Chemicals of High Concern to Children in Children's Clothing, Footwear, and Accessories - 2018

Environmental Assessment Program
Publication 20-03-011
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Abstract

In 2014 the Washington State Department of Ecology (Ecology) conducted a study to assess the levels of chemicals in children's clothing, footwear, and accessories (Mathieu and Sekerak, 2015). In 2018, Ecology conducted a follow-up study to the 2014 study. In May and June of 2018, Ecology purchased 50 products of children's clothing, footwear, and accessories. A total of 71 component samples from 42 of the 50 purchased products were sent to the laboratory for either metal or phthalate analysis.

Ecology carried out this study to confirm compliance with Washington State's Children's Safe Products Act (CSPA) (Chapter 70.240 Revised Code of Washington (RCW)). CSPA restricts levels of cadmium, lead, and phthalates in children's products to levels below 40 parts per million (ppm), 90 ppm, and 1,000 ppm, respectively. None of the component samples tested in the 2018 study were above the CSPA restriction levels for lead, cadmium, and phthalates.

Manufacturers are also required to report the presence of chemicals of high concern to children (CHCCs) in children's products (Chapter 173-334 Washington Administrative Code (WAC)). Fifteen of 16 brands or product lines of a manufacturer for follow-up testing in 2018 had at least 1 component sample with a target metal or phthalate above a CSPA reporting threshold of 100 ppm.

Publication Information

This report is available on the Department of Ecology's website at:
https://fortress.wa.gov/ecy/publications/SummaryPages/2003011.html.

Data for this study will be available on Ecology's Product Testing Database (PTDB) website at http://ecyapeem/ptdbpublicreporting. Search Study: *Chemicals of High Concern to Children in Children's Clothing, Footwear, and Accessories – 2018*.

Suggested Citation:
Nelson, K. 2020. Chemicals of High Concern to Children in Children's Clothing, Footwear, and Accessories – 2018. Publication 20-03-011. Washington State Department of Ecology, Olympia. https://fortress.wa.gov/ecy/publications/SummaryPages/2003011.html.

Quality Assurance Project Plan for this study:
Addendum to Quality Assurance Project Plan: Product Testing Program, Version 1.0 – Product Testing Follow-up Study 2018-2019. Publication 18-03-113.
https://fortress.wa.gov/ecy/publications/SummaryPages/1803113.

Websites:
Children's Safe Products Act: https://ecology.wa.gov/CSPA
Chemicals of High Concern to Children: https://ecology.wa.gov/HighConcernChemicals
Consumer Product Safety Commission: www.cpsc.gov

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Background

In 2014 the Washington State Department of Ecology (Ecology) conducted a study to assess the levels of chemicals in children's clothing, footwear, and accessories (Mathieu and Sekerak, 2015). Ecology carried out this study to confirm compliance with Washington State's Children's Safe Products Act (CSPA) (Chapter 70.240 Revised Code of Washington (RCW)). CSPA restricts levels of cadmium, lead, and phthalates in children's products to levels below 40 parts per million (ppm), 90 ppm, and 1,000 ppm, respectively. Manufacturers are also required to report the presence of chemicals of high concern to children (CHCCs) in children's products (Chapter 173-334 Washington Administrative Code {WAC}).

In 2018, Ecology conducted a follow-up study to the 2014 study. Ecology purchased 50 products of children's clothing, footwear, and accessories for this study based on the following criteria:

- Same or similar products from brands or product lines of manufacturers that did not meet the CSPA restriction limits or reporting rule requirements for metals and phthalates from the 2014 study.
- Additional product types from the same brands or product lines of manufacturers that had a product that did not meet the CSPA restriction limits or reporting rule requirements for metal and phthalates from the 2014 study.
- Products from additional brands or product lines of manufacturers previously tested that contained CHCCs at concentrations greater than a CSPA reporting threshold of 100 ppm but did not reveal violations to CSPA or the reporting rule. This is to ensure continued compliance with CSPA and the reporting rule.

