

# **Inadvertently Produced PCBs in Inks and Pigments. Partnerships for Innovative Solutions**

Room 401, Spokane Convention Center, Spokane WA

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Workshop Facilitated by Lisa Dally Wilson, Dally Environmental

WebEx Facilitators: Dr. Amelia Nestler, NGC and Maria Blackshear, WA Dept of Ecology

Notes prepared by Kara Whitman, Washington State University

## **Session 1: Framing the issues and public policy challenges.**

**Welcome: History of the Task Force. Why are we here?** Mike Petersen of the Lands Council provided an introduction to the Spokane River and the work of the Spokane River Regional Toxics Task Force (Task Force). See iPCB Workshop presentation 1.

**PCBs in our Environment: Spokane River, the US and Globally. Dr. Lisa Rodenburg, Rutgers University.** Dr. Rodenburg provided her technical expertise on inadvertent PCBs and the disconnect in the Toxic Substances Control Act which allows the production of inadvertent PCBs may not be protective of water quality or assist in meeting the water quality standards for PCBs when considering their potential interaction and pathway to water and the environment. Key conclusions to consider: “Aroclors are still usually the main source of PCBs; Inadvertent PCBs are showing up nearly everywhere; But maybe they’re just coming from blank contamination?; It’s not just PCB 11; Some of the most common iPCBs are not bioaccumulated as efficiently as other PCBs; Not a lot known about the toxicity of iPCBs, but what we know isn’t good” (slide 27). For more detail on this presentation, see iPCB workshop presentation 2 “ Inadvertent PCBs: An Introduction” by Lisa A. Rodenburg.

## **Q&A/Comments**

- Q. There are higher PCBs during storm event? What causes this? A. Washed off the land (not generated).
- Q. PCBs that are metabolized have not gone away, where are they? A. PCBs left over after metabolism is done ends up as feces to wastewater treatment. There is a lot of PCBs in wastewater. The lower level molecular weight PCBs are more hydroxylated and have toxic effects, but also flush through the organism more readily. Measuring hydroxylated PCBs is very difficult.
- C. Measurements in the water for PCBs. Using EPA method 1668, yields an error that is less than a picogram per liter per congener – raw detection. The problem is that you are running 200 pg./L, but in the blanks, there is like 80 or 90 from blank contamination. Detection is not a problem; blank contamination is the challenge. We estimate uncertainty at between 5 and 20%. When using the sum of the PCBs, then it is lower.
- Q. Are there sources of PCB 11 besides pigments? A. I have not seen it come from anywhere else besides pigments. PCB 11 leaches out of products readily. Q. What is the source of PCB 11 when there is a storm event? A. During a storm event, in some places, wastewater is overflowing – washing from streets as well as wastewater combined sewer and running off.
- C. Mass coloration of clothing is not done with pigments, it is done with dyes. When stuff is printed on the outside of clothing this is done with the same process with pigments.
- C. There has not been much done in making new pigments/replacements for this.

## **PCBs in our Watershed, PCBs in Products, and TSCA Exclusions: Putting it all Together.**

**“Water Quality Standards and PCBs: Inadvertently Produced PCBs Workshop: Partnerships for Innovative Solutions” Cheryl Niemi (Water Quality Program, WA Dept. of Ecology).** This presentation provided an overview of Washington’s Water Quality Standards (WQS), permitting under the National Pollutant Discharge Elimination System

(NPDES), and the freshwater PCB criteria for human health and aquatic life. The presentation also covered the Spokane 303(d) listing and what this means for permits. The presentation also shortly discussed the disconnect of TSCA requirements, consumer choice, and PCB contamination in the Spokane River. To see more detail from this presentation, see iPCB workshop presentation 3 “Water Quality Standards and PCBs: Inadvertently Produced PCBs Workshop: Partnerships for Innovative Solutions” by Cheryl Niemi.

**“Local Tribal Standards - Fish Consumption and Water Quality” by John Sirois, Upper Columbia United Tribes.**

Note: John Sirois was unable to attend the workshop therefore there is no presentation 4.

