IPL

Imaging Products Laboratory
CENTER FOR INTEGRATED MANUFACTURING STUDIES

Nekoosa Coated Products Carbonless Media Evaluation

Evaluation Report #: M5126-08

Date: March 07, 2008

3 Part Carbonless Form Image Permanence Evaluation

Media submitted for evaluation by:

Nekoosa Coated Products • 36 Meadow Cove Rd.. • Pittsford, NY 14534

Imaging Products Laboratory
Center for Integrated Manufacturing Studies
Rochester Institute of Technology
133 Lomb Memorial Drive • Rochester, NY 14623-5608
585.475.6091, phone • 585.475.5455, fax
www.cims.rit.edu • reman@cims.rit.edu

R·I·T

ATTN: Iain Craige, Director Sales & Marketing **START DATE:** 02/20/08

Cc: **END DATE:** 03/07/08

Evaluation Setup

Evaluation Description:	Cool White Florescent evaluation of 3 Part Carbonless form samples
Evaluation Protocol:	RIT standard protocols referencing ASTM and ISO standards where applicable.
Manufacturer:	Nekoosa Coated Products
Country of Origin:	USA
Evaluation Printers:	Samples were prepared in accordance with ASTM protocol
Media:	Nekoosa Coated Products- lot #'s U20A011608005, U20B073107003 Superior Brand
Environmental Conditions:	IPL evaluation labs are temperature (73F +/- 3) and relative humidity (45% +/- 10%) controlled. Conditions were monitored using the Preservation Environment Monitor (PEM) developed by the Image Permanence Institute. All equipment and materials are conditioned for a minimum of 24 hours prior to testing.

Evaluation Summary:

This report contains performance data for the image permanence of printed sample media following the Scope of Work between Rochester Institute of Technology, on behalf of the Center for Integrated Manufacturing Studies (CIMS), Imaging Products Laboratory (IPL), and Nekoosa Coated Products dated February 05, 2008.

All sample media were provided by Nekoosa Coated Products identified by media manufacturer.

This report contains the results for the Nekoosa Coated Products media and media labeled as Superior brand.

The results indicate that the Superior brand sample sets had higher delta E's and more noticeable fade in the UV Cool White fluorescence evaluations.

Reference Documents

Industry recognized standards will be followed whenever possible.

ASTM F767-98	Standard Test Method for Image Stability of Chemical Carbonless Paper to Light
ASTM D2244	Calculation of Color Tolerances and Color Differences from Instrumentally Measured Color Coordinates
ASTM D3424	Evaluating the Relative Light Fastness and Weatherability of Printed Matter
ASTM F2036-00	Evaluation of Larger Area Density and Background on Electrophotographic Printers
ISO 12640	Graphic Technology – Prepress digital data exchange – CMYK standard colour image data

Test Equipment

The following is a list of test equipment used in this evaluation.

Color / Optical Density	X-rite 939 Spectrodensitometer
Cool White Flourescent Exposure	QUV Accelerated Weathering Tester
Lab Environment	Image Permanence Institute (IPI) Preservation Environment Monitor (PEM)

Imaging Products Laboratory at RIT-CIMS

The Imaging Products Laboratory (IPL) was established to develop, evaluate and apply cost-effective, innovative technologies for the imaging industry. IPL transfers the benefits of ongoing research and development to its clients through a collection of analysis, evaluation, and industry outreach services.

IPL Facilities and Capabilities

- 170,000 square-foot facilities, including technology bays, specialized applied technology laboratories and a state-of-the-art training center.
- ASTM, ISO, ISTA, TAPPI, DIN and customized evaluations, including ASTM F1856, ISO 19752, ISO 19798, and ISO 24711
- Over 300 toner and inkjet printers
- Environmental chambers: Xenon Arc UV, ozone, temperature, humidity, altitude
- Image quality measurements using an ImageXpert full motion system
- Ink and toner physical properties and chemical analysis
- Monochrome and color cartridge test capabilities
- Substrate physical properties

Independent 3rd Party Analysis & Evaluation

- Best-value component determination
- Component interaction and optimization
- Objective analysis of performance and reliability
- Value engineering to reduce cost and improve reliability
- Prototype evaluation
- Life cycle analysis (LCA), Environmental Impact
- Critical-to-function attribute evaluation
- Total cost of ownership
- Failure modes and effects analysis (FMEA)
- Quantitative analysis of image quality
- System-level diagnostics
- Competitive performance evaluation
- Color gamut analysis
- Component recover and reuse development
- Statistical DoE process optimization
- Image permanence (UV, ozone)
- Runnability and media performance

Contact Information
Phone: (585) 475-5385
Fax: (585) 475-5455
E-mail: info@cims.rit.edu

Rochester Institute of Technology (RIT)

Founded in 1829, RIT is an internationally recognized research university with over 15,000 students taking course of study in 350 programs in eight colleges. The university is well known for its research and educational programs in imaging and color science, including ground breaking work in imaging portions of the Dead Sea Scrolls. Centers that concentrate on imaging include the Imaging Products Laboratory (IPL), Image Permanence Institute (IPI), the Center for Imaging Science (CIS), the Printing Applications Laboratory (PAL), and the Munsell Color Science Laboratory. RIT has one of the nation's oldest cooperative education programs, was the first university in the world to offer a Ph.D. in color science and is now developing the first Ph.D. in sustainability. The university also offers leading programs in photography, printing, graphic design, and microelectric engineering.