Children's products were deconstructed into individual components. For example, a pair of children's overalls were separated into the fabric, buttons, adjusters, and fastener components. A total of 71 component samples from 42 of the 50 purchased products were sent to the laboratory for either metal or phthalate analysis. Product types and component sample matrices selected for analysis are displayed in Figure 1.

Component samples for metal analysis were prioritized using X-ray fluorescence (XRF) then submitted to the lab for analysis of antimony, arsenic, cobalt, mercury, cadmium, and lead, with an emphasis for lead and cadmium samples because of the restriction levels in the law. Molybdenum was not evaluated in the current study as it was delisted from the CHCC list during the 2017 CSPA Reporting Rule Update (Steward, 2018).

Component samples for phthalate analysis were selected based on overall product composition, the product labels, product research, or data from prior sampling efforts. Phthalates evaluated in this study include: diethyl phthalate (DEP), di-n-octyl phthalate (DnOP), di-n-hexyl phthalate (DnHP), di-2-ethylhexyl phthalate (DEHP), diisodecyl phthalate (DIDP), dibutyl phthalate (DBP), butyl benzyl phthalate (BBP), diisononyl phthalate (DINP), and dimethyl phthalate (DMP). DMP is not listed as a CHCC under 173-334 WAC but was still evaluated in this study since it was evaluated in previous studies.[1]

[1] Rulemaking in 2017 (Steward, 2018) also added several new phthalates to the CHCC list. To stay consistent with the original study design in regards to phthalates, only the phthalates tested in 2014 were assessed in this study.

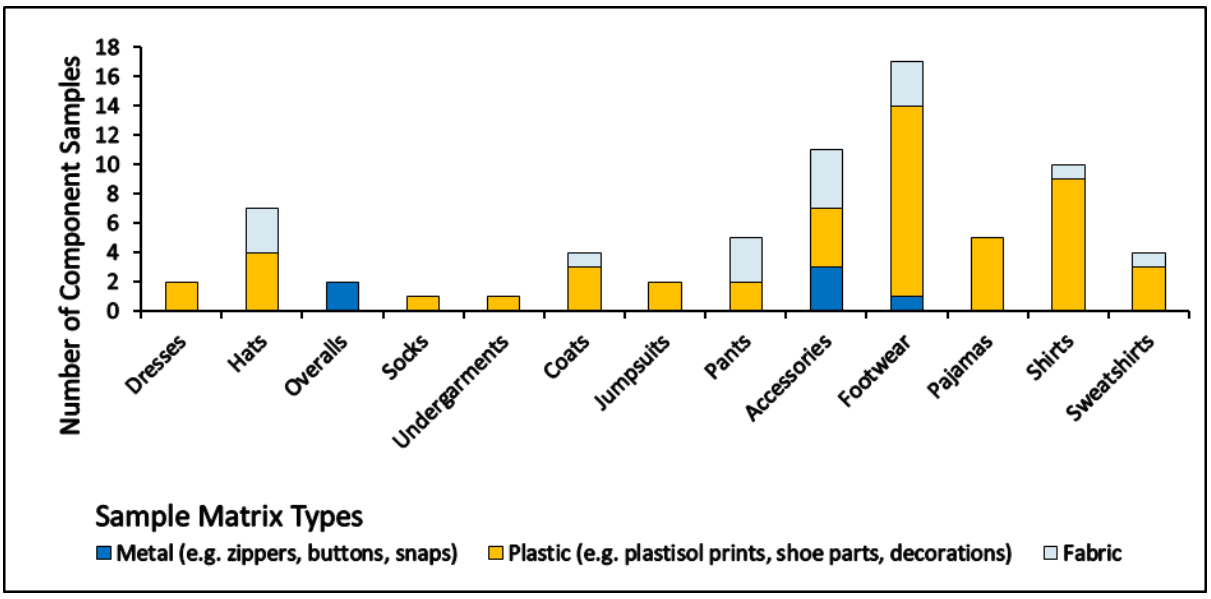

Figure 1. Types and Distribution of Products Submitted for Laboratory Testing in 2018.

Methods

The project plan for this study is Product Testing Follow-up Study 2018 – 2019 - Addendum to Quality Assurance Project Plan: Product Testing Program, Version 1.0 (Sekerak, 2018).

