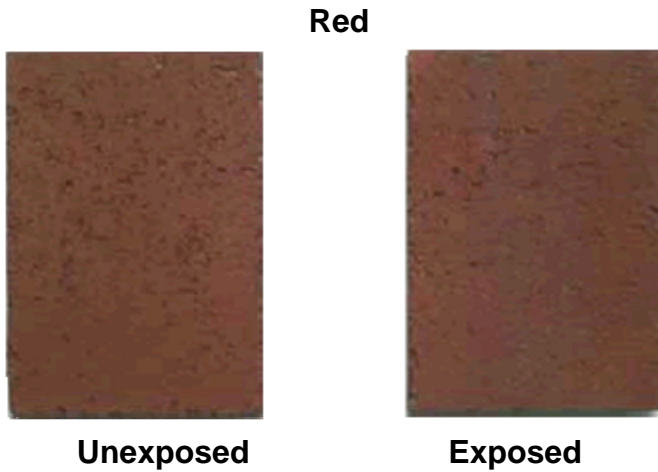
This machine continuously cycles through extreme weather simulated conditions, i.e., UV radiation and elevated temperature and moisture condensation.

This test is widely used in the coatings industry to assess durability of exterior coatings.

Nawkaw had this testing regime extended to simulate **25 years of continuous exposure on a vertical wall**.

At the end of its accelerated weathering exposure testing, the samples are examined for integrity and color fastness.

The results of these tests from our most recent set of exposure tests are shown pictorially:



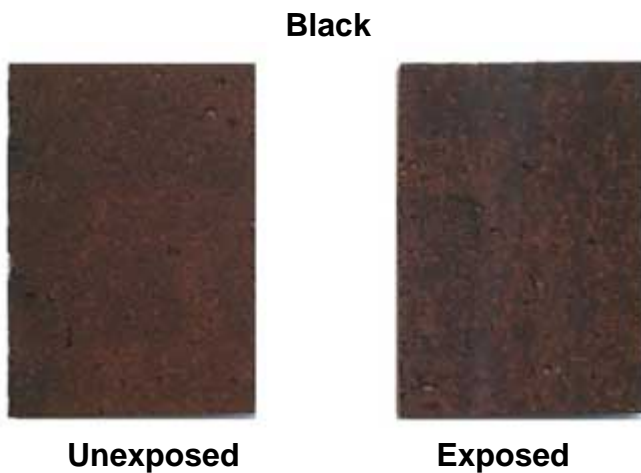
The sample on the left was exposed to no weathering while the one on the right withstood an equivalent of 25 years exposure to sunlight on a vertical wall in the accelerated testing apparatus.

Date of test - October 2000

Testing Facility - Bodycote Materials Testing Inc. - Toronto Canada

UV Radiation cycle 16 hours @ 60 degrees C

Condensation cycle 8 hours @ 50 degrees C



The sample on the left was exposed to no weathering while the one on the right withstood an equivalent of 25 years exposure to sunlight on a vertical wall in the accelerated testing apparatus.

Date of test - October 2000.

Testing Facility - Bodycote Materials Testing Inc. Toronto Canada.
UV Radiation cycle 16 hours @ 60 degrees C
Condensation cycle 8 hours @ 50 degrees C

Yellow



Unexposed



Exposed

The sample on the left was exposed to no weathering while the one on the right withstood an equivalent of 25 years exposure to sunlight on a vertical wall in the accelerated testing apparatus.

Date of test - October 2000
Testing Facility - Bodycote Materials Testing Inc. Toronto Canada.
UV Radiation cycle 16 hours @ 60 degrees C
Condensation cycle 8 hours @ 50 degrees C

White



Unexposed



Exposed

The sample on the left was exposed to no weathering whilst the one on the right withstood an equivalent of 25 years exposure to sunlight on a vertical wall in the accelerated testing apparatus.

Date of test - October 2000.
Testing Facility- Bodycote Materials Testing Inc. Toronto Canada.
UV Radiation cycle 16 hours @ 60 degrees C

Condensation cycle 8 hours @ 50 degrees C

Nawkaw recognizes the need to produce and apply superior products to meet the highest standards to the continuing benefit of our customers and the community.