Inadvertent PCBs in Pigments:
A Strategy for Market Transformation

(See Phase 1 documents at: http://srrttf.org/?p=9413)

Spokane River Regional Toxics Task Force
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# Two General Sources of PCBs

<table>
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<th>Legacy PCBs</th>
<th>Inadvertent PCBs</th>
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| - Outstanding properties made PCBs versatile and popular worldwide  
  - Heat- and flame-resistant  
  - Highly stable  
  - High boiling point  
  - Insulating  
| - 1979:EPA PCB Manufacturing Ban  
- Widespread environmental remediation ongoing  
  - PCBs travel through air, water, soil  
  - Found even in remote regions  
| - Byproducts of manufacturing  
- May have similar hazards as legacy PCBs, depending on the congener  
  - Many data gaps  
  - Creates ongoing risk to human and environmental health  
| - Continue to be released by ongoing manufacturing  
| - Effluent discharge limits are in place, but the sources can be diffuse  |
Sources of Inadvertent PCBs (iPCBs)

- Inadvertent PCBs come from a variety of sources (e.g. production) and pathways (e.g. wastewater treatment)
  - Organic and inorganic pigment manufacture
  - Production of chlorinated solvents
  - Agricultural chemicals
  - Detergent bars
  - Wood treatment
  - Paper mills
  - Wastewater treatment
  - Municipal stormwater runoffs

- **Result:** PCB levels have plateaued in some areas - despite remediation efforts - as PCBs continue to enter the environment
Pigments

- Production of certain pigments results in inadvertent PCBs
  - Many used in paper packaging
  - At least 18 PCB congeners identified
  - Of particular concern:
    - Diarylide Yellow
    - Phthalocyanine green
    - Phthalocyanine blue
  - TiO₂
    - Two production pathways
      - Chlorinated processes with heat can generate iPCBs
      - Sulfate process uses hazardous chemicals and generates copious acid waste
Hindering the Circular Economy

- The Circular Economy movement is growing globally
  - Design out waste and pollution
  - Keep products and materials in use
  - Regenerate natural systems

- iPCBs are legally permitted in pigments in most jurisdictions globally
  - Up to 50 ppm max, 25 ppm annual average

- The presence of iPCBs impacts recycling via
  - Contaminated recycled materials
  - Contaminated recycling effluent

- Example: Inland Empire Paper (IEP) in Spokane, WA
  - Recycled paper effluent contains inadvertent PCBs tied to colorants on incoming waste paper streams
  - Effluent exceeds water quality standards for PCBs
  - Could drive elimination of IEP’s paper recycling
Strategic Solutions

- Alternatives Assessment
  - Identify available and viable options for pigments with low or no iPCBs
    - Inherently safer colorants (no iPCBs generated)
    - Pigments manufactured with ultra low iPCBs due to controls

- Substitution
  - Drive adoption
    - Voluntary initiatives
    - Regulatory or procurement initiatives
  - Identify, align and expand best practices
Increasing Awareness of PCBs in Paper Packaging and Newsprint: Original SOW

Task 1. (Year 1, $5k) Prepare a white paper to increase awareness of key stakeholders of iPCB issue in pigments
   ○ Prepare a white paper intended for a professional audience that includes paper and packaging manufacturers, pigment manufacturers, newsprint and packaging users, NGOs including the Sustainable Packaging Coalition, industry associations, the USEPA and other regulatory agencies.

Task 2a. (Year 1, $5K) Safer alternatives for newsprint
   ○ Identify and engage key stakeholders
   ○ Prepare a written work plan using recent experience with road paint as a model

Task 2b. (Year 2. $10K) Implement work plan for newsprint. (Project scope pending results of Phase 1 work)

Task 3a. (Year 1 $5K) Safer alternatives in the packaging sector
   ○ Develop a written work plan of action including further education and awareness activities and a market-based initiative to drive the identification and adoption of pigments with ultra low/no inadvertent PCBs.