**“PCBs in our Watershed, PCBs in Products, and TSCA Exclusions: Putting It All Together” by Dave Dilks of LimnoTech, Inc.** Dave’s presentation addressed the key questions: Are iPCB concentrations exceeding allowable levels in consumer products, and are iPCB concentrations at problematic levels in the Spokane River? Dave concluded the presentation by asserting that many consumer products tested had detectable PCBs, however none of these exceeded TSCA standards. Also, PCB-11 was the dominant congener present in water throughout the Spokane River and PCB-11 has the highest water column concentration of all PCB congeners. Allowable levels of PCBs in products are 150 million to 360 billion times larger than allowable levels of PCBs in the water entering the river from the Spokane area. PCB-11 concentrations alone exceed EPA criterion for total PCBs. However, PCB-11 is not a large contributor to fish tissue PCB concentration. Simple conclusion is that iPCBs are not exceeding what is allowed in products, however they are seen at problematic levels in the Spokane River. For more detail on this presentation, see iPCB workshop presentation 5 “PCBs in our Watershed, PCBs in Products, and TSCA Exclusions: Putting It All Together” by Dave Dilks.

#### **Q&A/Comments**

- Q. Are the PCB measurements that have been taken upstream and downstream single one-time measurements or over time? A. These measurements are based on 3 years of synoptic surveys – summer dry flow conditions, which are not influence by wet weather events. In 2016 they had one sampling event that had high flow. Q. Do you have a concentration gradient for the river, and have you looked at what occurs at interim locations across the river? A. Yes, we see a gradual increase through the river system – of Total PCBs, including groundwater sources.
- Q. If you took PCB 11 out of the equation, how bad would it be? How high is it if you take out PCB 11? What about Biosolids? A. It is still bad, there are other PCBs that contribute to the elevated levels. We have not tracked the biosolids. This would be a good question to ask the biosolids folks.
- Q. The driver for WQS was fish consumption, different PCBs bioaccumulate in the fish. Is there any interest in reviewing the standards for different PCBs? Does it make sense to have a limit of 7 pg./L when not all PCBs bioaccumulate the same way? A. It has to do with the cancer slope factor, PCB 11 is not reflected as well in the cancer slope factor. EPA would have to take this on if it was to be looked at. C. Lisa Rodenburg noted that at this point the WQS for PCBs is based on cancer risk. There are many other risks of PCBs that are not cancer, such as neurological risks with PCB 11. When we calculate criteria, we calculate for the different effects and choose the most protective criteria (i.e. cancer, immune responses, etc.).
- Q. How will the pollutant reduction plans be developed? A. Cheryl explained that they are not voluntary, they are required as part of variance. They have adopted new regulations that expanded the requirements that includes variances which require a pollutant minimization plan. The requires a schedule for development of the plan, then Ecology reviews the application. They are entering a rulemaking process now. By the time we go out with a rule, we must have the minimization plan as part of the rule with a list of discrete activities for the full duration of the variance. Permits are enforceable and they also require adaptive management (monitoring, new technology, alternatives etc.).

- Q. If fish consumption is the driver, what is the rate? A. The fish consumption included in the equation is a part of the equation at 175 grams per day. The criteria account that they can come from just about anywhere. For the cancer-based values, the risk level is a strong driver in the equation.
- Q. Do you know what the other levels of PCBs around WA? What are the consequences of a community being over the WQS and for a discharger over the limit? A. The water column in the Spokane River on average is generally low, however it has higher than average in fish tissue concentrations. Q. What is the consequence(s) of being over the WQS? The Spokane river is “impaired” based on the old standard of 170 ppq. This would require a TMDL study – however the Spokane area is using a “Straight to Implementation” approach. The dischargers are currently meeting the old permit limits. They are being revised through the permit process (2021) with the permit limits of 7 (not based on a variance). Outcome is using a method for compliance that does not that gets us down to the lower numbers (EPA method 608 – quantification for that is 50,000) compliance assessment level is 50,000. Would not use method 1668 for compliance, would use method 608.
- Q. Is WA WQS on PCBs more stringent than other States? A. There is a lot of variability in WQS across the US. Some states use different consumption levels. The old EPA values are still used in some States. In the Great Lakes you will see similar standards. New York State has a WQS of 1 pg./L, Delaware is around 15 pg./L... so WQS for WA are fairly typical.

