

DEPARTMENT OF  
**ECOLOGY**  
State of Washington

# **Phthalates in Children's Products and Consumer and Children's Packaging**

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# Phthalates in Children's Products and Consumer and Children's Packaging

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*by*

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# Abstract

The Washington State Department of Ecology's [Waste 2 Resources \(W2R\)](#) and [Hazardous Waste and Toxics Reduction \(HWTR\)](#) programs conducted a study to evaluate the presence of eight phthalates in children's products and packaging from consumer and children's products. Phthalates are most commonly used as additives to make plastics softer and more malleable. The study was conducted to evaluate compliance with Washington's [Children's Safe Product Act \(CSPA\)](#) and to determine possible presence of phthalates in children's products, and consumer and children's product packaging. It was funded by a grant from the Washington State Attorney General's Office.

Products were tested for eight phthalates:

- diethyl phthalate (DEP)
- dibutyl phthalate (DBP)
- di-n-hexyl phthalate (DNHP)
- butyl benzyl phthalate (BBP)
- di-2-ethylhexyl phthalate (DEHP)
- di-n-octyl phthalate (DOP)
- diisodecyl phthalate (DiDP)
- diisononyl phthalate (DiNP)

Six of these phthalates (DEHP, BBP, DBP, DINP, DIDP, and DOP) are restricted in certain products by Washington law (RCW 70.240) and by federal law (the Consumer Product Safety Improvement Act of 2008). DEP, DNHP and the phthalate precursor, phthalic anhydride, must be reported under CSPA but are not restricted.

A wide range of product types were tested and substantial amounts of phthalates were found in children's products and children's and consumer packaging. The phthalate concentration of one children's product constituted 44 percent of the product by weight. In addition, seasonal Halloween products contained appreciable amounts of phthalates and may warrant further evaluation.

Packaging from children's and consumer products were found to contain high levels of DEHP, the phthalate of greatest concern due to its carcinogenic and endocrine-disrupting properties. Legislation restricting the use of DEHP often exempts packaging and packaging appears to be a potential source of exposure to DEHP. Several phthalates of concern, such as DEP, DiDP, and DiNP, were also found in packaging at appreciable levels.

The test results also showed that a wide range of phthalate products and packaging can be tested using existing methodologies and that phthalates were routinely detected at less than the 1 parts per million (ppm) level, validating the practical quantitation limit (PQL) of five ppm in Ecology's Reporting Guidance.<sup>1</sup> The lower detection limits obtained suggest a lower PQL in the Reporting Guidance may be appropriate.

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<sup>1</sup> Children's Safe Product Act-Reporting Rule-WAC 173-334, Reporting Guidance-Practical Quantitation Limits (PQLs), available at: [http://www.ecy.wa.gov/programs/swfa/cspa/pdf/cspaguide\\_pql.pdf](http://www.ecy.wa.gov/programs/swfa/cspa/pdf/cspaguide_pql.pdf), accessed 12/2013.



Ecology initiated compliance correspondence based upon 19 phthalate results. DINP was the most common subject of compliance assurance (8 letters), followed by DEP (6). In the majority of cases (10), the manufacturer was in compliance with the CSPA as the company's annual sales were low enough that reporting was not yet required due to the CSPA reporting rule's phase in schedule<sup>2</sup>. Ecology also identified 5 phthalate results from these studies that indicated possible violations of the limits in the CSPA<sup>3</sup>. Manufacturers were notified of these results and Ecology reported the data to the Consumer Product Safety Commission for possible violations of the federal Consumer Product Safety Improvement Act (CPSIA).

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<sup>2</sup> Specifically, WAC 173-334-110

<sup>3</sup> Specifically, RCW 70.240.020

# Background

## Phthalates

Phthalates are a class of chemicals added to improve the flexibility of plastics, and as solubilizing and stabilizing agents in other applications. Phthalates are used in a wide range of products including:

- Adhesives
- Automotive plastics
- Detergents
- Lubricating oils
- Some medical devices and pharmaceuticals
- Plastic raincoats
- Solvents
- Vinyl tiles and flooring
- Personal-care products, such as
  - soap
  - shampoo
  - deodorants
  - lotions
  - fragrances
  - hair spray
  - nail polish

Phthalates are also often used in polyvinyl chloride type plastics, such as plastic bags, garden hoses, inflatable recreational toys, blood product storage bags, intravenous medical tubing, and toys (CDC, 2009).

As phthalates are not chemically bonded to the plastic, they can be released directly to the environment. People can be exposed to phthalates through direct contact, ingestion, or breathing air contaminated with phthalates. Generally, phthalates are metabolized and excreted quickly and do not accumulate in the body (Anderson et al., 2001). The Center for Disease Control and Prevention (CDC) found phthalates in most samples in its recent evaluation of toxic chemicals in humans. (CDC, 2009)

Eight phthalates and the phthalate precursor, phthalic anhydride, were identified as chemicals of high concern to children (CHCCs) in Ecology's rule to implement the CSPA (Ecology, 2009). Six phthalates (DEHP, BBP, DBP, DINP, DIDP, and DOP) are restricted in certain products by Washington law (RCW 70.240) and by federal law (the Consumer Product Safety Improvement Act of 2008). DEP, DNHP and phthalic anhydride must be reported under CSPA but are not restricted. Of the eight phthalates, DEHP has been identified as causing cancer. All have been identified as having negative impacts on reproductivity, development, or other systemic impacts. (DOH, 2010) In addition, DEHP has been identified as potentially having a major impact on the Puget Sound. (Ecology, 2011)

## Project Description

Ecology's HWTR and W2R Programs conducted a study of eight phthalates (Table 1) in children's products and children's and consumer packaging with special emphasis on children's products. The objectives of the study were to:

- Determine compliance with reporting requirements of the CSPA.
- Validate methods used to analyze a wide variety of consumer products and packaging for phthalates.
- Assess levels of phthalates in children’s products and packaging from children’s and consumer products.

Product packaging components are not covered by the CSPA and information from this study will help quantify whether packaging of children’s products poses a potential risk to children.

Children’s products, and children’s and consumer product packaging were purchased during the spring of 2012. Products were disassembled into individual components as identified in the Quality Assurance Project Plan (QAPP; Ecology, 2012b). Samples most likely to contain phthalates based upon existing sampling results and publicly available databases were sent to a contract laboratory for analysis.

**Table 1: Eight phthalates included in study**

Phthalate ester	CAS
Diethyl phthalate (DEP)	84-66-2
Dibutyl phthalate (DBP)	84-74-2
Di-n-Hexyl Phthalate (DHP)	84-75-3
Butyl Benzyl phthalate (BBP)	85-68-7
Di-2-ethylhexyl phthalate (DEHP)	117-81-7
Di-n-octyl phthalate (DOP)	117-84-0
Diisodecyl phthalate (DiDP)	26761-40-0
Diisononyl phthalate (DiNP)	28553-12-0

## Metals

The QAPP for this study (Ecology, 2012b) included the analysis of product components for a suite of ten metals. As these same metals were included in several other QAPPs for analysis of children’s products for parabens (Ecology, 2012a), formaldehyde, and volatile organic compounds (Ecology, 2012c), all metals analyses for children’s products are published in a single report.

## Data Quality

Four duplicate packaging samples were sent to the laboratory for analysis to evaluate the ability of the laboratory to provide reproducible data. All four samples provided data exceeding required quality assurance controls. For example, two packaging samples from a body care bag containing several personal care products (SK015-p01), found the phthalate DiDP at 17,900 and 18,100 ppm. Packaging surrounding a yellow vinyl basket (DT034) identified DiNP at 157,000 and 172,000 ppm. Packaging surrounding two rackets (SK001) found DiDP at 129,000 and 116,000 ppm. These results are below  $\pm 10\%$  and exceed Quality Assurance/Quality Control (QA/QC) requirements identified in the QAPP.

All remaining data results were within the QA/QC parameters established within the QAPP (Ecology, 2011b.)