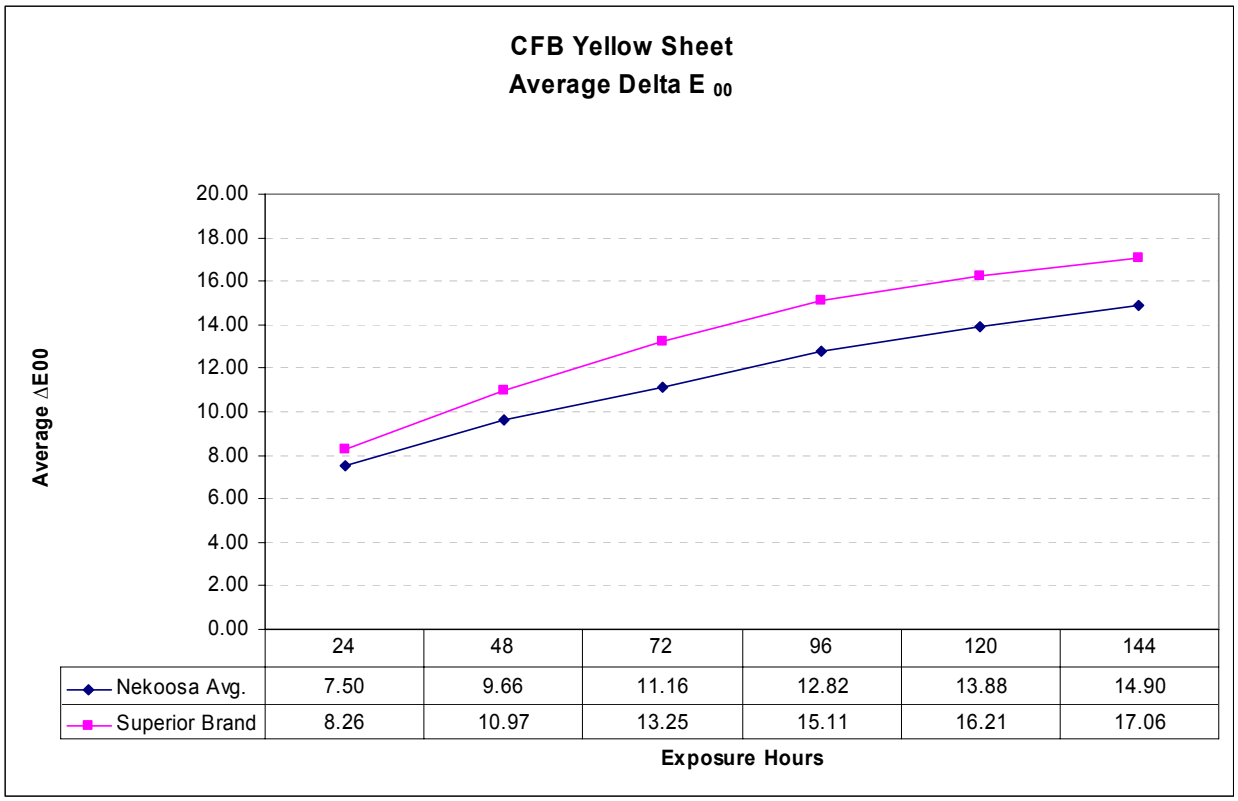
Ultraviolet Light Exposure – Cool White Flourescent

Light-fastness testing evaluates the performance of a sample exposed to an increased level of UV light, simulating years of cumulative exposure. Accelerated exposure testing assumes that the effects of exposure are cumulative in nature. Thus, exposure at high intensity light for a short period of time is the same as low exposure for a longer period of time. Reciprocity failure occurs when a sample fades faster than was predicted through accelerated testing. Reciprocity failure is always a concern when performing accelerated life testing and, for this reason, comparative analysis is preferred to stating specific sample life spans.

