PCBs in State Purchased Products – Fabrics 2017

Environmental Assessment Program
Publication 23-03-001
Authored by: Kari Trumbull
January 2023

Abstract

In 2017, the Washington State Department of Ecology (Ecology) conducted a study to assess PCBs in products available from state contracts. Washington State law [RCW 39.26.280 and RCW 39.26.290] requires state agencies to limit the purchase of products and packaging containing PCBs. The state Department of Enterprise Services (DES) leads the implementation of the law. This Ecology study was carried out to assist state agencies in identifying where PCBs may be present in a subgroup of state purchased products from state contracts.

This study examined whether PCBs were present in some fabrics used by Washington State Correctional Industries, a division of the state Department of Corrections. In 2017, Ecology collected 25 swatches of fabric material in use by Correctional Industries. These fabric samples were analyzed for PCBs. The types of fabric consisted of a variety of material with natural fibers, synthetic fibers, or blends of both natural and synthetic fibers, in a wide assortment of colors.

All 25 fabric samples from Correctional Industries had detectable levels of total PCBs (tPCBs). The tPCB concentrations ranged from 0.024 J, as an estimate, to 79.7 part per billion (ppb) in the fabric samples in a variety of fabric types and colors. Nine of the 25 samples had tPCB levels below 1 ppb, 10 samples had levels ranging from 1 to 10 ppb, and six samples had levels ranging from 10 to 100 ppb.

Publication Information

This report is available on the Department of Ecology's website at:
https://apps.ecology.wa.gov/publications/SummaryPages/2303001.html

Data for this project are available in Ecology's Product Testing Database at:
https://apps.ecology.wa.gov/ptdbreporting/
Study: *PCBs in State Purchased Products - Fabrics 2017*

The Activity Tracker code for this study is 22-001.

Suggested Citation:
Trumbull, K. 2023. PCBs in State Purchased Products, Fabrics 2017. Publication 23-03-001. Washington State Department of Ecology, Olympia.
https://apps.ecology.wa.gov/publications/SummaryPages/2303001.html

Contact Information

Author: Kari Trumbull
Environmental Assessment Program
Washington State Department of Ecology
P.O. Box 47600
Olympia, WA 98504-7600
Email: kari.trumbull@ecy.wa.gov

Washington State Department of Ecology – https://ecology.wa.gov

- Headquarters, Olympia 360-407-6000
- Northwest Regional Office, Shoreline 206-594-0000
- Southwest Regional Office, Olympia 360-407-6300
- Central Regional Office, Union Gap 509-575-2490
- Eastern Regional Office, Spokane 509-329-3400

Background

PCBs

Polychlorinated biphenyls (PCBs) are a family of synthetic chemicals consisting of two benzene rings joined together (a biphenyl molecule) and containing 1 to 10 chlorine atoms attached to the benzene rings (ATSDR, 2000). Figure 1 shows the basic structure of PCBs, where the numbers 2-6 and 2'- 6' represent possible substitution locations for chlorine. There are 209 possible configurations of chlorine positions around the biphenyl molecule. The 209 individual PCB compounds are known as congeners and designated by a congener number 1 through 209 (EPA 2022).

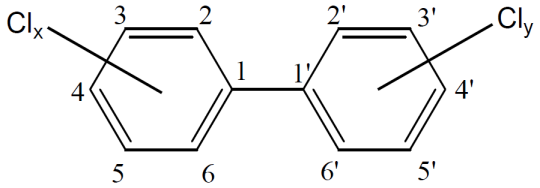

Figure 1. The general chemical structure of chlorinated biphenyls (ATSDR, 2000).

PCBs were manufactured as chemical mixtures made up of a variety of the different congeners. The most common commercial PCB mixtures in the U.S. are known by their industrial trade name Aroclor (EPA 2022). Aroclors are identified by number (e.g., 1254), with the last two digits representing the percent content of chlorine; higher Aroclor numbers reflect higher chlorine content (ATSDR, 2000). Due to their non-flammability, chemical stability, high boiling point, and electrical insulating properties, PCBs were used in hundreds of industrial and commercial applications (Ecology and Health, 2015). PCBs are identified as persistent, bioaccumulative, and toxic chemicals (PBTs). They are persistent in the environment, build up in the food chain, and can cause adverse health effects including cancer and harm to immune, nervous, and reproductive systems in humans and wildlife (Ecology and Health, 2015).