### **Spokane River Case Studies.**

***“Characterization of PCBs in the Spokane County Regional Water Reclamation Facility: Discussion of 2019 Annual Report Findings” by Amy Sumner.*** Amy Sumner provided an overview of what they know to date about PCBs that enter (influent) and leave (effluent) the Spokane County Regional Water Reclamation Facility. They know that PCBs appear to be caused by many distributed sources, Aroclors and Aroclor mixtures appear to be the main source of PCBs, and PCB 11 also appears to be a main source but is not associated with Aroclors. Sumner also noted that PCB sources have not changed over time, and they vary by land use. It does appear that PCB-11 is decreasing over time in the influent, and they are able to treat out about 98% of PCB-11. For more detail on the presentation see iPCB presentation 6 *“Characterization of PCBs in the Spokane County Regional Water Reclamation Facility: Discussion of 2019 Annual Report Findings” by Amy Sumner.*

### ***Q&A/Comments***

- Q. In residential areas is there an increase in flows due to development? A. Yes, there is an increase in total, some of the decrease could be due to dilution. Q. have there been any major collection maintenance projects? A. So far, there is no infiltration into the system.
- Q. Where is the 1254 spikes in effluent coming from? A. Track down sampling has been sporadic and has not been conducted at same time as effluent sampling.
- C. Pigment and Dyes are very different, so make sure to distinguish between the two!
- Q. Spokane County has a very good treatment with high level of PCBs, is this true for other water treatment plants? A. As a result of a DOTMDL, all the permittees are in different points at applying a next level of treatment. In part this is affecting the removal rate of PCBs. Coeur d’Alene just put in a membrane system, which removes virtually all the solids.
- Q. When Spokane County did the blank correction, did they use subtracting or censoring methods? A: It depends, they used subtraction method then censoring. Q. Could the PMF readings be ghost readings? Are they showing up as a result of the mathematics? A. there are many ways to do blank correction in the water column of the river, it does not matter how you do the blank correction, no method will make PCB 11 go away. The bottom line is that PCB 11 is in the river and it is coming from somewhere.

**“Recycled paper and Waste Stream” by Doug Krapas of Inland Empire Paper.** Doug Krapas presented an overview of the sustainable approach Inland Empire Paper (IEP) uses in the production of their products. He also discussed the challenges that their company faces with the use of recycled paper products. They have limited options for best management practices due to the inadvertent generation of PCB’s in inks and pigments, and their use in paper products that they recycle. There are no known technologies to remove enough PCB out of effluent water to attain the WQS. Elimination of recycling and use of virgin wood to create their products would solve the PCB challenge but is not desirable and would not ultimately solve the problem. Dave proposed two main areas to begin to address this challenge: Technical solutions and regulatory/policy level solutions.

Technical:

- Use/develop alternative non chlorinated products.
- Use/develop products w/reduced levels of PCBs.
- Develop new end of pipe treatments.

Regulatory/Policy:

- Perform risk assessment of iPCB congeners.
- Do not regulate lower congener PCBs.
- Regulate only the 12 Dioxin like PCBs.
- Establish lower TSCA thresholds.
- Rulemaking to bring CWA & TSCA regulations on PCBs into conformity, if environmental or health risk is demonstrated.
- Provide NPDES permit Offsets/Exclusions for iPCBs.
- Encourage End-Users to use lower or non-chlorinated containing products (Publishers, Printers, Packaging, State’s, etc.).
- Incentivize competitive marketing advantage with use of non-PCB containing products.

For more detail on this presentation see iPCB presentation 7 “ Recycled paper and Waste Stream” by Doug Krapas, IEP.