## Children's Product Results

Eighty-six individual products (Table 2) were analyzed for eight phthalates. From these 86 products, 105 individual samples were sent to the laboratory for analysis as some products were separated into multiple individual components. For example, a set of baby sandals (Figure 1) was separated into two different components, the sandal base and the strap. Multiple samples were collected from another fifteen products and each component will be presented separately.



Figure 1: Example of product for testing

Table 2: Products Tested for Phthalates

Category	Description	Category	Description
Art	Washable, no run school glue	Bath	Bath book
Art	Assorted play-doh	Bath	Detangling spray - double Dutch apple
Art	Minnie Mouse Pencil Case	Bath	Bubble Bath
Art	Pirate Pencil Case	Bath	3 in 1 Shampoo conditioner body wash
Art	Colored moldable "play" dough	Bath	Body Wash - Vanilla Swirl
Baby	Natural Rubber Teething Giraffe	Bath	Bubble Bath Sweet Strawberry
Baby	Soft baby toothbrush teether	Bath	2 in 1 Conditioning detangler
Baby	Bumpy raspberry teething pacifier	Bath	Strawberry body wash
Baby	Baby tooth brush	Bath	Bath fish book
Baby	3 Pack silicone nipples	Bath	Rubber duckies
Baby	Scrub-bubble bath book	Bath	Squirry bath toys
Baby	Disposable baby bibs	Bath	Fish bath toys
Baby	Bedtime Baby Cream	Cosmetics	Princess lip gloss/nail polish
Baby	Floating stars teether	Cosmetics	Nerds scented nail polish pack
Baby	Blue teething ring	Cosmetics	Make up pack
Baby	2 Pacifier set	Cosmetics	Pink Coin Purse
Baby	Pacifier	Cosmetics	Scented neon nail polish set

Category	Description	Category	Description
Baby	2 Pacifier set	Cosmetics	Scented Nail Polish
Baby	Easy squeeze spoon	Cosmetics	12 Roll-on lip glosses
Baby	Assorted baby spoons	Fragrance	Body "splash" (body spray)
Baby	2 Pacifier set	Fragrance	Eau de toilette
Baby	2 Teething rings	Fragrance	Eau de parfum spray and body lotion
Baby	Contact nipple shield	Fragrance	Perfume and Body Wash
Baby	Wide base nipples	Fragrance	Eau de toilette
Baby	Teething rings	Fragrance	Eau de toilette and body lotion
Baby	Ernie book	Fragrance	Body spray
Baby	2 Pacifier set	Fragrance	Mickey Eau de Toilette
Baby	Silicone nipples	Fragrance	Adorable Eau de Toilette
Baby	Pacifier	Fragrance	Body mist
Baby	Pink teething ring	Fragrance	Most Wanted fragrance body spray
Baby	Dr. Suess bib	Fragrance	Someday eau de parfum spray
Baby	Pee protector with basketball motif	Halloween	Vampire teeth
Baby	Small baby bottle	Halloween	Replacement necklace
Baby	Basketball pacifiers	Halloween	Elephant Nose
Baby	Soothie pacifier	Halloween	Ghoul costume
Baby	Pink bib	Halloween	Teeth Paint and Mouth Glow
Baby	Striped blue/green bib	Shoes	Egyptian turquoise sandals
Baby	3 Teething rings	Shoes	White Tennis Shoes and bib
Baby	4 Baby feeding spoons	Shoes	Tennis Shoes
Baby	Assorted baby spoons	Shoes	Baby Sandals
Bath	Squishy squirty fish	Shoes	Yellow baby mud boots
Bath	Tinkerbelle bubble bath	Shoes	Baby Sandals
Bath	Body Care shower gel, body lotion & body mist	Shoes	Pink baby ballet slippers

Products were separated into seven larger groups; art supplies, baby accessories, bath accessories, cosmetics, fragrances, Halloween products. and shoes (Table 3).

**Table 3: Breakdown of products into categories**

Category	Nr.	%
Art	5	5.8
Baby	35	40.7
Bath	15	17.4
Cosmetics	7	8.1
Fragrance	12	14.0
Halloween items	5	5.8
Shoes	7	8.1

Complete phthalates analyses are provided in Appendix 1.

Emphasis was placed on products that are likely to be placed into the mouth or applied to the skin, which accounts for the larger number of samples in certain categories. In addition, sampling occurred prior to Halloween in 2012 and several Halloween products were collected and analyzed as likely come in contact with a child’s skin during the holiday. In general terms, high levels of phthalates were found in several samples. The results were grouped into six ranges (Table 4) to provide a broader overview of the individual phthalates found.

**Table 4: Breakdown of phthalates found in product packaging**

Phthalate	ND	%	<1	%	1 to <100	%	100 to <1,000	%	1,000 to <100,000	%	100,000 & >	%
DEHP	81	77.1	0	0.0	18	17.1	4	3.8	2	1.9	0	0
BBP	102	97.1	0	0.0	3	2.9	0	0.0	0	0.0	0	0
DEP	95	90.5	0	0.0	4	3.8	1	1.0	5	4.8	0	0
DiDP	99	94.3	0	0.0	2	1.9	1	1.0	1	1.0	2	1.9
DiNP	93	88.6	0	0.0	0	0.0	10	9.5	1	1.0	1	1
DBP	104	99.0	0	0.0	1	1.0	0	0.0	0	0.0	0	0
DNHP	105	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0
DOP	105	100.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0

DEHP, the phthalate with the most significant toxicity concerns identified to date, was found in 24 of the 105 (22.9%) components tested although a majority of those (17.1%) were found at levels below 100 ppm. Two samples (1.9%) contained DEHP at above 1,000 ppm, a page from a plastic bath book at 1,630 ppm and a plastic pouch used to hold lip gloss at 1,030 ppm. The highest concentrations of detectable phthalates, however, occurred for DiNP. The children’s sandals shown previously (Figure 1) contained 443,000 ppm of DiNP (Table 5), which translates into 44.3% of the sample by weight. Lesser amounts of DiDP and BBP were also found in the same sample.

**Table 5: Phthalate results for analysis of small children’s sandals**

Description	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Baby Sandals	ON003-c01	0.0	12.9	0.0	646	443,000	0.0	0.0	0.0

Two other samples were found to contain a phthalate, DiDP at high levels, a plastic pouch used to store fish bath toys and a Princess lip gloss and nail polish kit at 148,000 and 128,000 ppm respectively. Seven other samples contained phthalates in the range between 1,000 and 100,000 ppm.

To better clarify which type of products contained the highest levels of phthalates, the results were separated into seven large categories, i.e., art supplies (Figure 2), baby accessories (Figure 3), bath accessories (Figure 4), cosmetics (Figure 5), fragrances (Figure 6), Halloween products (Figure 7), and footwear (Figure 8).

Figure 2 shows phthalates concentrations in art supplies for the five products and six product components tested. Only two products contained detectable levels of phthalates at 20.8 and 298 ppm. At these low levels, it is unlikely the phthalates played a role as a plasticizer. The products with detectable levels of phthalates included a Minnie Mouse pencil case (20.8 ppm) and a pirate pencil case (298 ppm). No other product components tested found detectable levels of phthalates.