Product Collection and Processing Samples

In May and June of 2018, Ecology purchased 50 children's products from 9 retailers, which included 7 south Puget Sound retail stores and 2 online retailers. Products collected included 29 children's clothing (58% of products), 10 children's footwear (20%), and 11 children's accessories (22%). The 50 products were separated into 271 individual components. A total of 71 component samples from 42 of the 50 products were sent for lab analysis, Figure 1.

From the 42 products that had component samples sent to the laboratory for testing:

- Twenty products had more than one component sample from each product sent for lab analysis. For example, the adjusters and the fasteners were different component samples from the overalls. While the plastic zipper teeth and the plastic outer hologram decoration were different component samples from a wallet sent for lab analysis.
- Three component samples were sent for lab analysis for both metals and phthalates. Two separate samples of each component were processed for each analysis, resulting in 6 unique laboratory sample identification numbers being assigned for 3 unique Ecology product testing component identification numbers (Component IDs).
    - These components were the printed material off of the clothing item, which may be a plastisol. Plastisol is a suspension of polyvinyl chloride (PVC) particles in a liquid plasticizer and is commonly used as a textile for screen-printing. Phthalates are added to PVC plastic and PVC-based inks to increase flexibility (Mathieu and Sekerak, 2015).
- Forty-two component samples were selected for metals analysis based on XRF screening results that indicated the highest potential concentration of target metals.

- Twenty-nine component samples were selected for phthalates analysis based on overall product composition and research. The plastic components had the characteristic flexibility in the plastic that could indicate phthalates were added.

Chain of custody was maintained throughout the product collection, sample processing, and transfer of samples to the laboratory for analysis. Complete laboratory results for this study can be downloaded from Ecology's Product Testing Database (PTDB) website at http://ecyapeem/ptdbpublicreporting. Search Study: *Chemicals of High Concern to Children in Children's Clothing, Footwear, and Accessories – 2018.*

Laboratory Procedures

Ecology's Manchester Environmental Laboratory (MEL) prepared samples for metals analyses in 3 lab sample batches, using the microwave digestion technique following the U.S. Environmental Protection Agency (EPA) Method 3052 method. Analyses were performed on the inductively coupled plasma mass spectrometer (ICP-MS) following EPA Method 6020B.

MEL prepared samples for phthalate analysis using the microwave extraction technique following a modified EPA 3546 method. Two lab sample batches of extracts were analyzed using a modified EPA 8270D method for the gas chromatography/mass spectrometry identification and quantification of phthalates.

MEL prepared written case narratives assessing the quality of the data and the case narratives are available upon request.

Data Quality

Quality Control (QC) requirements and measurement quality objectives (MQOs) are outlined in the quality assurance (QA) project plan addendum (Sekerak, 2018). The correct Chemical Abstracts Service Registry (CAS) Number for antimony should have been listed as 7440-36-0 in the project plan addendum.

Metals

Acceptance criteria were met for metal analysis with the following exceptions. The cobalt result in a component sample (RE-8-3-5) was qualified as an estimate, "J," due to the duplicate sample relative percent difference (RPD) exceeding the acceptance limit (>20%). The antimony result in a component sample (FM-31-2-4) was qualified as an estimate, "J," due to the duplicate sample relative percent difference (RPD) exceeding the acceptance limit (>20%). The lead results in the same component sample (FM-31-2-4) and sample duplicate also exceeded the RPD but was not qualified by the lab as the source result was less than 5 times the reporting limit. However, the sample duplicate result was greater than 5 times the reporting limit and the project manager qualified the lead result as an estimate, "J."

One component sample (TG-37-3-8) underwent additional size-reduction at MEL. The sample had a detected arsenic result of 213 ppm, and the project manager verified the lab followed proper procedures for minimizing sample contamination. The reporting limit for a component sample (KL-5-3-2) was raised from 1 ppm to 4.63 ppm due to limited sample available for repeated digestion and analysis. Only antimony was detected above the 4.63 ppm reporting limit at 21.2 ppm in the sample.

Eleven component samples did not completely digest in the microwave digestion technique before metal analysis on the ICP-MS. The results for these samples were not qualified on this basis.

