National Association of Printing Ink Manufacturers

NATIONAL ASSOCIATION OF PRINTING INK MANUFACTURERS
napim
180 Admiral Cochrane Drive, Suite 370, Annapolis, MD 21401

December 30, 204

Ms. Kim Morley (kmor461@ecy.wa.gov)
State of Washington, Department of Ecology
Hazardous Waste and Toxics Reduction Program
P.O. Box 47600 Olympia, WA 98504-7696

Ref. Washington State Department of Ecology – Draft Regulatory Determinations Report to the Legislature – Safer Products for Washington Implementation Phase 3

Dear Ms. Morley,

National Association of Printing Ink Manufacturers (NAPIM)

NAPIM is a trade association representing the United States manufacturers of letterpress, gravure, lithographic, flexographic and digital printing inks. The association was formed in 1917 and is comprised of ink producing member companies representing 80+% of U.S. manufactured printing inks. Membership also includes members who are suppliers (e.g. specialty chemicals, ink-related raw materials, etc.) to the ink manufacturing industry.

Overview/Summary

As we indicated to Ms. Niemi on January 28, 2022 (attached) the association continues to dispute the conclusions outlined in Chapter 2 – Priority Product: Printing Inks of the June 2022 report (Publication 22-04-018). In our view these conclusions show a fundamental misunderstanding of ink formulation, color science and production of commercial and packaging printing. Specifically, there is no valid, scientific basis for the subject report's conclusion that non-inadvertent polychlorinated biphenyl (iPCB) or non-chlorine containing inks are feasible and available as total market replacements for all current ink systems. The very limited number of inks tested for this report were of indeterminate type and are not representative of the wide range of commercial and packaging ink systems currently being sold for modern printing applications. In addition, assumptions contained within the report relative to pigment compatibilities across inks systems is incorrect.

Discussion

There are multiple, major Ink types: lithographic, letterpress, flexographic, gravure, screen and digital. Within each of these categories there are subcategories including conventional/oil-based, energy curable (both ultraviolet cured and electron beam cured), water based and solvent based systems. Major ink types are not interchangeable (e.g. a flexographic ink cannot be used on an lithographic press, etc.) and have very different chemical compositions.

The raw material selection process for each of these ink systems is critically important and different for each system. Minimally, the selection of the component raw materials is driven by the print process to be used, printing substrate, color specifications, printed article performance properties, end use requirements, costs, etc. In the design of any multi-component system individual materials compatibilities is a critically important consideration. Input raw materials, including pigments, that function well in water-based inks cannot generally be used effectively in oil-based or solvent based systems.

Printing ink pigments are organic chemicals and while they are synthesized to be inert – the synthesis is predicated on a specific target medium (described above). Paste inks use oils for solvents, fluid inks may use water or alcohols for solvents, energy cured inks use monomers as solvents. A pigment that is stable in an oil (e.g. PY12, etc.) will be dissolved and lose all color in alcohol. This is similar for blues and particularly so for magentas.

Following are descriptions from the *Printing Ink Manual* on the pigment selection process for gravure and flexographic inks:

Gravure ink pigment selection - "The initial factor in pigment selection is that it should be chemically suitable for the end use application e.g. an acidic pigment should not be adopted for a design requiring alkali resistance. Secondly, the pigment should disperse readily in the selected vehicle system giving an ink with near Newtonian flow properties which when reduced to press viscosity will give good gravure printability. Thirdly, the pigment must exhibit good dispersion stability both as ink supplied and also at press viscosity since press returns may be stored for lengthy periods prior to reuse[1]."

Flexographic ink pigment selection - "Pigments used in flexographic inks will have similar specification requirements to those used for other processes. Irrespective of the properties required by the end use of the print, suitable pigments will be chosen for their wettability and dispersion characteristics in the various solvents and resins systems that are used[2]."

Another important pigment consideration is surface chemistry. Ink system pigment concentrations (especially in the 15% - 25% range) require critical adjustments to pigment surface chemistry necessary to keep the pigments in solution. Pigments do not like to be separated they want to flocculate and agglomerate. These surface chemistries differ between pigment type and ink system which means each ink and pigment combination are unique to that application.

Furthermore, the pigment selection characteristics and processes noted above are similar for all types of commercial and packaging inks, which cover a range of printing application technologies.