The manufacture of PCBs, such as Aroclors, for intentional use in products was restricted in the U.S. more than 30 years ago. Products may still contain PCBs at an annual average of less than 25 parts per million (ppm) with a 50 ppm maximum, under the U.S. Toxic Substances Control Act (TSCA; EPA 1979). PCBs continue to be generated as inadvertent byproducts in manufacturing processes and are referred to as inadvertent PCBs (Panero et al. 2005). Processes that may result in the creation of inadvertent PCBs involve carbon, chlorine, and high temperatures, such as the production of pigments, dyes, and chlorinated chemicals. Inadvertent PCBs may be released from products, when present, during their use and eventual disposal.

PCBs in Fabrics

In 2017, the Washington State Department of Ecology (Ecology) conducted a study to assess the levels of PCBs in products available from state contracts. Washington State law [Revised Code of Washington (RCW) 39.26.280 and RCW 39.26.290] requires state agencies to limit the purchase of products and packaging containing PCBs. The state Department of Enterprise Services (DES) leads the implementation of the law. This study was carried out to assist state agencies in identifying where PCBs may be present in a subgroup of state purchased products from state contracts.

Washington State Correctional Industries, a division of the Washington State Department of Corrections, manufactures a wide range of textile products, such as garments, furniture, mattresses, pillows, and accessories, using fabrics purchased from other vendors. The textile products are available for purchase from Washington state contracts. This study examined whether PCBs were present in some fabrics used by Correctional Industries. Ecology collected 25 swatches of fabric material in use by Correctional Industries in 2017. All 25 fabric samples were analyzed for PCBs. The types of fabric consisted of a variety of material with natural fibers, synthetic fibers, or blends of both natural and synthetic fibers in a wide assortment of colors.

Methods

Product Collection and Sample Processing

The quality assurance project plans (QAPPs) for this study are

- *PCBs in State Purchased Products – 2017: Addendum to Quality Assurance Project Plan: Product Testing Program, Version 1.0* (Trumbull, 2017a)
- *Addendum 1 to PCBs in State Purchased Products – 2017: Addendum to Quality Assurance Project Plan: Product Testing Program, Version 1.0* (Trumbull, 2017b).

Ecology collected 25 donated fabric swatches from Correctional Industries in Tumwater, WA on April 12, 2017. The fabric swatches were provided as a stack with each swatch touching another and clipped together. The fabric name used by Correctional Industries for each swatch was identified with either an adhesive sticker affixed to the fabric or a piece of paper stapled to the fabric. Immediately after receipt, the fabric swatches were separated into individual sample bags by Ecology staff.

Fabric samples were labeled with a unique Ecology identification number (ECY ID). For example, the ECY ID fabric sample DOC-5-1-2 corresponds to: DOC for the Department of Corrections, the 5 indicates the fifth time Ecology acquired samples from DOC, the 1 refers to a unique fabric swatch from DOC, and the 2 indicates the second sample from the swatch.

A section of the fabric swatch was removed with decontaminated stainless steel scissors for sample processing; this did not include the area with the adhesive label, the outer precut edge of swatch, or any irregularity in the fabric such as loose threads or fuzz. Fabric samples were further hand-reduced in size to about 2 millimeters (mm) by 2 mm size pieces. Each sample was at least five grams in weight, except for three samples, DOC-5-1-2, DOC-5-3-2, and DOC-5-24-2, where the sample weight was less than 5 grams due to a smaller size in the donated swatch.

Samples were not stored at reduced temperature, but rather at ambient temperature, after processing and during shipment to the contract lab, a deviation from the project plan. This deviation is considered to not have adversely impacted the reported study data quality.

Laboratory Analysis and Data Quality

ALS Life Sciences – Environmental Division (ALS) in Burlington, Ontario, Canada –extracted the fabric samples with dichloromethane by Soxhlet extraction using modification of EPA Method 1668C. The sample extracts were analyzed for all 209 PCB congeners by high-resolution gas chromatography mass spectrometry in accordance with EPA Method 1668C (EPA 2010).

Ecology's Manchester Environmental Laboratory (MEL) Quality Assurance Coordinator performed a stage 4 validation to verify that the data were generated following the analytical method with no omissions or errors (EPA 2009, EPA 2020). The project manager also reviewed all the data. Data were deemed usable as qualified.