**“Challenges in Navigating WA Purchasing Policies for PCBs: Steve Jones Hamilton Manufacturing.** Steve Jones and Mathew Smith gave a presentation on Hamilton Manufacturing, their sustainable business model, their use of recycled materials in their products, and the impact of potentially having PCBs in their products due to recycled materials use. The use of green coloring is part of a regulatory requirement in hydro-mulch so that you know when and where it has been applied (later in the workshop found out that hydroseed is colored with dye, not pigment). They use 50 – 60% cardboard and some recycled newsprint. They use 13 million pounds of recycled paper from the Pacific Northwest (including WA). They are a major user of recycled materials (mainly cellulose in the US). If there is PCBs coming from hydro mulch, the question is, how much of that interacts with water and ends up in groundwater or the river? They added that photodegradation must be considered as hydro-mulch is exposed to sunlight. The mulch industry is under very strict guidelines to be approved. For more information see the iPCB presentation 8 which is a Subtitled webinar about Hamilton Manufacturing.

**Q&A/Comments**

- Q. Has anyone done profiling of hydroseed to see where the PCBs are coming from? A. The Task Force evaluated 4 different hydroseed manufactures. They did not get the high hits that the City of Spokane did with their initial hydroseed product test. It was a blind study, which looked at the binders in the hydroseed. Doug Krapas noted that we must be very careful, because of contamination issues and variability. Recycled materials can come from all over. We cannot make conclusions from one sample.

- C. They could take out the green coloring and the hydro mulch would still work; however, this could create a regulatory challenge to make sure that contractors applied it correctly.
- Q. Have you analyzed the whole process at IEP? A. Yes. They did a PCB source Id as part of the permit cycle. It was overwhelmingly evident that it was coming out of the recycling plant. They profiled all their systems. There is no processing way that they are getting di-chlors.
- C. Heather Trim noted that she has worked on phthalates. They tested tons of products, not one paint has phthalates, manufacturers took it out. So, this is a solvable problem.
- Q. How low can membrane technology get the PCBs? A. 100% of solid particulate matter will be removed, soluble will not, it will pass through the membrane.
- Q. Hydro mulch, are there things we can do that can make it better, i.e. a shorter-term pigment? Can there be additional training in the field to get consistent coverage of the product, make sure mixing is done well?

### **Toxics Control Substances Act (TSCA) History and Overview.**

***“Polychlorinated Biphenyls, a brief history” by Adriane Borgias, WA Department of Ecology.*** Adriane Borgias presented on the history of PCBs, regulatory allowances, the 1979 rule on PCBs, and this informs the discussion in the Spokane River. There are many moving pieces to consider through best management practices, regulation, toxics reductions plans, scientific approach to understanding the sources, pathways, and treatment of PCBs, and education. To review the full presentation, see iPCB presentation 9 “Polychlorinated Biphenyls, a brief history” by Adriane Borgias.

***“Updating the Toxics Substances Control Act” by Mike Petersen, the Lands Council.*** Mike Petersen discussed the Public Law 114–182—June 22, 2016: Frank R. Lautenberg Chemical Safety for the 21st Century Act, risk evaluations and petitioning the EPA by showing evidence that the allowable level of 50 ppm is insufficient to protect the environment and human health. To review the presentation, see iPCB presentation 10 “Updating the Toxics Substances Control Act” by Mike Petersen.

### **Session II. Understanding the Pigment Industry and Supply Chain for Inks and Printing; Technical Requirements and Solutions**

***“iPCBs and Printing”, presented by Gary A. Jones, Director Environmental Health and Safety Affairs Specialty Graphic Imaging Association.*** Gary Jones provided a look into the world of printing, color marketing, the role of ink in print, technologies, and sustainability in printing and packaging. He also discussed the importance of color. Print color can provide different psychological effects in marketing. Color is important, as it is driving force. Visual appearance also plays a large role in purchase decisions. The CMYK – four basic process colors. (cyan, magenta, yellow, black) + spot colors (over 2100 different PMS (Pantone Matching System)). Ink is ordered to meet color specifications set by the customer. It is important to note that the printers do not delve into pigment specifics. Ink can be ordered based on performance specifications. Also, products are substrate driven. For much more detail on printing, technology, and pigment use review iPCB presentation 11 “iPCBs and Printing” by Gary Jones.

