NATIONAL ASSOCIATION OF PRINTING INK MANUFACTURERS
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Ref. Washington State Department of Ecology – Draft Regulatory Determinations Report to the Legislature – Safer Products for Washington Implementation Phase 3

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

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

<u>Conclusion</u>
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.

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

[2] Ibid, 562

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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 a complete understanding of the range of potential PCBs in ink systems can be correctly understood. Ecology has not established sufficient data to move forward with a regulation.

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