- Three fabric samples (TG-37-4-9, TG-37-1-6, and RE-8-3-2).
- Six fabric with plastisol print samples (AM-21-9-3, KL-5-3-2, FM-31-2-4, BRU-3-3-2, JC-6-8-3, and JC-6-8-4).
- Two plastic samples (JC-6-1-1 and TG-37-5-6).

Phthalates

All data for phthalates were within the MQO targets with the following exceptions. The matrix spike (MS) and MS duplicate samples for a component sample (TG-37-3-2) exceeded the upper control limit for DBP. DBP was not detected in the source sample and no action was taken.

Results

A total of 71 component samples were selected for analysis from 42 children's products. Forty-two component samples were analyzed for 6 metal analytes. Twenty-nine component samples were analyzed for 9 phthalates. Results are compared to levels set by the Children's Safe Products Act. The levels include:

- Cadmium restriction limit of 40 ppm.
- Lead restriction limit of 90 ppm.
- Six phthalates (DnOP, DEHP, DIDP, DBP, BBP, DINP) restriction limit of 1,000 ppm individually or combined.
- All other analytes are compared to a CSPA reporting threshold of 100 ppm.

Metals

Table 1 displays the summary statistics for laboratory results of target metals detected in component samples of children's products. Of the 42 component samples tested, 37 samples reported at least 1 metal above the laboratory reporting limit and 28 samples reported a metal above a 100 ppm CSPA reporting threshold.

Table 1. Summary Statistics of Detected Metals in Children's Products.

Analyte	Antimony	Arsenic	Cadmium	Cobalt	Lead	Mercury
Number of samples (n)	42	42	42	42	42	42
n > RL	36	8	0	12	10	0
% > RL	86%	19%	0%	29%	24%	0%
Minimum (ppm)*	2.52	1.38	0	1.32	1.23	0
Maximum (ppm)*	12,300	213	0	112	19.6	0

RL = Laboratory reporting (quantitation) limit.
*Statistic includes only detected results.

Figure 2a-c shows the concentration of metal analytes in component samples by Component ID (Appendix Table A1 lists the product component description for each Component ID) of children's products with detected results. Component samples are separated by the matrix type: metal and plastic (Figure 2a), fabric (Figure 2b), and plastisol print (Figure 2c).

Plastisol print samples (Figure 2c) were separated from the rest of the plastic samples. The plastisol print matrix had some of the highest antimony results detected in this study, which is consistent with the 2014 study (Mathieu and Sekerak, 2015).

- Antimony was detected in 36 of 42 component samples of children's products. Of the 36 component samples: 20 were from children's clothing, 11 were from children's accessories, and 5 were from children's footwear.
  - Antimony had the highest detection frequency (86%) of the metal analytes.
  - Antimony was detected in 3 component samples above 1,000 ppm:
    - The pancake decal of a children's shirt (JC-6-8-4) at 12,300 ppm.
    - The gold glitter decal in the same children's shirt (JC-6-8-3) at 9,170 ppm.
    - The shirt decal in a 2-piece sleepwear set (FM-31-2-4) at 4,100 ppm.
  - Twenty-five component samples exceeded a CSPA reporting threshold of 100 ppm for antimony.
- Cobalt was detected in 12 of 42 component samples. Of the 12 component samples: 8 were from children's clothing, 3 were from children's accessories, and 1 was from children's footwear.
  - Two component samples exceeded a CSPA reporting threshold of 100 ppm for cobalt.
    - The fabric of a sahara convertible pants (RE-8-3-2) at 112 ppm.
    - The metal fastener loop on the brown overalls (FM-31-4-3) at 102 ppm.
- Lead was reported in 10 of 42 component samples. Of the 10 samples: 7 were from children's clothing, 2 were from children's footwear, and 1 was from a children's accessory.
  - Detected results for lead were below the CSPA restriction limit of 90 ppm.
- Arsenic was detected in 8 of 42 component samples. Of the 8 component samples: 5 were from children's clothing, 2 were from children's accessories, and 1 was from children's footwear.
  - One component sample exceeded a CSPA reporting threshold of 100 ppm for arsenic.
    - The metal zipper teeth from a girl's purse (TG-37-3-8) at 213 ppm.
- Cadmium and mercury were not detected above the laboratory reporting limit in any of the component samples tested.