Task 3b. (Year 2, $15K) Implement work plan for paper packaging. (Project scope pending results of Phase 1 work)

Task 4. (Year 2, $5k) Prepare a white paper to increase awareness of key stakeholders
   ○ Prepare a literature review of what is known about PCBs in titanium dioxide, discuss how widely the material is used, the range of products it is found in, how it is manufactured, etc.
Implementation Plan

- Total Phase 2 Budget remains $30K
- Combine Tasks 2b and 3b for efficiency
  - Focus primarily on paper packaging, but work with Doug Krapas and the TSCA Workgroup to share what is learned and apply it to newsprint
  - Focus on alternatives to specific pigments starting with yellows (Diarylile yellows)
  - Focus on ALL pigments that can achieve ultra low iPCB thresholds; and those that cannot
  - Be flexible to allow for the unexpected
  - Work with the TSCA and Green Chemistry workgroups and assist with public outreach such as a workshop
  - See Plan Items 1 and 2 that follow

Image Source: Lumen Bioscience, Inc.
Plan Item 1: Identify Viable Alternatives

- Understand the scope of use of pigments **in paper packaging**
  - Price and performance requirements
  - How inks and pigments are currently sourced
  - Current specifications used to comply with or exceed regulations on PCBs

- Identify available no/ultra low iPCB free pigments or colorant technologies
  - Currently available inherently iPCB-free chemicals (i.e., no iPCBs generated)
    - Emerging options (e.g. Lumen Bioscience)
  - Ultra-low iPCBs in conventional pigments, based on manufacturing controls

- Approach
  - Research
    - Review the available literature including internet resources and publications
    - Interview key stakeholders in the supply chain (pigment manufacturers, brands, ink manufacturers, industry associations, NGOs, government entities, etc.)
  - Screen options to avoid highly toxic chemicals (i.e. no CMRs, etc.)
  - Collaborate and share information with Doug Krapas who will lead focus on newsprint

- Deliverables
  - Prepare a list of viable pigments that can be used in paper packaging that have no/ultra low iPCBs; Focus on yellows initially
  - Develop a resource such as a design guide to help identify ultra low thresholds for iPCBs in pigments, and the pigments that meet those thresholds. Apply to all colors as feasible.
  - Prepare final report by June 30, 2019; updates in December; draft by early April.

- Budget: $17,500
Plan Item 2: Identify, Inform, and Engage Stakeholders

- Identify and engage key stakeholders
  - Address the entire supply chain
  - Identify ‘champions’ (e.g. HP, IEP, WA State procurement)
  - Be open, transparent, and inclusive (ask stakeholders to identify additional stakeholders)
  - Provide information about the problem and the project
  - Give stakeholders the option to participate, advise, or observe

- Engage Sustainable Packaging Coalition (SPC) Leadership
  - Prepare presentation materials to educate SPC leadership and members about the scope of the problem, why it matters to them and how they may be able to help
  - Demonstrate that the problem is national/global; not just a problem for WA State
  - Work with GreenBlue and SPC on a strategy for advancing solutions

- Deliverables
  - List of stakeholders and a description of their potential role in market transformation
  - Participate in the TSCA and Green Chemistry workgroups as needed
  - Assistance with public outreach such as hosting a workshop on iPCBs
  - Final report by June 30 2019; December and April updates

- Budget: $7,500
Contract Task 4: Prepare white paper on TiO$_2$ manufacturing and generation of iPCBs

- Prepare a white paper on the generation of inadvertent PCBs in TiO$_2$
  - Provide a literature review of what is known about PCBs in titanium dioxide, discuss how widely the material is used, the range of products it is found in, how it is manufactured, etc. Identify any potential strategies for helping purchasers to know if TiO2 is likely, or not, to contain iPCBs

- Deliverable: Final report no later than June 30, 2019; draft by December 2018

- Budget: $5000
Current Opportunities

- Road paint case study is a good model for the value of looking at existing options to see if viable alternatives already exist
  - Alternatives identified and available
  - Procurement policies refined to promote available non diarylide alternatives
  - Efforts to replicate procurement policies in other jurisdictions

- PCBs on Governor Inslee’s radar due to Orca health problems

- Hewlett Packard has released procurement specification for PCBs in pigments at 0.1ppm, 500 times below the current regulatory limit
  - Opportunity to see what is feasible
  - If successful, opportunity to use as model for other companies

- Sustainable Packaging Coalition open to learning more and engaging as long as members see this as not just a Washington State issue
  - Willing to educate leadership team and potentially member organizations
    - Via annual meetings
    - Via design guides and other educational resources

- Clariant chemist willing to provide scientific expertise, contacts at Dominion Colour (via Doug K)

- ACA and CPMA have been cooperative in advancing solutions
Acknowledgments and Questions

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  - Patience with our many questions

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Thank you!

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