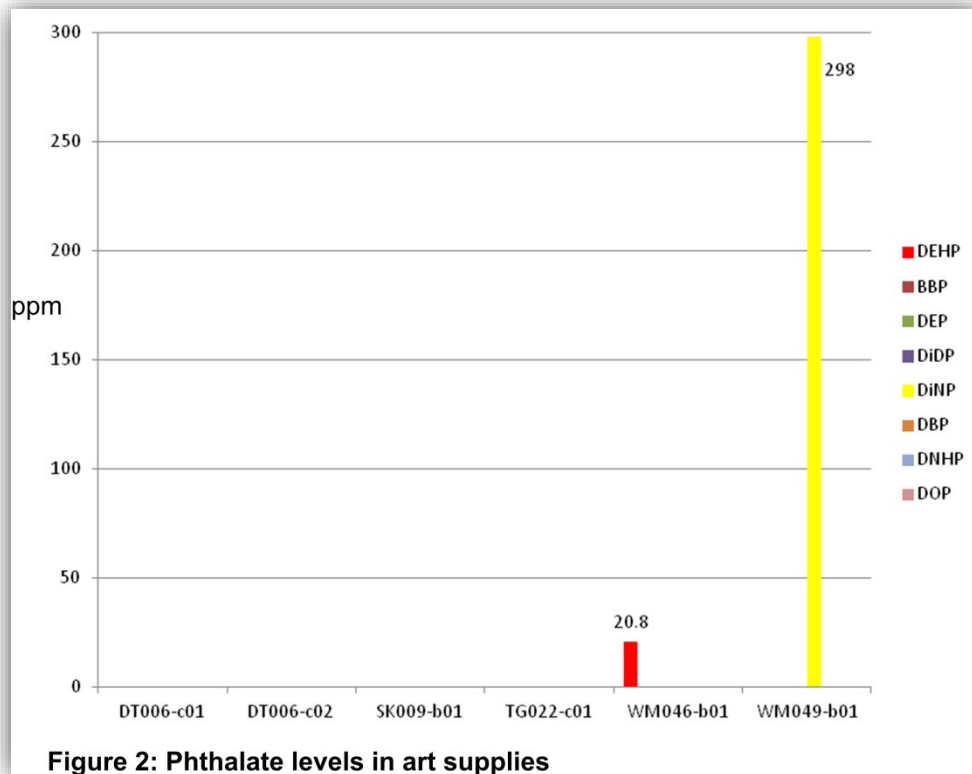


Figure 3 shows phthalate concentrations in baby accessories for the 35 products and 38 product components tested. Only four of the 35 products tested (11%) contained any detectable amounts of phthalates. The phthalate levels were relatively low and it is unlikely they played any major role as a plasticizer in the products tested although other uses are possible. The products containing phthalates included a baby feeding bib (277 ppm), a teether (49.7 ppm), baby cream (47.6), and a pink bib that contained DEHP and DBP at 28.3 and 11.9 ppm, respectively.

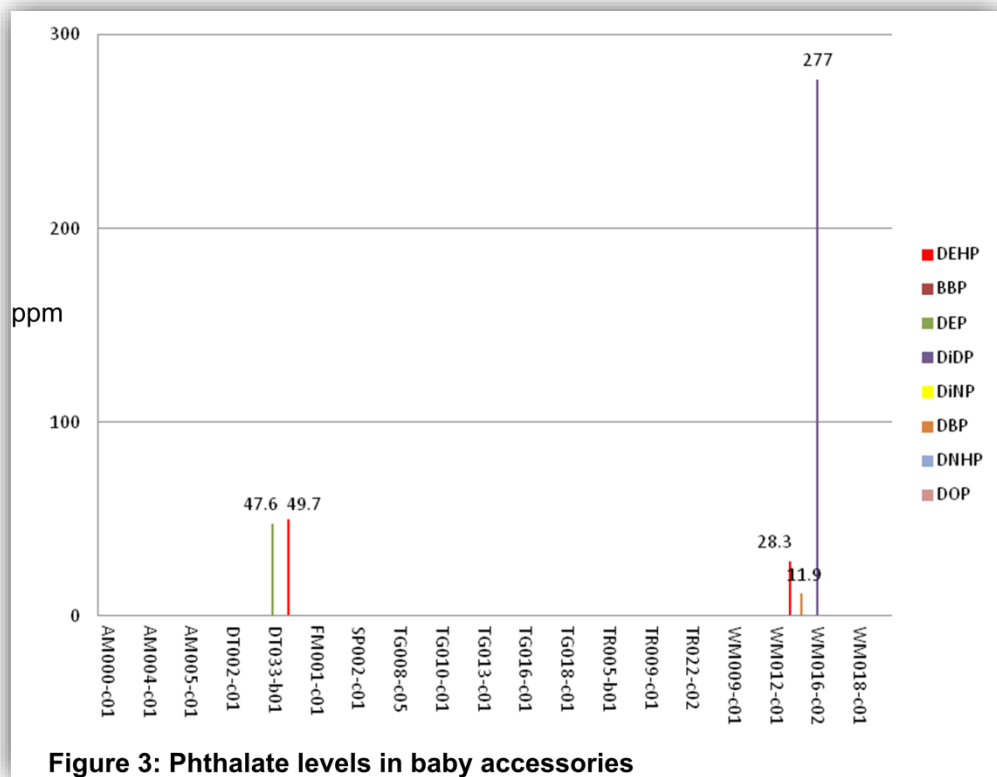




Figure 4 shows phthalate concentrations in bath accessories for the 15 products and 18 product components tested. Five of the 15 products tested (33%) contained detectable amounts of phthalates. Two products contained high levels of phthalates. A plastic page from a bath book contained DEHP and DiDP at 1,630 and 68,700 ppm, respectively. A fish bath toy contained three phthalates, although the concentration of DiDP at 148,000 ppm was orders of magnitude higher than the levels of DEHP and DiNP at 117 and 604 ppm, respectively. Three remaining products contained appreciably lower concentrations of phthalates. A carrying case containing bath products was found to contain DEHP and DEP at 22.7 and 4,970 ppm, respectively. Two separate components of a container of bubble bath contained DEHP and DiNP at 19.3 and 565 ppm, respectively. A rubber ducky contained DEHP at 58.4 ppm. The remaining products contained no detectable level of the eight phthalates tested.

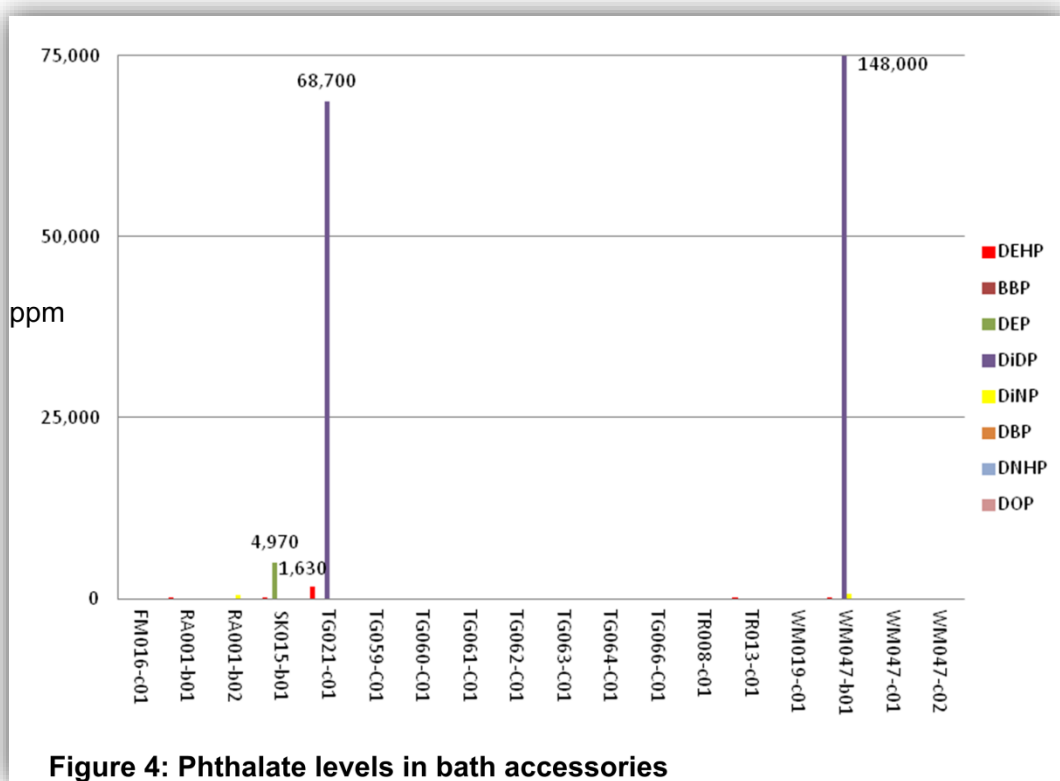


Figure 5 shows phthalate concentrations in cosmetics for the seven products and 11 product components tested. Four products (57%) contained detectable amounts of phthalates. One product, a plastic pouch to contain lip gloss and nail polish, contained high levels of DiDP at 128,000 ppm along with low levels of DEHP and BBP at 25.3 and 13.7 ppm, respectively. Another sample of the pouch from the same product also contained DiDP but at substantially lower concentrations (6,390 ppm) and a mixture of three other phthalates at lower levels including DEHP, BBP, and DiNP at 19.7, 11.9, and 443 ppm, respectively. Two other products contained phthalates above 1,000 ppm. Scented nail polish contained DEP at 1,390 ppm and plastic from a product containing 12 roll-on lip glosses contained DEHP at 1,030 ppm. The only other products containing phthalates were a pink coin purse (14.1 ppm DEHP) and a lip gloss composite (78.9 ppm DEP).