PCB congener concentrations below the limit of quantitation (LOQ) and above the estimated detection limit (EDL) were qualified "J" (indicating that the analyte was positively identified, and the associated value is an estimate). PCB congener concentrations less than five times the concentrations found in the associated lab method blank were qualified as non-detects: either "UJ" when concentrations were reported below the LOQ or "U" when concentrations were reported above the LOQ.

Measurement quality objectives (MQOs) were met with the following exceptions. For sample DOC-5-22-2, three labeled standard recoveries ($^{13}C_{12}$-PCB-1, $^{13}C_{12}$-PCB-3, and $^{13}C_{12}$-PCB-4) were less than 10% recovery, and the associated detected analytes were qualified "J," as estimates.

Total PCB (tPCB) concentrations, calculated by the project manager as the sum of PCB congeners in the sample, include only detected congener results that were either unqualified or were qualified "J," as estimates. Data qualified as "NJ" (indicating that the analyte has been tentatively identified and the associated value represents its approximate concentration) were not included in the tPCB sums. Total PCB calculations were qualified "J" when 10% or more of the detected congener concentration results in the sample were qualified "J," as estimates.

All PCB concentrations are reported on an as-received (wet weight) basis in picogram per gram (pg/g) and have been converted to nanogram per gram (ng/g) for reporting in Table 1. PCB data are available for download from Ecology's product testing database[1] by searching *PCBs in State Purchased Products - Fabrics 2017.*

Results for Total PCBs

ALS analyzed 25 fabric swatch samples for all 209 PCB congeners. Total PCB (tPCB) concentrations were calculated according to the procedure outlined in the Data Quality section of this report. Table 1 reports the results for tPCBs in the 25 fabric samples. The tPCB levels above 1 part per billion (ppb, equivalent to ng/g) in the table are highlighted in green. For assessing data in this study, results above 1 ppb tPCBs are identified in the discussion and tables. The value of 1 ppb was selected for discussion purposes and does not represent a regulatory level.

[1] https://apps.ecology.wa.gov/ptdbreporting/

Table 1. Summary Results for PCBs in Fabric Samples

Number	ECY ID	Product Name	tPCBs (ng/g or ppb)	Color	Type	Blend	PCB Congener(s) above 1 ppb (concentration in ppb)
1	DOC-5-1-2	FAB1039 Poplin 4.25 oz Poly Cotton 65/35 Fabric Swatch	4.68	white	polyester cotton	65/35	na
2	DOC-5-2-2	FAB1021 White Twill 7.5 oz Poly Cotton 65/35 Fabric Swatch	0.940	white	polyester cotton	65/35	na
3	DOC-5-3-2	FAB1077 Muslin 3.5 oz Poly Cotton 50/50 Fabric Swatch	0.861 J	white	polyester cotton	50/50	na
4	DOC-5-4-2	FAB1155 White 7 oz Organic Cotton 100% Fabric Swatch	0.822 J	white	organic cotton	100	na
5	DOC-5-5-2	FAB1165 White 8.5 oz Cotton 100% Fabric Swatch	0.358 J	white	cotton	100	na
6	DOC-5-6-2	FAB1060 Yellow 7.5 oz Poly Cotton 65/35 Fabric Swatch	1.86	yellow	polyester cotton	65/35	na
7	DOC-5-7-2	FAB1043 Orange 7.5 oz Poly Cotton 65/35 Fabric Swatch	3.81	orange	polyester cotton	65/35	na
8	DOC-5-8-2	FAB1020 Red Twill Poly Cotton 7.5 oz 65/35 Fabric Swatch	9.16	red	polyester cotton	65/35	PCB-11 (1.05) PCB-56 (2.17) PCB-77 (1.67) PCB-184 (1.01)
9	DOC-5-9-2	FAB1152 Ceil Blue 7 oz Organic Cotton 100% Fabric Swatch	0.538 J	blue	organic cotton	100	na
10	DOC-5-10-2	FAB1040 Windsor Poplin Ceil Blue 4.5 oz Poly Cotton 65/35 Fabric Swatch	1.01	blue	polyester cotton	65/35	na
11	DOC-5-11-2	FAB1076 Postman Blue 7.5 oz Poly Cotton 65/35 Fabric Swatch	14.6	blue	polyester cotton	65/35	PCB-11 (1.99) PCB-56 (1.38) PCB-77 (1.37) PCB-155 (1.31) PCB-184 (4.42)
12	DOC-5-12-2	FAB1055 Gray 7.5 oz Poly Cotton 65/35 Fabric Swatch	6.62	gray	polyester cotton	65/35	PCB-184 (2.71)
13	DOC-5-13-2	FAB1061 Forest Green 7.5 oz Poly Cotton 65/35 Fabric Swatch	79.7	green	polyester cotton	65/35	PCB-155 (2.89) PCB-161 (1.00) PCB-184 (61.1) PCB-197 (1.36) PCB-204 (1.53)
14	DOC-5-14-2	FAB1154 Navy 7 oz Organic Cotton 100% Fabric Swatch	0.313 J	navy	organic cotton	100	na
15	DOC-5-15-2	FAB1164 Dark Navy 8.5 oz Cotton 100% Fabric Swatch	0.024 J	navy	cotton	100	na