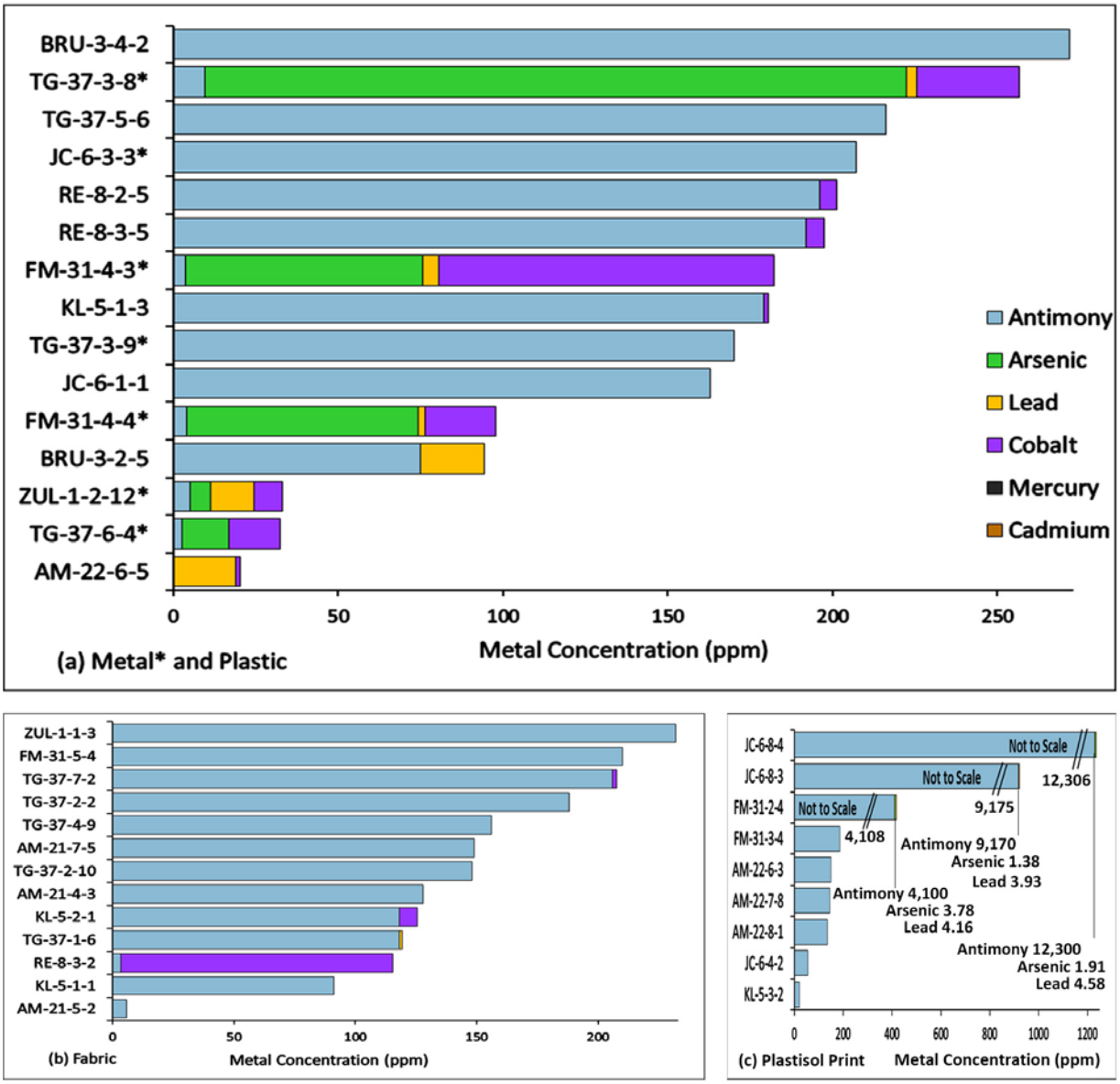

Figure 2a-c. Detected Metal Concentrations in Children's Products by Component ID in 2018 by matrix type: (a) Metal (* denotes a metal matrix) and Plastic, (b) Fabric, and (c) Plastisol Print. Appendix Table A1 lists the product component descriptions.