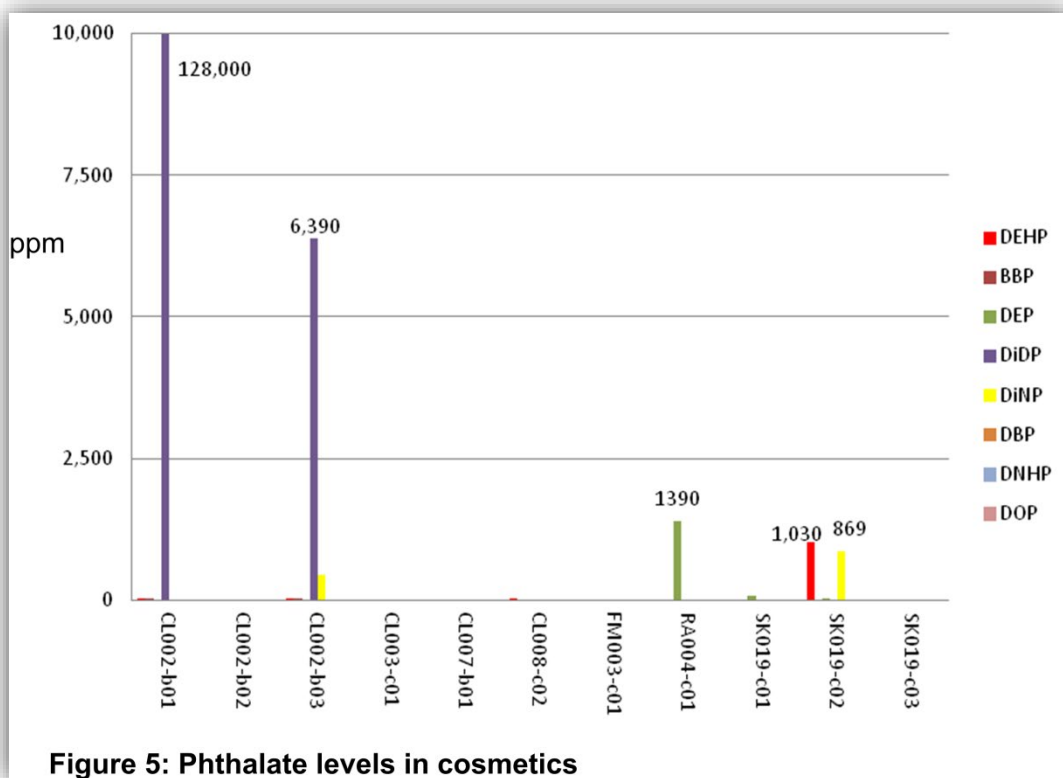


Figure 6 shows phthalate concentrations in fragrances for the 12 products and 15 product components tested. Seven products (58%) contained any detectable amounts of phthalates. Three product components contained DEP above 1,000 ppm, Pink Sugar Eau de Toilette (4,790 ppm), Toy Story Eau de Toilette (2,330 ppm), and Mickey Mouse Eau de Toilette (1,630 ppm). Other fragrance products containing detectable levels of phthalates included Sponge Bob Square Pants Perfume (DEHP at 35.3 ppm), Dora the Explorer Eau de Toilette (DEHP at 46.1 ppm), Justin Bieber Perfume (DEHP at 54.2 ppm), and Britney Spears Body Mist (DEP at 285 ppm).

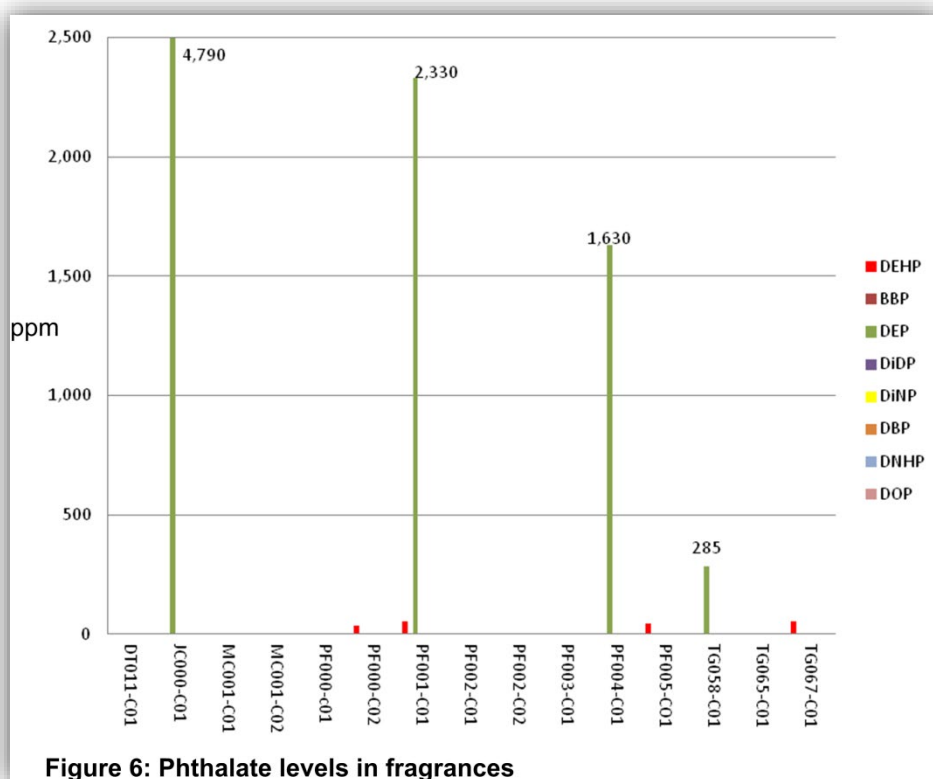


Figure 6: Phthalate levels in fragrances

Figure 7 shows phthalate concentrations in Halloween products for the 12 products tested. Three products (60%) contained detectable amounts of phthalates. The only phthalates found were DEHP (all three products) and DiNP (two products). The products containing phthalates included a rubber necklace (234 ppm DEHP), a rubber ghoulish mask (171 and 841 ppm DEHP and DiNP, respectively), and a rubber mouthpiece which was part of a teeth painting and mouth glow kit (15.7 and 920 ppm DEHP and DiNP, respectively).