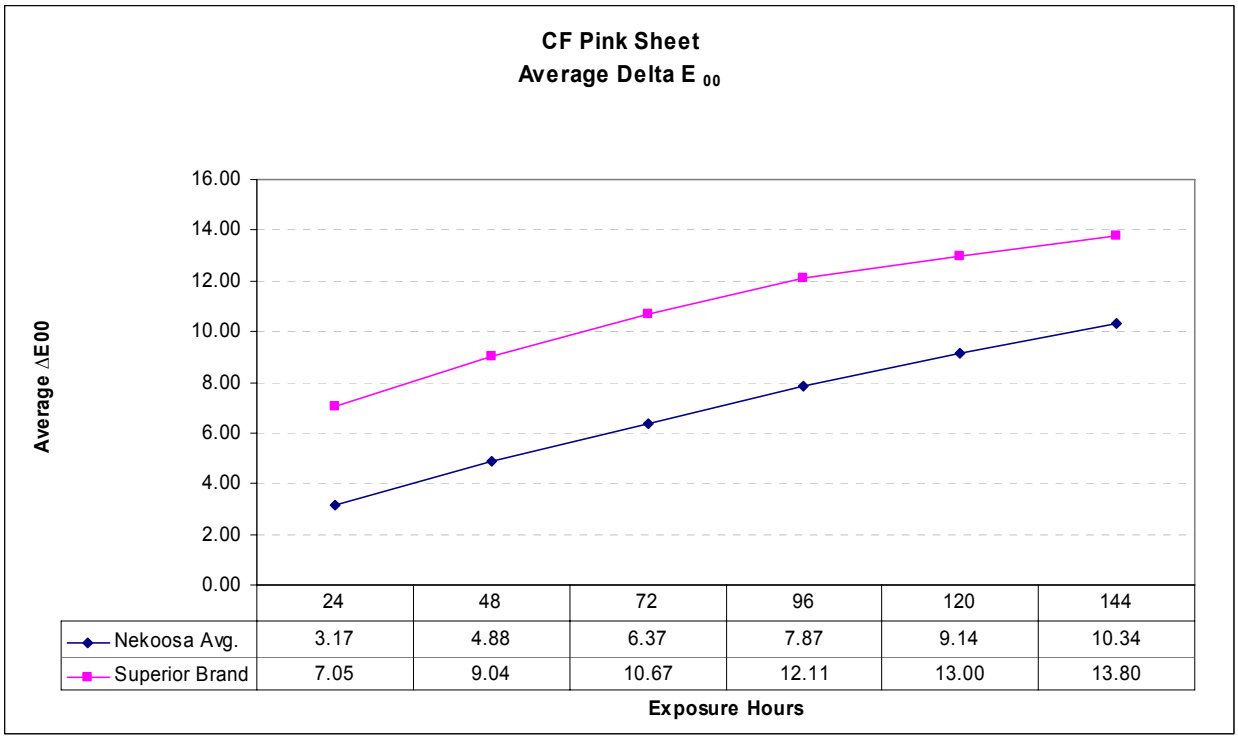
The evaluation references ASTM F767-98 test method. For this evaluation, samples are exposed in a QUV Accelerated Weathering Tester chamber for 144 hours at 40°C and irradiance set to 0.60 x 10^4 lux. An X-Rite spectrodensitometer is used to measure L*, a*, b* units for the sample impression. ASTM D2244 is used to calculate the CIELAB color difference, Delta E 2000 (ΔE_{00}) at 24, 48, 72, 96, 120 and 144 hours of UV exposure.

The CIELAB color difference, ΔE_{00}, is calculated between each sample at the beginning of the test, and at the specified measurement interval. ΔE_{00} is a single number that expresses the magnitude of the difference between two colors. There is no recognized correlation between the magnitude of ΔE and the observed difference. It is our experience however, that values of ΔE less than 0.5 can be due to variations within a sample, or measurement, ΔE less than 2.5 are typically not visible, ΔE around 5 are just noticeable, and anything over 10 is very noticeable and could be considered objectionable. These levels are subject to change depending on the application, but provide a guide when looking at the data.

The results indicate that the Superior brand sample sets had higher delta E's and more noticeable fade in the UV Cool White fluorescent evaluations.