### **Q&A/Comments**

- Q. What is the awareness of PCBs from a printers’ perspective? A. None. This is not an issue that crosses the radar screen. This is driven by the customer.
- C. Packaging and printing is an indicator of the product that people want. Q. Has there been any effort that you are aware of by any brands to feel out the public as to whether more sustainable printing inks/packaging is considered as a boon to business?
- Q. There are many different processes for printing, pigment is only one small part of the ink. Do any of these processes remove the need for the pigment? A. No, you must have pigment in the ink to get the color. The

method of application dictates the formulation of the ink. Each process is designed with a different type of ink, which must match the application method. The application method is determined by cost, need, performance requirements, etc.

- Q. You work with sustainable green printing partnership and discuss potential solutions. Can you speak to an example that highlights success? Who was at the table, how did you engage along the supply chain? A. In order to be certified, the printer must have these conversations and seek out sustainable options. The printer is not going to dictate the product that is going to be produced.

***“Printing Inks Formulation & Manufacture” Presented by George Fuchs, National Association of Printing Ink Manufacturers (NAPIM).*** George Fuchs presented on the history and current status of the printing ink industry and discusses the regulatory frameworks that they work under. He also explained the difference between ink and dyes (an important distinction for PCB considerations). The inks and pigments are Intellectual Property, customers must sign non-disclosure agreements. They are regulated under: OSHA, RCRA, CPSA, CAA, CWA, FDCA, and peripherally TSCA. The FDA does not really regulate PCBs. EPA: Threshold regulation – if you have migration from the package to the food above .5 ppb, then you are regulated as a food additive (not a straight concentration, a dietary concentration). Much of the raw materials supply chain has moved outside the US (outside of their control)

Ink manufacture is a mixing and blending, not running a chemical reaction. Most of the ink used in US is buy and large made in the US, while raw materials in large come from outside of US. Relatively inexpensive product. We call digital printing “non-impact” two largest markets for ink is Flexo and Litho (by volume). A lot of packaging is done with Flexo. Dyes are fully solubilized; inks are a dispersion. All the colors have a very specific formula to match a shade. A lot of printing happens outside US as well. Ink must consider: weatherability, water resistance, acid/alkali, temperature, compatibility (ink system, substrate, print process). Standards would need to be revised to take out the Colors that have PCBs. To review the full presentation, see iPCB presentation 11 “Printing Inks Formulation and Manufacture” presented by George Fuchs.

#### **Q&A/Comments**

- Q. Are PCBs on the industries radar? A. We do not have a lot of leverage in terms of turning the ship. “we meet applicable regulatory standards”.
- C. The industry has historically gone through shifts that have been successful. Were these shifts the result of regulatory action? A. Yes, for the most part RCRA- which addresses metals, and under OSHA (exposure limits).
- Q. Additives in the inks, are any chlorinated? A. Very few chlorine-based solvents or vehicles used.
- Q. Siloxanes, two type phenyl and methyl. Do they use the phenyl? A. don’t know.
- C. In the US market, there are only a small number of players, but sourcing of raw materials may be a large part of the issue. There was an issue with Brake Pads, the manufacturers go together and worked on a reformulation standard, has been taken on globally. A. the printing business is a global business.
- Q. From a business perspective with the printing market changing, what is the business side of the equation? What is the ability to absorb increased costs? A. Trade organizations don’t really get into the costs side of things. We are a very low margin business. Cutthroat business, so the ability to absorb costs is minimal.
- Q. You mentioned the trend over time of becoming more sustainable. In terms of a brand to be PCB free, are there boutique shops that could do this, is it feasible? I.e. brands developing a PCB line that does not have that exact color but could be marketing otherwise. A. This could happen but would be a real challenge to meet the color specifications, this needs to be a group effort with all the players in the supply chain.

***“Partnerships for Innovative Solutions” presented by Dr. Robert Mott and Dr. Mark Vincent of CPMA.*** Dr. Mott and Dr. Vincent presented an overview of the Color Pigments Manufacturers Association (CPMA) which is “the recognized voice for manufacturers, importers, suppliers, and distributors in North America”. They also explained what color

pigments are and a bit about their manufacturing process. They explained that there was no color industry in North America until the end of WW1. CPMA founded in 1925. Dyes are soluble, pigments are insoluble. Pigments are dispersed in the vehicles. The first step in the process (in the Diazo Tank) is where PCB 11 is likely produced. Must be very controlled to reduce how much PCB is produced.