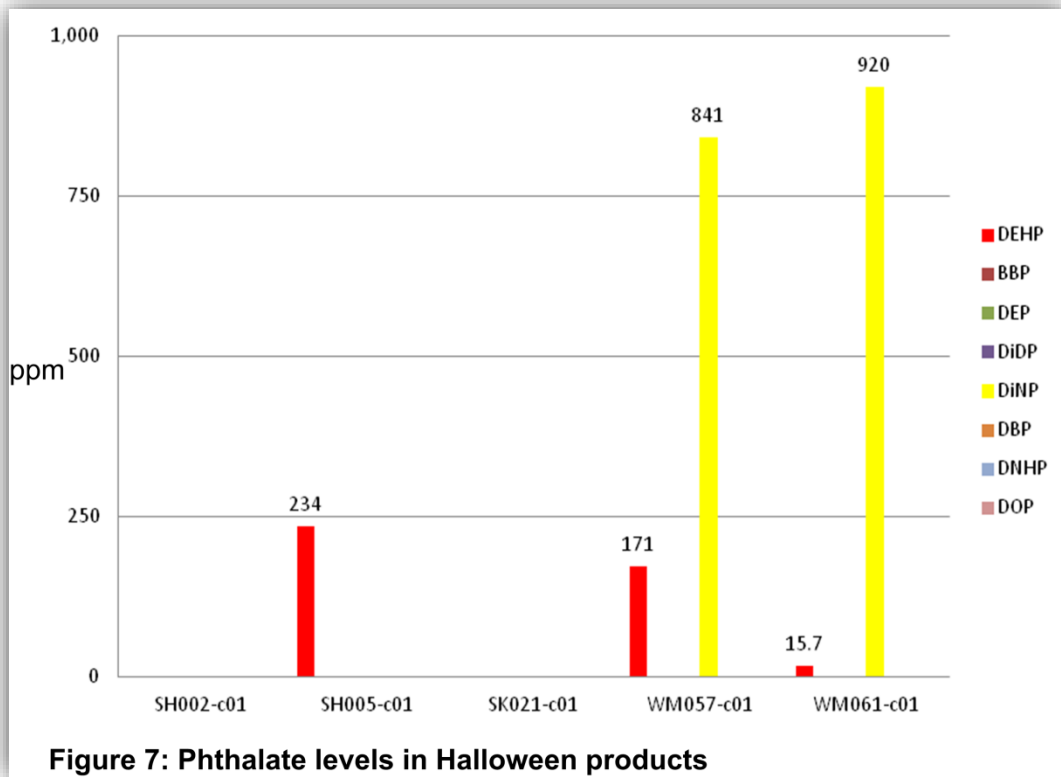
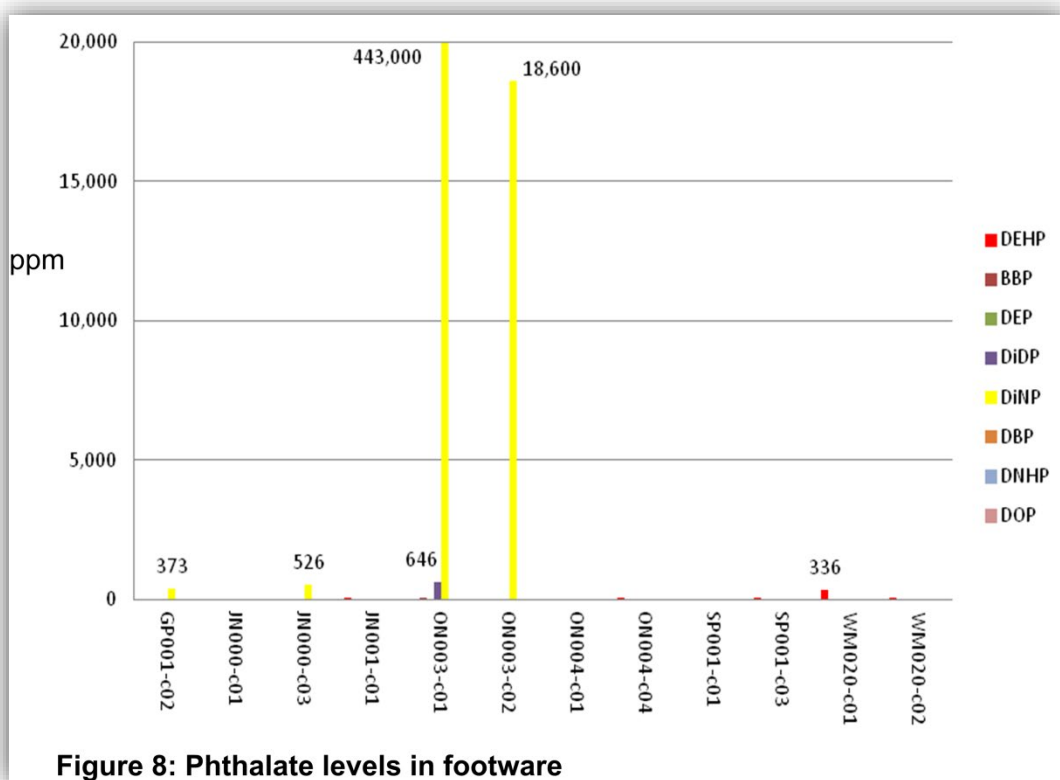


Figure 8 shows phthalate concentrations in footwear for the seven products and 12 components tested. At least one component from all products (100%) contained detectable amounts of phthalates. As indicated previously, one of these products, baby sandals, contained the highest level of detected phthalates as DiNP was 44.3% of the product by weight (Table 5). The strap for the same product also contained DiNP at high levels (18,600 ppm or 1.86% by weight), although this concentration was substantially less than the sandal base. The remaining products contained phthalates at considerably lower levels and included baby turquoise sandals (373 ppm DiNP), a tennis shoe insert (526 ppm DiNP), a baby's tennis shoe (52.4 ppm DEHP), baby mud boots (DEHP at 30.8 ppm), baby sandals (33.1 ppm DEHP), and outer portion and insert for pink baby ballet slippers (336 and 177 ppm DEHP, respectively).



Sampling results are available (Appendix 2).

## Compliance

Analytical results were compared with product data reported to Ecology as required by the CSPA. In response to results from this and other studies funded by Attorney General's office, Ecology initiated compliance correspondence with manufacturers regarding possible failure to report CHCCs as required by the CSPA. Ecology identified 73 results and sent 30 letters to manufacturers containing one or more analytical result that indicated a need to evaluate compliance with the CSPA.

Ecology initiated compliance correspondence based upon 19 phthalate results. DINP was the most common subject of compliance assurance (8 letters), followed by DEP (6). Ecology sent 13 letters to manufacturers. In the majority of cases (10), the manufacturer was in compliance with the CSPA as the company's annual sales were low enough that reporting was not yet required due to the CSPA reporting rule's phase in schedule<sup>4</sup>. In 2 cases, Ecology resolved the compliance issue by examining manufacturers' plans to minimize the level of phthalates and ensure accurate reporting. In 1 case, the company agreed to stop selling the product in Washington.

Ecology also identified 5 phthalate results from these studies that indicated possible violations of the limits in the CSPA<sup>5</sup>. Manufacturers were notified of these results and Ecology reported the data to the Consumer Product Safety Commission for possible violations of the federal Consumer Product Safety Improvement Act (CPSIA).

For 4 results, Ecology determined federal law did not preempt state law and assured compliance with the CSPA by examining the manufacturer's plan to ensure future compliance with the limits in the CSPA.

## Conclusions: Children's Products

Based on the results discussed above, the following conclusions can be reached:

- Substantial amounts of phthalates continue to be used in children's products. One product contained such a large amount that it comprised over 44% of the product by weight.
- Phthalates were found in all seven product categories. The lowest levels were found in art supplies and baby accessories.
- Although the number of products tested was limited and further testing is needed, it appears that most shoes contain some levels of phthalates and that Halloween products might warrant further evaluation.
- A wide range of product types can be analyzed for the phthalates of interest.
- Phthalates can be detected at ppm levels in all product categories encompassing a range of different media types.

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<sup>4</sup> Specifically, WAC 173-334-110

<sup>5</sup> Specifically, RCW 70.240.020

## Phthalates in Packaging Results

Packaging from 93 individual products was analyzed for eight phthalates (Table 6). From the 93 products tested, 107 individual samples were sent to the laboratory for analysis as some products were separated into multiple components. For example, the small plastic bag in a Princess lip gloss and nail polish variety pack (Figure 9) was separated into three different components, the clear plastic, the zipper, and the pink plastic edging. Multiple samples were collected from additional products and results from each component will be presented separately. Four of the 107 samples were duplicates sent to the laboratory as an unannounced test of the quality of data obtained. The results from these four samples are included in the following information and are discussed in detail in the Data Quality section.