Phthalates

Table 2 displays the summary statistics for laboratory results of target phthalates detected in component samples of children's products. Of the 29 component samples tested, 9 samples reported at least 1 phthalate above the laboratory reporting limit and 2 samples reported a phthalate above a 100 ppm CSPA reporting threshold.

Table 2. Summary Statistics of Detected Phthalates in Children's Products.

Analyte	DEP	DnOP	DnHP	DEHP	DIDP	DBP	BBP	DINP	DMP
Number of samples (n)	29	29	29	29	29	29	29	29	29
n > RL	0	0	0	7	0	3	0	0	0
% > RL	0%	0%	0%	24%	0%	10%	0%	0%	0%
Minimum (ppm)*	0	0	0	30.0	0	21.4	0	0	0
Maximum (ppm)*	0	0	0	551	0	28.4	0	0	0

RL = Laboratory reporting (quantitation) limit.
*Statistic includes only detected results.

No phthalates were detected above the CSPA restriction limit of 1,000 ppm either individually or combined in any of the samples from children's products submitted for laboratory analysis. Figure 3 shows the concentration of phthalate analytes in the 9 component samples of children's products with detected results.

- All 9 component samples with at least 1 detected phthalate consisted of a plastic-like material.
  - Two of the 9 component samples were the plastic components of flip-flop straps.
  - Five of the 9 component samples were the plastic decoration components attached to children's products.
  - Two of the 9 component samples consisted of a composite of fabric and plastic in the component: the plastisol print from a fabric pajama shirt (FM-31-2-4) and the fabric slipper's sole with embedded plastic grips (JC-6-1-4).
- DEHP was detected above the laboratory reporting limit in 7 of 29 of the component samples, which was the highest detection frequency (24%) of the phthalate analytes.
  - Of the 7 component samples with DEHP, 1 sample contained DBP above the laboratory reporting limit. DBP was detected in 2 additional component samples above the laboratory reporting limit.
- Six of the 9 component samples with at least 1 detected phthalate were in children's footwear.
  - DEHP was detected above a CSPA reporting threshold of 100 ppm at 516 ppm in plastic eye decorations for a pair of Despicable Me Minions slippers (AM-21-4-4).
- Two of the 9 component samples with at least 1 detected phthalate were from children's clothing.
  - DEHP was detected above a CSPA reporting threshold of 100 ppm at 551 ppm in the pink heart decorations on the soles of a pajama suit (AM-22-8-4).
- One of 9 component samples with at least 1 detected phthalate was in a children's accessory.
  - DEHP and DBP were detected in the black plastic eyes component in a toddler's monkey hat (AM-21-5-4). Both phthalates were below a CSPA reporting threshold of 100 ppm.