There are about 210 different yellows in the color index. Color pigment characteristics and customer requirements consider chroma, broad shade functionality, durability/lightfastness, low metamerism (looks different in different light), dispersibility, Heat stability, solvent resistance, gloss retention, color strength (one of the reasons dialdehydes are used as they are high strength). Cost is a huge factor; which is why it has been outsourced to other countries. Availability is also an issue. Also, they must consider the fitness of the product for purpose and regulatory status. In 2010 USEP implemented the Benzidine Dyes Action Plan (no exposure concern for pigments in printing inks), and the 2010 REACH Dossiers for diarylide pigments (safe for intended use). The pigment industry has been addressing PCBs since the 1970s. They have modified the manufacturing processes and product formulations since 1990s to minimize inadvertent PCBs and ensure compliance with global regulations. To review the full presentation, see iPCB presentation 12 “Partnerships for Innovative Solutions” presented by Dr. Robert Mott and Dr. Mark Vincent.

### **Q&A/Comments**

- Q. If you were to ensure that temperature is controlled in Diazo tank, does PCB production go to zero? A. We all start with the same material, if you add to this that the production of nitrogen is entropy driven, there will always be some level of PCB-11 produced. The presence of certain metals can also cause PCBs to be produced, and certain buffers can also do this. Learning about this has led the industry to dramatically reduce the production of PCB-11. TSCA- annual production and use must be 25ppm.
- Q. A study from Japan showed that some were quite high. Are some manufacturers just sloppy? If there is no way to avoid the creation, is there a way to remove it from the pigment before shipping it out? A. Removal would be difficult if not impossible. Japan, signed Stockholm, but had no guideline for testing and compliance in manufacturing.
- C. TSCA Question. TSCA regulates intended use, however these molecules get out into the environment, and represents an unintended consequence. As regulators, we deal with end of pipe, intended use does not factor in the full life cycle. A. TSCA does not address this, because the byproducts and impurities that result in manufacture of a chemical substance, which is not covered by TSCA.
- Q. Are all 333 pigments chlorinated processes? It depends on how you look at chlorination. Sometimes you use chlorination to add another functional group. In pigments it probably amounts to 2 dozen, or a bit more. We would have to look at things that have been phased out over time.
- Q. Are there actions to develop new pigments? A. Very unlikely as the cost to launch is very high. Costs millions and millions to launch a new product.
- Q. Is there only one way to make a color? A. You must ask a lot of other technical questions – this narrows the pigments down from 300 down to a handful that can be used. Color selection is compromise first.

***“Opportunities to advance no and low inadvertent PCB (iPCB) pigments” presented by Dr. Lauren Heine, Dr. Amelia Nestler, and Dr. Anna Montgomery of Northwest Green Chemistry.*** The presenters discussed the main goal to reduce PCB levels in the Spokane River, while using increased recycled content in paper, and maintaining vibrant colors of our printing inks. There are challenges and opportunities in reaching this tri-fold goal.

Diarylide yellows all share a common structure. The question is, are there process controls options to minimize the PCB production? Can you get away from the chlorinated solvents? There may be opportunities through regulation, procurement, and through supply chain engagement. To review the full presentation, see iPCB presentation 13 “

Opportunities to advance no and low inadvertent PCB (iPCB) pigments” presented by Dr. Lauren Heine, Dr. Amelia Nestler, and Dr. Anna Montgomery of Northwest Green Chemistry.

### **Q&A/Comments**

- C. EPA -Kat Compton. EPA has been doing product testing, this work is continuing. They are also looking at some emissions testing (volatilizing) and settled dust studies. The National Toxicology Program (part of NIH) is doing a toxicology study, IRIS program – analysis of PCBs has been done, have been initiating an updated analysis (this will take 5-7 years, they update their website on their process regularly).
- C. Pollution Prevention: EPA Green chemistry challenge program. There are some tools at EPA disposal that could perhaps incentivize work on creating new pigments/formulations.
- C. Grossly unfair to represent data from products if they have not been tested (make sure it only represents what is tested).
- Q. What if it comes back that PCB-11 (through IRIS assessment) is shown to have low or no toxicity, what happens? A. I cannot speculate on this. There is a process to update regulations, the agency must show that the level is not protective of the population.
- C. Global regulation- does EPA take away key learning from global regulation? A. (Steve, BCSM) There are no drivers in Europe to reduce the PPBs of PCBs, not a concern currently.