Packaging can also be considered a children's product and the analytical results were used to determine compliance with both the Toxics in Packaging law and Children's Safe Product Act (CSPA) reporting requirements. All samples which were considered to be both packaging under the Toxics in Packaging law and a component of a children's product are denoted as 'b' after the dash in the name of the sample (Appendix 3).

**Table 6: Packaging tested for phthalates**

Product ID	Brick Description	Product ID	Brick Description
CL002-a00	Princess lip gloss/nail polish	SK006-a00	Princess bouncy ball paddle
CL004-a00	Hello Kitty Nail Polish Pack	SK007-a00	Twistable crayons, 24
CL007-a00	Make up pack	SK009-a00	Washable, no run school glue
DT017-a00	3 Pack of bubble solution	SK011-a00	Blobby Robby Junior
DT019-a00	Mouse traps	SK012-a00	Smoked two tone porkhide knotted bones
DT020-a00	Eyeglass cleaning cloth	SK013-a00	Pillow protector
DT022-a00	Herbal clarifying conditioner	SK014-a00	Pillow protector
DT024-a00	Bungee cords	SK015-a00	Body Care Bag, shower gel, body lotion etc.
DT025-a00	Cherry body lotion and scent	SK016-a00	Purple makeup bag
DT026-a00	Plastic snakes	SK017-a00	Pink/purple polka dot bag
DT028-a00	Yellow rubber gloves	TG006-a00	Hooded towel
DT029-a00	Super molding compound	TG008-a00	Easy squeeze spoon
DT030-a00	Makeup brush	TG021-a00	Bath book
DT031-a00	Eyebrow razors, 2	TG022-a00	Assorted play-doh
DT032-a00	Angel tip eyeshadow brush	TR004-a00	Baby spoon and bowl
DT033-a00	Bedtime Baby Cream	TR005-a00	Pacifier
DT034-a00	Yellow vinyl basket	TR009-a00	Pink teething ring
DT035-a00	20 Washable markers	WM008-a00	Squishy book
DT036-a00	Baseball set, bases	WM019-a00	Squirty bath toys
FM012-a00	Ginormous Grow Frog	WM022-a00	Lip Gloss
FM013-a00	3 Whiffle balls	WM023-a00	Diaper sacks
FM014-a00	Orange glow necklace	WM024-a00	Bird Toy
FM015-a00	35 Toy soldiers	WM026-a00	Soothing Breast Wipes

Product ID	Brick Description	Product ID	Brick Description
FM016-a00	Squishy squirty fish	WM028-a00	Party favors: mini tiaras
FM017-a00	Nerf ammunition	WM029-a00	SpongeBob table cloth
FM018-a00	Paint roller	WM030-a00	Holographic Classroom Accents
FM020-a00	Peanut butter tennis balls (2)	WM032-a00	Manicure Set
FM023-a00	Little people in plastic balls	WM034-a00	Toilet seat sticker
FM024-a00	Glow in the dark plastic bugs	WM035-a00	Snack food container
FM025-a00	Whoopee cushion	WM036-a00	Hair Rollers
FM026-a00	Waterproof pouches	WM037-a00	Lip smackers bath and body collection
FM027-a00	Plastic farm animals	WM038-a00	Lip balm
FM028-a00	Play-doh animal bag	WM039-a00	Pizza Slice Bags
FM029-a00	Paint roller	WM040-a00	Minnie mouse noise makers
FM030-a00	Pink plastic recorder	WM041-a00	30 Washable fine point markers
FM031-a00	Mini whiffle balls	WM043-a00	48 Small army soldiers
FM033-a00	Nerf gun darts	WM044-a00	Moist wipes
FM035-a00	Tablecloth clamps	WM045-a00	Party favors: 4 tractors
FM036-a00	Green lantern kite	WM046-a00	Minnie Mouse Pencil Case
FM037-a00	Beach/Sand toys	WM047-a00	Fish bath toys
JN001-a00	Tennis Shoes	WM048-a00	Aqua Jewels
RA001-a00	Tinkerbell bubble bath	WM049-a00	Pirate Pencil Case
SK001-a00	2 Rackets with ball and birdy	WM050-a00	Mickey Mouse undies
SK002-a00	Turquoise teenage curtain	WM051-a00	Pink fitted crib sheet
SK003-a00	Khaki curtain	WM052-a00	2 Wooden whistles
SK004-a00	White sleep mask	WM054-a00	Yellow plastic recorder
SK005-a00	Rawhide dog treats		



Figure 9: Example of product for testing (CL002)



To better clarify which type of product packaging contained the highest phthalate levels, sampling results were separated into seven large categories (Table 7), i.e., art supplies (Figure 10), baby accessories (Figure 11), bath accessories (Figure 12), cosmetics (Figure 13), housewares (Figure 14), miscellaneous products (Figure 15), and toys (Figure 16).

**Table 7: Breakdown of product packaging into categories**

Category	Nr.	%
Art supplies	12	12.9
Baby	11	11.8
Bath	4	4.3
Cosmetics	12	12.9
Housewares	14	15.1
Miscellaneous	6	6.5
Toys	34	36.6

Complete packaging phthalate results are provided in Appendix 3.

Ranges for specific phthalates from the packaging samples are shown in Table 8. DEHP, one of the phthalates of considerable concern, was found at appreciable levels. DEHP has been identified by EPA as a probable human carcinogen (EPA, 2014) and was identified by California’s Environmental Protection Agency as known to cause reproductive toxicity (Cal EPA, 2003).

Thirteen packaging samples, 12% of the total number of samples, were found to contain DEHP above 100,000 ppm or 10% of the sample by weight. The highest level, 202,000 ppm (20.2% of the sample by weight) was found in packaging for tennis balls. Of these 12 samples above 100,000 ppm, two were from children’s products. DEHP was also found in the most samples. DEHP at some level was found in 70% of the samples although more than half of those (37.4%) were found at levels below 100 ppm.

Two additional phthalates, DiDP and DiNP, were found above 100,000 ppm in fewer samples (6.5% and 2.8%, respectively). DiDP was detected at the highest concentration. Packaging from waterproof packaging contained 264,000 ppm (26.4% by weight) DiDP. Smaller levels of the remaining phthalates were found in packaging. Two phthalates, DNHP and DOP, were not detected in any packaging.

**Table 8: Breakdown of phthalates found in product packaging**

Phthalate	ND	%	0 to <100	%	100 to <1,000	%	1,000 to <10,000	%	10,000 to <100,000	%	100,000 or >	%
DEHP	32	29.9	40	37.4	14	13.1	1	0.9	7	6.5	13	12.1
BBP	97	90.7	8	7.5	2	1.9	0	0.0	0	0.0	0	0.0
DEP	91	85.0	11	10.3	4	3.7	1	0.9	0	0.0	0	0.0
DiDP	77	72.0	1	0.9	9	8.4	8	7.5	5	4.7	7	6.5
DiNP	77	72.0	0	0.0	20	18.7	4	3.7	3	2.8	3	2.8
DBP	87	81.3	16	15.0	3	2.8	1	0.9	0	0.0	0	0.0
DNHP	107	100	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
DOP	106	99.1	1	0.9	0	0.0	0	0.0	0	0.0	0	0.0

Figure 10 shows phthalates in packaging from art supplies and art toys. Phthalates were found in appreciable concentrations in only three samples. DEHP was found at 107,000 ppm (10.7% by weight) in packaging from a paint roller. DiNP was found at 175,000 ppm (17.5%) and 42,700 ppm (4.27%) in two samples, packaging from washable markers and the same paint roller found to contain DEHP, respectively. The combined phthalate concentrations of the eight phthalates tested in the paint roller packaging was 151,330 ppm (15.133%).