Number	ECY ID	Product Name	tPCBs (ng/g or ppb)	Color	Type	Blend	PCB Congener(s) above 1 ppb (concentration in ppb)
16	DOC-5-16-2	FAB1075 Dark Navy 10.5 oz Poly Cotton 65/35 Fabric Swatch	2.95 J	navy	polyester cotton	65/35	na
17	DOC-5-17-2	FAB1001 Dark Navy 7.5 oz Poly Cotton 65/35 Fabric Swatch	14.3	navy	polyester cotton	65/35	PCB-155 (1.92) PCB-184 (5.74)
18	DOC-5-18-2	FAB1011 Khaki 7.5 oz Poly Cotton 65/35 Fabric Swatch	10.7	khaki	polyester cotton	65/35	PCB-155 (2.29) PCB-184 (4.56)
19	DOC-5-19-2	FAB1158 Denim Khaki 10 oz Cotton 100% Fabric Swatch	0.414 J	khaki	cotton	100	na
20	DOC-5-20-2	FAB1062 Polar Fleece 100% Poly 7.5 oz Khaki Fabric Swatch	2.29	khaki	polyester	100	na
21	DOC-5-21-2	Nylon 210 Denier FB Fabric Swatch*	2.60	blue/ white	nylon/ unknown	composite*	PCB-11 (1.11)
22	DOC-5-22-2	Ticking Correct-Tick 10 oz Gray Fabric Swatch	10.2	gray	unknown synthetic	unknown	PCB-11 (2.32)
23	DOC-5-23-2	Ticking ACA Blue & White Striped Fabric Swatch	0.353 J	blue/ white	unknown	unknown	na
24	DOC-5-24-2	Ticking Project 210 Nylon Fabric Swatch	2.82	blue	nylon	unknown	na
25	DOC-5-25-2	CV Clearview Fabric Swatch	25.1	clear	unknown synthetic	unknown	PCB-11 (2.72) PCB-18/30^ (1.01) PCB-20/28^ (1.07) PCB-31 (1.08) PCB-44/47/65^ (1.19) PCB-52 (2.28) PCB-61/70/74/76^ (1.10) PCB-95 (1.25)

Green-shaded results represent tPCB concentrations above 1 ppb.
*Fabric consists of blue top layer fabric glued to white felt bottom layer. Layers cannot be easily separated.
^Co-elution of congeners quantified as a mixture of more than one congener during laboratory analysis (EPA 2010).
J = tPCB calculations were qualified “J” when 10% or more of the detected congener concentration results were qualified “J,” as estimates.
na = PCB congener(s) not above 1 ppb.

Results by Fabric Color

The five white color fabric swatches consisted of two poly cotton 65/35 blend (DOC-5-1-2 and DOC-5-2-2), one poly cotton 50% to 50% (50/50) blend (DOC-5-3-2), and two 100% cotton (DOC-5-4-2 and DOC-5-5-2) fabrics. One of the five white color fabrics, a polyester cotton (poly cotton) 65% to 35% (65/35) blend fabric sample (DOC-5-1-2), had tPCB concentrations above 1 ppb.

Five different color fabric samples of yellow (DOC-5-6-2), orange (DOC-5-7-2), red (DOC-5-8-2), gray (DOC-5-12-2), and green (DOC-5-13-2) poly cotton 65/35 blend fabrics all had tPCB levels above 1 ppb. Another gray color fabric (DOC-5-22-2) of unknown fabric type also had tPCBs above 1 ppb.