### **Panel Discussion: Moderated by Anna Montgomery, NGC Executive Director**

#### **Question: iPCB levels can be reduced in the Diazo Tank. How does this process work, is it a potential solution?**

- Mark: PCB levels in diarylides is from 1-5 ppm. You control it by controlling the temperatures, Maybe getting down to 1-2 ppm.
- Robert: When they identified that PCBs were there (in some cases well over 1000 ppm) they changed the process and got it below 10. However, one of the problems with this change was that they got customer complaints when they reduced PCBs, the PCB “coating” helped the crystals disperse better. Research has advanced to help disperse the pigment in a different way.
- George – There is the regulatory driver to limit air emissions. This “incentive” led to some innovations, driving out volatile compounds and elimination of heavy metal-based pigments.
- Gary: the change in technology from conventional analog to digital applications is being driven primarily by economics, less waste, and less use of solvents. We will see this continue to migrate. We will see stepwise changes as well as revolutionary changes. There are real limits depending on cost and need.
- Why so expensive? Could be tied to proprietary technology. Inks are tied to the application method, lots of R&D are involved.
- Will there be a shift in type of pigments as digital grows? Limitations of digital are such that you cannot get direct color match (can get close). Analog can get direct color match. Limited in digital.

#### **Question: are there any other drivers affecting the industry?**

- It is customer driven.
- Raw materials, is it where the materials are found? The raw materials mainly are coming out of China. The primary driver of this was cost. The ink industry is hyper competitive.
- Cost: there are literally tens of thousands of printing companies. The average printing company makes 3-4% profit, so there is not a lot of room to absorb costs. Downward pressure cost curve.

#### **Incentives for innovation? Who should the incentives go to?**



- EPA tools: green chemistry challenge program – incentives. How could we design a challenge for a no PCB pigment? Are there enough players in the innovative space to make this work? Small business innovation grant program (not housed in pollution prevention program).

#### **What is the number of pigments in distribution?**

- Decreased from 1000 to 300, a couple dozen is in the diarylides.
- Of the 24, are most widely used? A. by far from a tonnage point of view, to make something yellow, you will use diarylide yellows. The top yellows are all diarylides. Phthalo blue is the blue everywhere. In nature you are seeing a lot of refractive color, not absorbed color. There are limited applications using natural pigments.

#### **How would you convene a group/process to develop a new color/process or color standards/pantones. There is collaboration throughout the value chain, how do you do this given the proprietary nature of the work?**

- Intellectual property differs from one company or another.
- It is an issue that we could more clearly identify what the impact would be. There are enough people in the industry to address this, it is not impossible, but dealing with a different palette of colors that could be used.

#### **Are there uses that could be intervened in where the use of the specific yellow/green etc. does not need to be used.**

- It really depends on the need.

#### **Life Cycle Assessment (LCA): has there been any push in the pigment and printing industry to do LCA? Has this issue of toxicity come up, how about GHGs?**

- The only LCA that they are aware of is in the soybean industry looking at soy oil in printing inks. They concluded that it was pretty much a wash comparing to other petroleum hydrocarbons (because of the inputs in growing soy).
- There have been some comparative studies, print competes with electronic information distribution. Scope and assumptions play a role in outcomes of an LCA.
- Supply chain is very responsive if it possible.
- We must be careful about mandated solutions. Unintended consequences of leakage from tanks to groundwater.

#### **Incentives ?**

- HP: instant ink (subscription service)
- HP has a toxicology department
- Balancing many “plates”. Very hard if not impossible to find drop in “replacements”
- HP has a procurement standard that is much less than TSCA.
- Incentivizing up/down the chain?
- Reduce regulatory constraints to approval for products coming to market. How do we do this, and ensure that the products are safe?
- Q. How about work with a large recognizable company such as Amazon? They are so recognizable, that they can use an outline and people would recognize it. So, this may not be impossible.
- There is not a lot of money for R&D.
- Q. Which printing processes are most compatible for low PCB production? A. don’t think there is any significance between the processes.