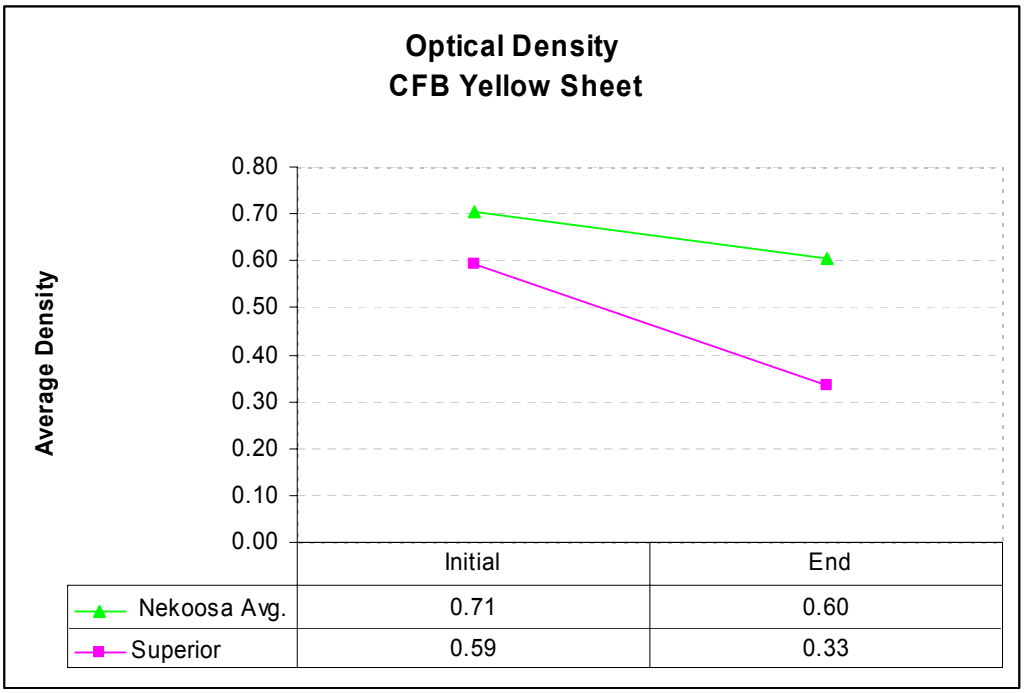
	24	48	72	96	120	144
Nekoosa Avg.	7.50	9.66	11.16	12.82	13.88	14.90
Superior Brand	8.26	10.97	13.25	15.11	16.21	17.06



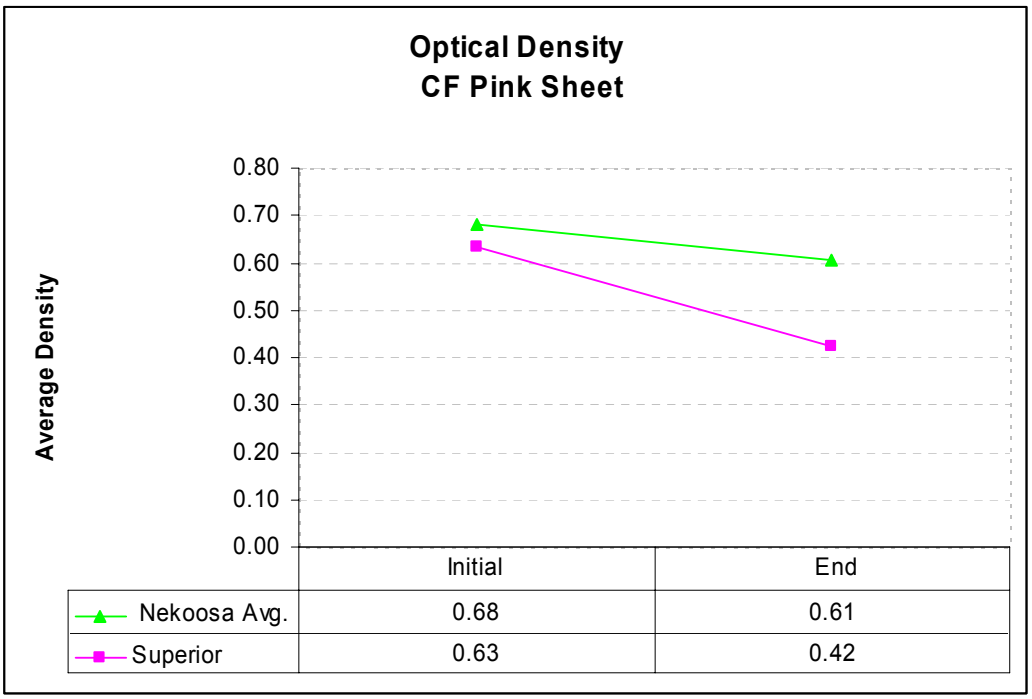
	24	48	72	96	120	144
Nekoosa Avg.	3.17	4.88	6.37	7.87	9.14	10.34
Superior Brand	7.05	9.04	10.67	12.11	13.00	13.80

Optical Density

Density is the ability of a material to absorb light – the darker it is, the higher the density. An X-Rite spectrodensitometer was used to measure the optical density for the sample. The diffuse reflection density is the logarithm of the inverse of the ratio of the reflected light to the incident light.



	Initial	End
Nekoosa Avg.	0.71	0.60
Superior	0.59	0.33



	Initial	End
Nekoosa Avg.	0.68	0.61
Superior	0.63	0.42