Two blue color poly cotton 65/35 blend fabric samples (DOC-5-10-2 and DOC-5-11-2) had tPCB levels above 1 ppb, while one blue 100% cotton fabric (DOC-5-9-2) was less than 1 ppb. Two blue nylon containing fabrics samples (DOC-5-21-2 and DOC-5-24-2) were detected above 1 ppb tPCBs. Two of four navy color poly cotton 65/35 blend fabric samples (DOC-5-16-2 and DOC-5-17-2) were above 1 ppb tPCBs. The two navy color fabrics detected below 1 ppb were 100% cotton fabric (DOC-5-14-2 and DOC-5-15-2).

Two of three khaki color fabric samples had tPCB levels above 1 ppb: a poly cotton 65/35 blend fabric (DOC-5-18-2) and a 100% polyester (DOC-5-20-2). The khaki 100% cotton fabric (DOC-5-19-2) had tPCBs levels below 1 ppb.

One blue-and-white striped color fabric (DOC-5-23-2) of unknown fabric type had tPCB levels below 1 ppb, while the clear CV Clearview fabric sample (DOC-5-25-2) of unknown fabric type had levels above 1 ppb tPCBs.

The color of the fabric did not necessarily indicate tPCB levels above 1 ppb. No certain color of fabric, and not all fabrics with color, had tPCB levels above 1 ppb. Fabric samples with color (non-white) and made of synthetic fibers (if known) were above 1 ppb tPCBs, while color fabrics that were 100% cotton and a blue-and-white striped fabric of unknown fiber type had levels below 1 ppb tPCBs. Fabrics white in color had levels below 1 ppb tPCBs, whether 100% cotton or poly cotton blend, except for one white poly cotton 65/35 blend fabric sample had levels above 1 ppb tPCBs.

Results by Fabric Type (Fiber Content)

Six fabric samples consisted of 100% cotton fabric, a natural fiber, in several colors: white (DOC-5-4-2 and DOC-5-5-2), blue (DOC-5-9-2), navy (DOC-5-14-2 and DOC-5-15-2), and khaki (DOC-5-19-2). All six of these samples had tPCB concentrations below 1 ppb.

One fabric sample consisted of 100% polyester fabric, a synthetic fiber, in khaki color and had tPCB levels above 1 ppb (DOC-5-20-2).

Thirteen fabric samples consisted of poly cotton blended fabric in a wide variety of colors. One of these 13 samples was a 50/50 blend of poly cotton in the color white and had tPCB levels below 1 ppb (DOC-5-3-2).

The other 12 fabric samples consisted of a 65/35 poly cotton blend. One poly cotton 65/35 blend sample, white in color, had tPCB levels below 1 ppb (DOC-5-2-2), while another poly cotton 65/35 blend sample, white in color, had tPCB levels above 1 ppb (DOC-5-1-2). The additional 10 poly cotton 65/35 blend fabric samples had tPCB levels above 1 ppb; these were

yellow (DOC-5-6-2), orange (DOC-5-7-2), red (DOC-5-8-2), blue (DOC-5-10-2 and DOC-5-11-2), gray (DOC-5-12-2), green (DOC-5-13-2), navy (DOC-5-16-2 and DOC-5-17-2), and khaki (DOC-5-18-2).

Two fabric samples consisting of nylon, a synthetic fiber, had tPCB levels above 1 ppb (DOC-5-21-2 and DOC-5-24-2). One of these samples was a composite of a blue nylon fabric glued to a white felt backing of unknown fiber content (DOC-5-21-2), while the other sample was only the blue nylon fabric layer (DOC-5-24-2).

The fabric type for three fabric samples could not be identified from the sample names on the labels. The Ticking ACA in Blue and White Striped color fabric sample (DOC-5-23-2) had tPCB levels below 1 ppb tPCBs. The gray Ticking Correct sample (DOC-5-22-2) and clear CV Clearview sample (DOC-5-25-2) appeared to be made of synthetic material and both had tPCB levels above 1 ppb tPCBs.

Overall, with the limited samples of this study, fabric samples with synthetic fibers had higher levels of tPCBs than fabric samples based on color. Total PCBs were found to be above 1 ppb in fabric samples containing at least partial synthetic fibers (if known) in a variety of colors, except for two of three poly cotton blend fabrics white in color. The 100% cotton fabrics, regardless of color, all had tPCB levels below 1 ppb.

PCB Congener Results

PCB congeners (individual or co-eluting) detected at a concentration higher than 1 ppb in fabric samples are listed in Table 1.