- Q. Is there a market opportunity for the industry to consider making these changes from a quality control standpoint? Can we produce products here in the US, with low or no PCBs? A. Right now, there is no market drive – this is where it must come from.

Day 2:

**Government Drivers Panel: Sundae Delgado, Elsa Pond, and Dr. Craig Monahan.**

- *WA Department of Enterprise Services (DES) Procurement Policy Update. Sundae Delgado*
- *WA Department of Transportation (WSDOT) Road Paint Case Study*
- *Safety Products for Washington Law – Identifying Priority Products – Dr. Craig Monahan*

**Q&A/Comments**

- Q. What can State Agencies do better? A. They cannot just switch over night. It is important get lots of stakeholder feedback to fully understand the impacts of decisions made. We want to avoid regrettable substitutes. A. WSDOT has updated their construction specs. A. Improved specifications (adaptive and creative with new information). A. Ecology needs to be providing DES with the technical support to do their work (chemist and engineers). Executive orders can drive the work across the different agencies.
- Q. Yellow road paint policy- 5% preference – how do you determine whether the paint does not have those prohibited products? A. This is a contract requirement, so they have to certify that their products don't have those prohibited chemicals (they provided data to DES).
- Q. Is there some insight into how they decided to pick certain products in testing? A. They looked at the criteria and then did some calculations based on the literature/reports out on PCBs. They are also looking at things that are sold in WA State. (i.e. inks). They must think about where along the supply chain that regulation could play a role.
- C. Dave Darling – unique situation with the paint in that they already had low level PCBs.
- Q. What is the role out/contract language? The road paint rule is current. The law and the training are done. Contracts are 3-5 years. As contracts come up for renewal or rebid, this will come up then. Packaging- “please deliver the products in plain packaging”. C. It would be helpful to explain whether it is the packing, the product or both.
- C. Ecology can protect proprietary information and still be able to determine if products do not contain toxics.

**Market Drivers Panel:**

- *The Healthy Printing Initiative (Germany) Jenny Pfau and Christina Krebs*
- *HP, INC. Case Study on Developing – Jim Kildae, HP*
- *Downstream Market Impacts from Recycling Printed Paper – Doug Krapas*
- *Meeting Market Demands – Mark Vincent, CPMA*

**Q&A/Comments**

- C. The impact of recycling changes – where will the materials will go? (i.e. landfill) A. CA is going back to a dual stream source.
- Q. HP Question: What process was used to derive .1 ppm for PCBs limit in inks? A. Informal surveying with color manufacturers led to this number. This is benchmarking on what they thought they could do and balance with what the customers want. HP decided to set an aggressive limit and also looked at the proposed limits in State of WA. We will see what we discover.
- Q. Is there PCB in malachite green (dye)? There are no chlorines in the structure, would need to look back at the materials. More testing needs to be done to see where it is coming from.

**Break Out session: See those notes separately from this set of notes.**

**Actionable Next Steps:**

**Commitments to action:**

- Imperative to make sure the right folks are at the table. Branch out, send out the message to your colleagues, make sure everyone is getting this info.
- Mike Petersen is involved in forest collaborations where each member supports each other's goals. How can we approach this to support each other?
- Ecology will go back and report on the success of this workshop and see how to move forward.
- Packaging representative will communicate a summary of what has been learned back to representatives.
- Each agency has their own printing departments, is it time to talk to these folks- reviewing our own processes that are contributing to the problem.
- Do a thorough evaluation of existing pigments. Is this information readily available? What do we know already, what needs to be known (inks and pigments – is this available?) This info does not exist.
- HP would be willing to share information on what they learn during their process (protecting confidentiality)
- Need a reasonable target, without which there is no reason to invest money.
- Challenge the agencies (specifically EPA) to really evaluate the regulatory framework (TSCA, CWA, etc.) based on the full socio-economic analysis – rather than cost at national level.