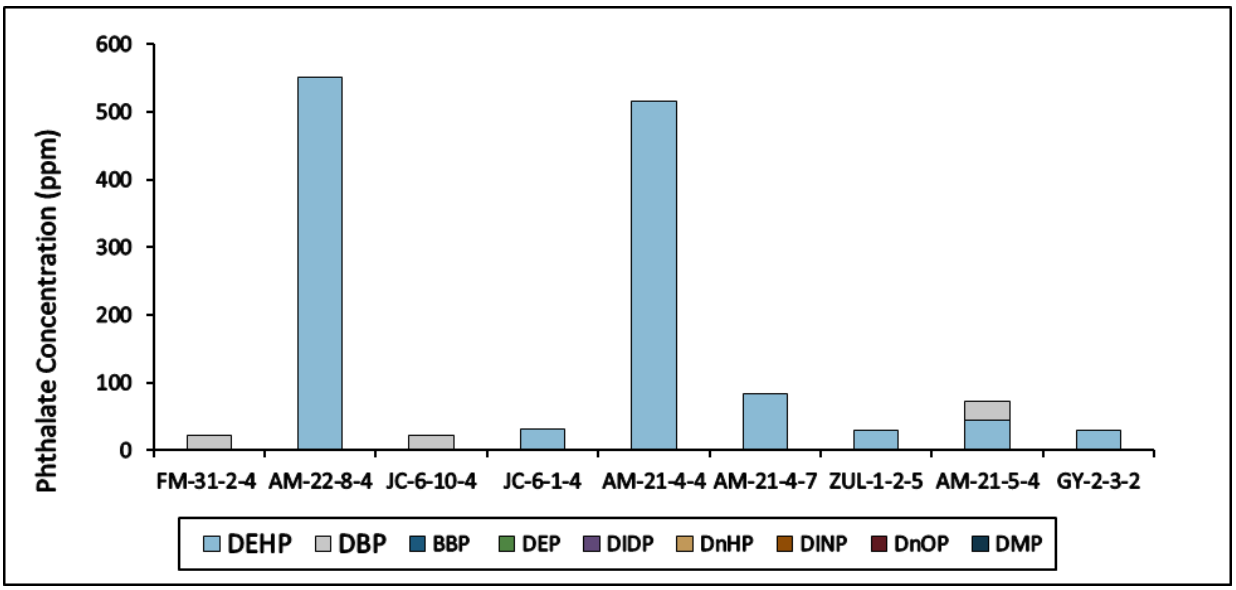

Figure 3. Detected Phthalate Concentrations in Children's Products by Component ID in 2018. Appendix Table A1 lists the product component descriptions.

2018 Study Results Compared to 2014 Results for Selected Products

Table A1 in the Appendix displays the comparison of the 2018 study results with the results from the 2014 study for children's products with detected results above a CSPA reporting threshold (100 ppm). The table also includes the product component description for the corresponding product testing component IDs in Figure 2 and Figure 3.

The products selected for follow-up testing were based on the study criteria outlined in the overview and the QA project plan (Sekerak, 2018). In 2018, products meeting the study criteria objectives were tested from 16 brands or product lines of manufacturers identified from products tested in the 2014 study.

- None of the component samples tested from a follow-up product in 2018 had a result above the CSPA restriction levels. In the 2014 study, 2 component samples had results above the CSPA restriction level for phthalates and 1 component sample result was above for lead.
- At least 1 component sample tested from a follow-up product in 2018 with the same brand or product line of a manufacturer or from the same distributor (e.g. manufacturer or retailer) in the 2014 study (except for Gymboree) had a detected result of a target analyte above a CSPA reporting threshold of 100 ppm.
    - A Gymboree children's product was tested in the 2018 study, and the component sample contained DEHP (GY-2-3-2) below a CSPA reporting threshold of 100 ppm.
- Two clothing products tested in the 2018 study appeared to be the same products and had the same Universal Product Codes (UPC) to products in the 2014 study.
    - A Carhartt brown overalls contained cobalt at 102 ppm in the metal fastener loop (FM-31-4-3) while the metal adjuster loop (FM-31-4-4) did not have a target metal over a CSPA reporting threshold. The metal adjuster loop on the overalls (FM-10-3-3) had 147 ppm of arsenic in the 2014 study.
    - A Ransom girl teal long-sleeve pullover was tested for metals and the glitter heart component (AM-22-6-3) contained 150 ppm of antimony while the gold and blue jewels components on the same shirt (AM-22-6-5) did not have a target metal over a

CSPA reporting threshold. The teal material of the pullover (JC-2-7-1) was tested for ethylene glycol, at 370 ppm, in the 2014 study. Ethylene glycol was not tested in the 2018 study.

- The 2018 Despicable Me slippers from SGFootwear (AM-21-4-4), that appeared very similar to the 2014 Despicable Me slippers, had 516 ppm of DEHP in the plastic eye component sample. The 2018 results for these slippers are well below the 2014 result of 6,300 ppm DEHP (KL-1-17-5) which exceeded the CSPA phthalate restriction limit (1,000 ppm).
  - One character-themed footwear product tested was a new style of footwear and the interior fabric on these bear slipper socks (ZUL-1-1-3) contained 232 ppm antimony.
- A 2018 Total Girl nightshirt contained 12,300 ppm of antimony in the pancake decal component (JC-6-8-4) and 9,170 ppm of antimony in the gold decal component (JC-6-8-3). The 2018 antimony results are well above the 2014 result in a different pajama shirt from the same Total Girl brand with 2,500 ppm of antimony in the silver heart decal (JC-2-12-2).