PCB-184 was detected at the greatest concentration of a PCB congener in the 25 fabric samples at 61.1 ppb in the green poly cotton 65/35 blend fabric swatch (DOC-5-13-2). In six of 25 fabric samples, PCB-184 was detected above 1 ppb. The concentrations of PCB-184 in the additional five fabric samples ranged from 1.01 to 5.70 ppb. These five samples were all poly cotton 65/35 blend fabric in a variety of colors: red (DOC-5-8-2), blue (DOC-5-11-2), gray (DOC-5-12-2), navy (DOC-5-17-2), and khaki (DOC-5-18-2).

PCB-155 was detected above 1 ppb in four of 25 fabric samples. The concentration for PCB-155 in these four samples ranged from 1.31 to 2.89 ppb and were all poly cotton 65/35 blend fabric in blue (DOC-5-11-2), green (DOC-5-13-2), navy (DOC-5-17-2), and khaki (DOC-5-18-2) colors. PCB-184 was also detected in these four samples above 1 ppb.

PCB-11 was detected above 1 ppb in five of the 25 fabric samples. The concentration of PCB-11 in these five samples ranged from 1.05 to 2.72 ppb. Two of these five samples were poly cotton 65/35 blend fabric in red (DOC-5-8-2) and blue (DOC-5-11-2). The additional three samples with PCB-11 higher than 1 ppb were fabrics with an unknown fabric type but appeared to be made of synthetic material: composite of a blue nylon fabric glued to a white felt backing of unknown fiber content (DOC-5-21-2), gray Ticking Correct fabric sample (DOC-5-22-2), and clear CV Clearview fabric sample (DOC-5-25-2).

Conclusions

All 25 fabric samples from Correctional Industries tested had detectable levels of tPCBs. The tPCB concentrations ranged from 0.024 J to 79.7 ppb in the samples in a variety of fabric types and colors. These results were below the 50 ppm TSCA limit. Sixteen of these 25 samples had tPCB levels above the 1 ppb discussion level. Table 2 displays the distribution of tPCB results by concentration range in the fabric samples.

Table 2. Total PCB Results (ppb) by Concentration Range

Fabric Samples	< 0.50	0.50 to < 1	1 to < 10	10 to < 100	≥ 100
25	5	4	10	6	0

The exact source of PCBs in the fabric samples is unknown. Pigments and dyes are a known source for inadvertent PCBs in products and have previously been detected in pigment-printed and dyed fabric material (Guo et al. 2014 and Stone 2016). It is not possible to conclude from this 2017 study that the PCBs detected in the fabric samples are only from the pigments or dyes. Very different PCB levels were reported in similar color fabrics (for example, see the results for the khaki color fabrics or navy color fabrics in Table 1), but it is unknown if the same pigment or dye was used in fabric samples of similar color.

PCB-11 is considered a key indicator of inadvertent PCBs, as PCB-11 is not typically found in Aroclor mixtures and is primarily associated with color pigments, especially yellow (Hu and Hornbuckle 2010). PCB-11 levels detected in fabric samples from this study are consistent with levels reported in the literature regarding dyed fabric, with tPCB concentrations from 1 to 2 ppb, rather than the pigment-printed fabric at levels much higher than 2 ppb (Guo et al. 2014). Guo et al. proposed that PCB-11 levels in dyed fabric may be present from cross-contamination, likely during the production or dyeing of the fabric or the sewing and processing of the garment.

PCB-184 has not been reported in the literature as a significant contributor of inadvertent PCB congeners in products. PCB-184 and PCB-155 are not congeners associated with Aroclors (ATSDR, 2000). However, PCB-184 and PCB-155 were reported as part of a unique PCB signature in environmental contamination at a textile dyeing and finishing plant which closed in 2007 (Virginia DEQ, 2017). The heat transfer oil used for a “fabric roll type continuous press machine” was identified as the likely source of these inadvertent PCBs through a trackdown study (Virginia DEQ, 2017).

Ultimately, detected PCBs in the fabric samples may be due to several sources:

- Fiber content.
- Manufacturing of the fiber content into fabrics.
- Pigments, dyes, and/or additional chemicals through the dyeing process.
- Environmental contamination from manufacturing equipment.
- Packaging, handling, and/or the storage of fabric material prior to its use in the production of the final textile product.