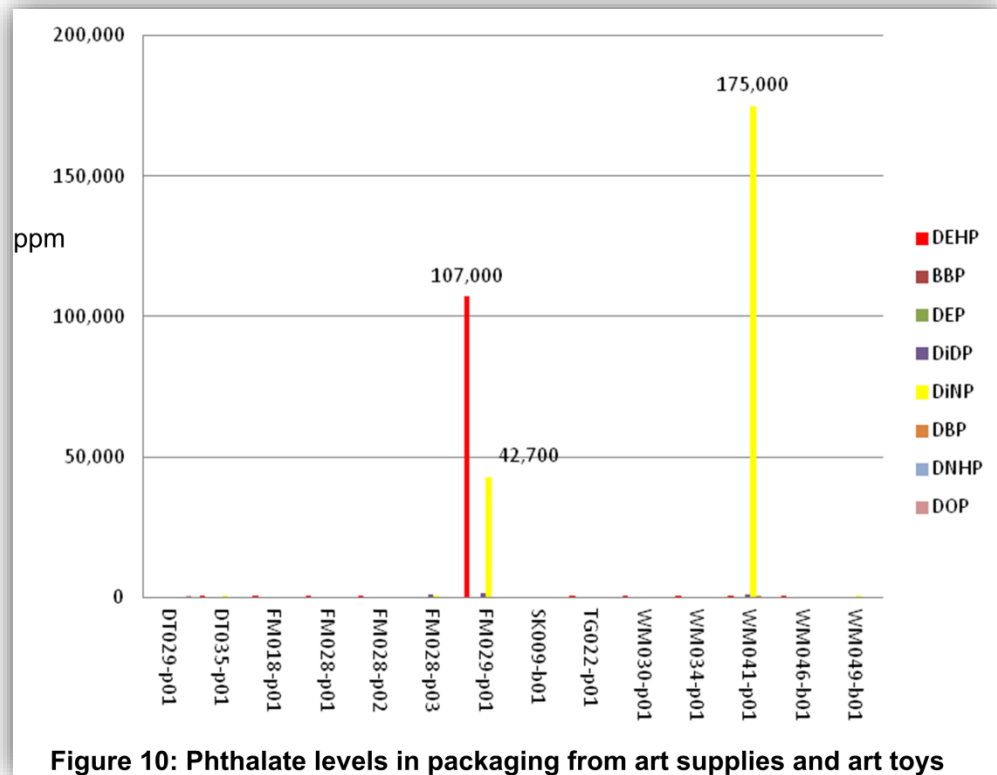


Figure 11 shows phthalates in packaging from baby accessories. Only one sample contained appreciable levels of phthalates. Packaging from a pair of Mickey Mouse underwear contained DEHP at 84,800 ppm (8.48% by weight). DEHP was the only phthalate found in this category. Three other samples contained low levels of DEHP ranging from 13.6 to 120 ppm. As phthalates are typically used at much higher levels, it is possible DEHP was a contaminant in these samples and not intentionally added.

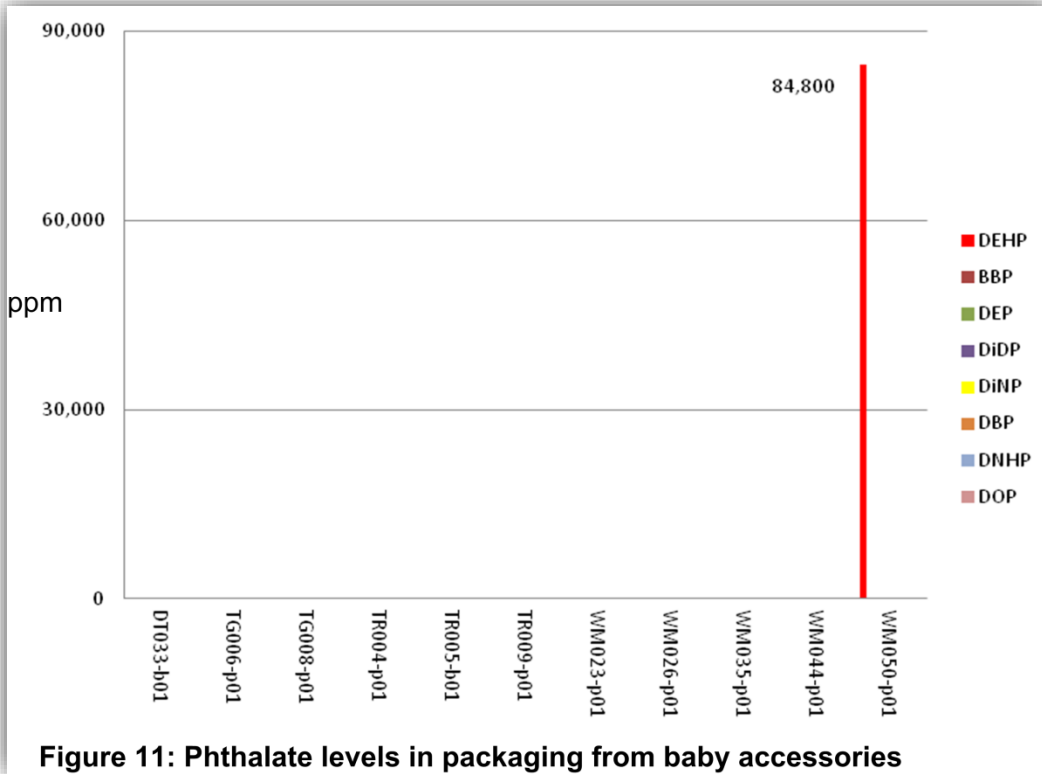


Figure 12 shows the phthalates in packaging from bath accessories. Packaging from only two products contained phthalates at appreciable levels ranging from 4,970 (0.50% by weight) to 18,100 (1.81%). Packaging from a Green Apple Body Care Bag containing shower gel, body lotion, body mist, and a loofah (SK015-p01) contained DiDP at 18,000 ppm (1.8%). This sample was run in duplicate and both sample results are shown in Figure 12.

Another sample from the same Body Care product, a case used to contain items in the set was evaluated for compliance with both toxics in packaging legislation and reporting requirements for the Children’s Safe Product Act. This sample, SK01-b01, contained DEP at 4,970 ppm (0.50% by weight).