Conclusions

In 2018, Ecology performed a follow-up study to assess children's products for the levels of select chemicals from Washington State's Chemicals of High Concern to Children (CHCC) list to support enforcement of the Children's Safe Products Act. This report provides the results of the 2018 follow-up to the 2014 study.

Summary of results for the 2018 follow-up study:

- None of the 71 component samples tested in the 2018 study were above the CSPA restriction levels for lead, cadmium, and phthalates.
- Fifteen of 16 (94%) brands or product lines of a manufacturer for follow-up testing in 2018 had at least 1 component sample with a target metal or phthalate above a CSPA reporting threshold of 100 ppm.
  - A total of 24 of 42 (57%) products tested had at least 1 component sample with a target metal or phthalate above a CSPA reporting threshold of 100 ppm.
- Thirty-seven of 42 (88%) of the component samples selected for metals analysis contained 1 or more of the target metals above the laboratory reporting limit. Concentrations of metal analytes ranged from 1.23 ppm to 12,300 ppm.
  - Twenty-eight of the 37 component samples (76%) with detected metals contained at least 1 metal above a CSPA reporting threshold of 100 ppm.
  - Antimony was detected in the highest concentration (at 12,300 ppm) and in 36 of the 42 samples (86% frequency of detection).
    - Three plastisol print component samples from the printed decals of children's shirts contained the highest levels of antimony detected in this study (i.e. above 1,000 ppm). These results are consistent with the 2014 study with antimony detected in the highest concentration at 2,500 ppm, in a plastisol print component sample, and the highest detection frequency, being present in 72% of samples (Mathieu and Sekerak, 2015).
  - Lead was detected in 10 of 42 (24% frequency of detection) of the component samples selected for metals analysis.

        - Lead was not detected above the CSPA restriction limit of 90 ppm in any of the samples.
    - None of the component samples contained mercury or cadmium above the laboratory reporting limit.
- Nine of 29 (31%) of the component samples selected for phthalate analysis contained 1 or more of the target phthalates above the laboratory reporting limit. Concentrations of individual phthalates ranged from 21 ppm to 551 ppm.
    - DEHP and/or DBP were the only target phthalate analytes detected in 1 or more of the component samples.
        - DEHP was the most frequently detected phthalate in 7 of 29 samples (24% frequency of detection).
    - Two of the 9 component samples with detected phthalate results contained DEHP above a CSPA reporting threshold of 100 ppm.
    - Phthalates were not detected either individually or in combination above the CSPA restriction limit of 1,000 ppm.

Recommendations

The laboratory data for this project were submitted to Ecology's Children's Safe Products Act (CSPA) enforcement coordinator for assessment of compliance with Washington State and Federal laws. Where violations are pre-empted by federal law, results have been provided to the Consumer Product Safety Commission for enforcement. Responsible parties (manufacturers, distributors, and/or retailers) of products that appear to violate restrictions, or have not reported as required by the CSPA reporting rule, were notified.

All potential enforcement actions have been satisfactorily resolved by the CSPA enforcement coordinator.

Acknowledgments

The author of this report thanks the following for their contributions to this study:

- Sara Sekerak for developing the project and writing the quality assurance project plan.
- Chrissy Wiseman for purchasing the products and XRF screening product components.
- Tina Schaefer for purchasing the products, Garret Peck for photographing and recording product information into the product testing database.
- Jeff King for recording product information into the product testing database.
- Manchester Environmental Laboratory (MEL) staff for laboratory analysis.
- Kara Steward and Kari Trumbull for reviewing the draft report.

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Appendix. Summary Comparison Data

The appendix is linked to this report online at: https://fortress.wa.gov/ecy/publications/SummaryPages/2003011.html.