Washington State law states that "no agency may knowingly purchase products or products in packaging containing PCBs above the practical quantification limit except when it is not cost-effective or technically feasible to do so" (RCW 39.26.280). However, no established standardized practical quantitation limits (PQLs) exist for PCBs in products. The law also states that DES "may request suppliers of products to provide testing data" documenting the level of PCBs in products and packaging but does not require testing every product procured (RCW 39.26.290). In 2019, DES Policy (DES-280-00, 2019) established the purchasing preference to incentivize the State's contract suppliers to provide products and product packaging that do not contain PCBs.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for Polychlorinated Biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service. https://www.atsdr.cdc.gov/ToxProfiles/tp.asp?id=142&tid=26

DES-280-00. 2019. Purchasing Preference for Products and Product Packaging That Do Not Contain Polychlorinated Biphenyls (PCBs). Washington State Department of Enterprise Services. Effective date: January 1, 2019. https://des.wa.gov/sites/default/files/public/documents/About/Procurement_reform/Policies/DES-280-000PCB.pdf

Ecology and Health. 2015. PCB Chemical Action Plan. Publication 15-07-002, 223 pages. Washington State Department of Ecology (Ecology) and Washington State Department of Health (Health), Olympia. February 2015. https://apps.ecology.wa.gov/publications/summarypages/1507002.html

EPA. 1979. EPA Bans PCB Manufacture; Phases out Uses. U.S. Environmental Protection Agency (EPA) press release on April 19, 1979. Retrieved from https://archive.epa.gov/epa/aboutepa/epa-bans-pcb-manufacture-phases-out-uses.html

EPA. 2009. Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use. EPA 540-R-08-005. Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency. January 2009.

EPA. 2010. Method 1668C: Chlorinated Biphenyl Congeners in Water, Soil, Sediment, Biosolids, and Tissue by HRGC/HRMS. EPA-820-R-10-005. Office of Water, Office of Science and Technology, Engineering and Analysis Division, U.S. Environmental Protection Agency. April 2010.

EPA. 2020. National Functional Guidelines for High Resolution Superfund Methods Data Review. EPA 542-R-20-007. Office of Superfund Remediation and Technology Innovation, U.S. Environmental Protection Agency. November 2020.

EPA. 2022. Learn about Polychlorinated Biphenyls (PCBs). Retrieved from https://www.epa.gov/pcbs/learn-about-polychlorinated-biphenyls-pcbs

Guo, J., Capozzi, S., Kraeutler, T. and L. Rodenburg. 2014. Global Distribution and Local Impacts of Inadvertently Generated Polychlorinated Biphenyls in Pigments. Environmental Science and Technology, 48: 8573-8580. https://pubs.acs.org/doi/pdf/10.1021/es502291b

Hu, D. and Hornbuckle, K.C. 2010. Inadvertent Polychlorinated Biphenyls in Commercial Paint Pigments. Environmental Science and Technology, 44: 2822-2827. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2853905/pdf/es902413k.pdf

Panero, M., Boehme, S., and Muñoz, G. 2005. Pollution Prevention and Management Strategies for Polychlorinated Biphenyls in the New York/New Jersey Harbor. New York Academy of Sciences, New York.

Stone, A. 2016. Polychlorinated Biphenyls in Consumer Products. Publication 16-04-014, 61 pages. Washington State Department of Ecology, Olympia. https://apps.ecology.wa.gov/publications/SummaryPages/1604014.html

Trumbull, K. 2017a. PCBs in State Purchased Products – 2017: Addendum to Quality Assurance Project Plan: Product Testing Program, Version 1.0. Publication 17-04-004. Washington State Department of Ecology, Olympia. https://apps.ecology.wa.gov/publications/summarypages/1704004.html

Trumbull, K. 2017b. Addendum 1 to PCBs in State Purchased Products – 2017: Addendum to Quality Assurance Project Plan: Product Testing Program, Version 1.0. Publication 17-04-045. Washington State Department of Ecology, Olympia. https://apps.ecology.wa.gov/publications/summarypages/1704045.html

Virginia Department of Environmental Quality (DEQ). 2017. *Draft* - Roanoke River PCB TMDL Success Story. February 2017. Retrieved from https://www.deq.virginia.gov/Portals/0/DEQ/Water/TMDL/Success/Other/Burlington_Hurt_PCB_Roanoke.pdf?ver=2017-05-30-104117-617