In consideration of Ecologies statements in the draft report regarding composition similarity of ink systems please note that the reference, (NAPIM, 2019 p.67), in the draft report ((Publication 22-04-018) points to a presentation made to the DoE in 2019 by NAPIM. This presentation was intended as an introduction to printing ink and printing ink manufacturing. It made of use of simple, example ink formulations intended to illustrate the basic structure and composition of various ink types. These basic

[1] "Printing Ink Manual Fifth Edition" ed. R.H. Leach, R.J. Pierce, (Blueprint – an Imprint of Chapman and Hall), 491

[2] Ibid, 562

examples were meant to show the basic chemical types and percentages and in no way intended to represent any production ink system.

It is critically important that Washington State Department of Ecology recognizes the sophistication and technological complexities with modern ink and print technologies. Following is a partial listing of critical properties that are monitored and measured by brands and other print buyers. All are effected by pigment selection.

Print Performance Characteristics and Measurement

Ink Adhesion and Transfer:
How well the ink adheres to the substrate surface, ensuring crisp and clear printed images without smudging or bleeding.

Color Quality:
The ability of the substrate to accurately reproduce colors from the print file, maintaining consistent color across the printed area.

Dimensional Stability:
Resistance to warping, shrinking, or stretching after printing, crucial for maintaining precise print registration.

Surface Properties:

- Wettability: How well the substrate surface interacts with the ink, influencing its spreading and penetration.
- Work of Adhesion: The force required to separate the ink from the substrate surface.

Mechanical Properties:

- Tensile Strength: Ability to withstand pulling forces without tearing.
- Tear Resistance: Resistance to tearing along edges

Chemical Resistance:
How well the substrate withstands exposure to chemicals without degradation.

Printability Measures:

- Minimum Line Width: The smallest width of a printed line that can be accurately reproduced
- Minimum Gap Width: The smallest space between printed lines that can be maintained
- Dot Gain: Change in dot size during printing process, affecting color accuracy

Color Measurement in Print Applications

Brands and other print buyers specify exact color tolerances to be met before acceptance of any print job. These color specifications have been developed by exhaustive and expensive market surveys and analyses. Color (produced by a specific pigment in the ink) in print applications is measured with highly sensitive and sophisticated analytical equipment:

Colorimeter:
A colorimeter can measure the absorbency of light waves. During colour measurement the change in the intensity of electromagnetic radiation in the visible wavelength region of the spectrum after transmitting or reflecting by an object or solution is measured.

Densitometer:

A reflection densitometer is used to measure color through red, green and blue filters, similar to those used for color separation, to provide press operators with quantitative actionable feedback. Densitometers measure changes that result from mechanical changes on press, including solid ink density, tone value increase/dot gain, and ink trap.

Spectrophotometer:

A spectrophotometer measures the percentage of light reflected or transmitted from the print wavelength by wavelength within some subset of the visible spectrum for the primary purpose of computing colorimetric values. This data can be plotted versus the corresponding wavelength to form a spectral curve and be used in computing the color stimulus function for various illuminants and then combined with an appropriate standard observer function. Most commercially available spectro-colorimeters measure from 400 nm to 700 nm and sample the reflectance curve at 10 nm inter

Conclusion

There are critical, functional differences among commercial and packaging ink types. Commercial and packaging printing inks are complex, multi-component systems which are specifically formulated to meet critical end-use properties and requirements. They are not generic, interchangeable commodity products.

In addition, banning the use of chlorine-containing pigments in inks and print applications would cause broad disruption and increased costs in the critically important print market which among other benefits provides essential product safety and health information to consumers.

There are approximately 240 US ink companies. Small ink companies can have thousands of significantly different formulations for multiple ink types, larger companies can have 10 times that number or more (see October 18, 2021 memorandum Fuchs to Niemi attached). DoE's test sample of twenty ink systems is not sufficient as the basis for regulating commercial and packaging ink systems. Therefore, additional sampling and testing of representative inks needs to occur before DoE can validly conclude that non-iPCB or non-chlorine-containing ink systems are feasible and available. Ecology has not established sufficient data to move forward with a regulation.

George Fuchs
Director – Regulatory Affairs and Technology

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January 28, 2022

Cheryl A. Niemi
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Overview/Summary
In our view, the conclusions outlined in Chapter 2 – Priority Product: Printing Inks of the subject draft report show a fundamental misunderstanding of ink formulation, color science and production of commercial and packaging printing. Specifically, there is no valid, scientific basis for the subject report's conclusion that non-inadvertent polychlorinated biphenyl (iPCB) containing inks are feasible and available as total market replacements for all current ink systems. The very limited number of inks tested for this report were of indeterminate type and are not representative of the range of commercial and packaging ink systems currently being sold. In addition, assumptions within the report about pigment compatibilities across inks systems is incorrect.

Discussion
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<u>Conclusion</u>

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George Fuchs
Director – Regulatory Affairs and Technology