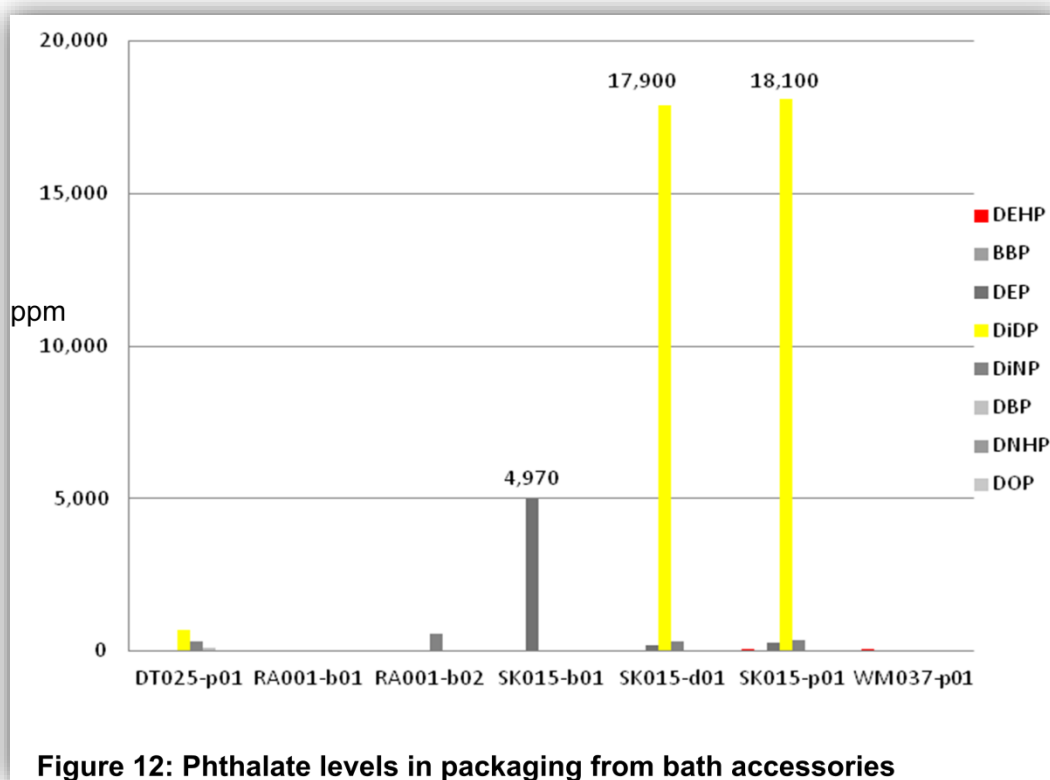


Figure 13 shows phthalates levels in packaging from cosmetics. Three samples contained DEHP, the phthalate of highest concern, at concentrations ranging from 125,000 (12.5% by weight) to 196,000 ppm (19.6%). The highest concentrations (196,000 ppm) were found in packaging from a white sleep mask (SK004-p01), the plastic pouch (136,000 ppm) from an eye shadow brush (DT032-p01), and the plastic pouch (125,000 ppm) from a makeup brush (DT030-p01). One other sample, a pink/purple polka dot bag (SK017-p01), contained DEHP at 15,400 ppm (1.54%). This sample also contained DiNP at similar levels of 12,200 ppm (1.22%). Six other samples contained substantially lower levels of DEHP ranging from 19.7 to 123 ppm. These levels may be due to contamination and not an intentional addition as the concentrations are too low to function as a plasticizer.

Two other packaging samples, packaging from a Princess lip gloss and nail polish (CL002-b01) and a Hello Kitty nail polish package contained DiDP at 128,000 ppm (12.8%) and 38,200 ppm (3.82%), respectively. Several other phthalates were found at substantially lower levels. DNHP and DOP were not found in any of the packaging tested.

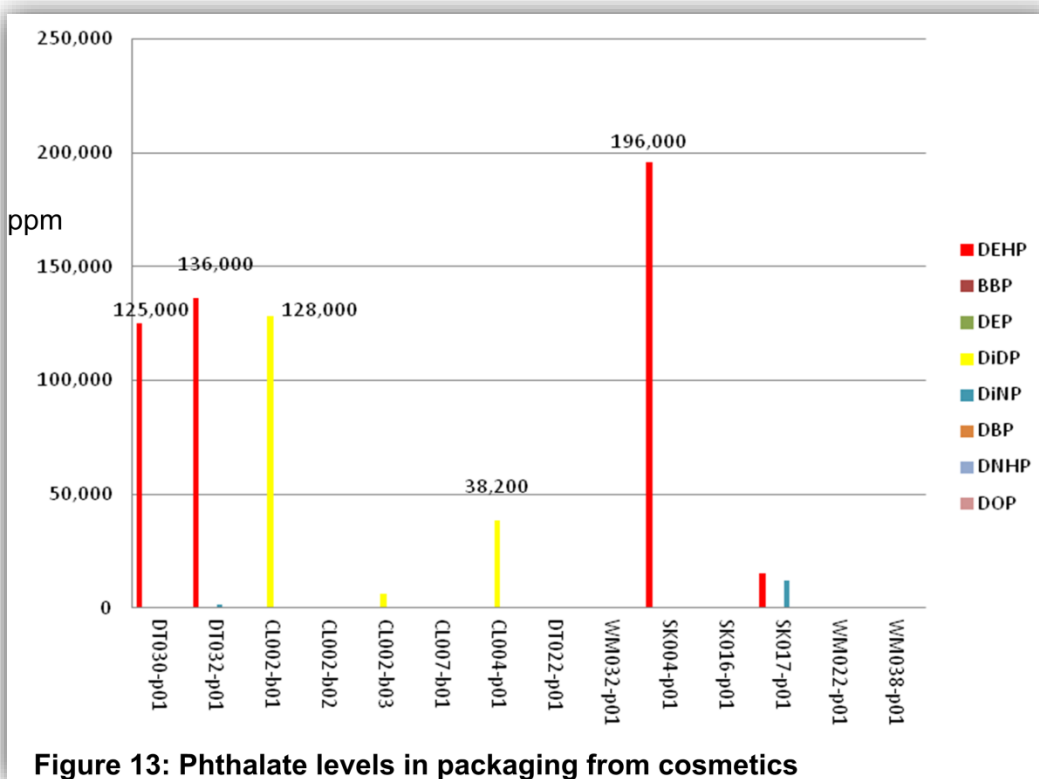


Figure 14 shows phthalates in packaging from houseware products. DEHP was found at appreciable levels ranging from 13,900 ppm (1.39% by weight) to 168,000 ppm (16.8%). The highest levels were in packaging from a turquoise curtain (168,000 ppm or 16.8%), waterproof pouches (166,000 ppm or 16.6%), a pillow protector (150,000 ppm or 15.0%), and a khaki curtain set (139,000 ppm or 13.9%). Pillow protector packaging had slightly lower levels (75,000 ppm or 7.5%) and a razor set packaging contained even lower levels (13,900 ppm or 1.39%). Packaging from five other samples contained DEHP between 85.9 ppm to 291 ppm, possibly due to contamination rather than intentional addition.

Packaging from two other products contained appreciable levels of phthalates. One product, a yellow vinyl basket, was run in duplicate and contained DiNP at approximately 165,000 ppm or 16.5%, (172,000 and 157,000 ppm). Both values are shown in Figure 14. Another sample of waterproof pouch packaging contained the highest phthalates level in this study with DiDP at 264,000 ppm (26.4%).

Small amounts of phthalates were found in other packaging samples. BBP, DNHP, and DOP were not found in any samples.

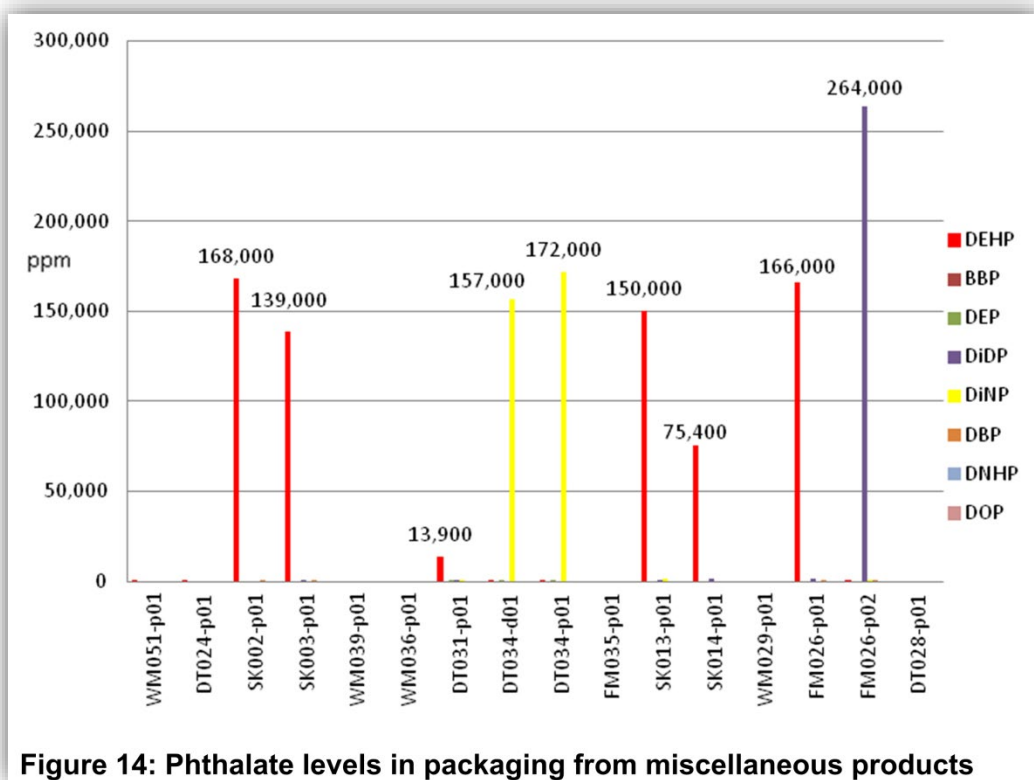


Figure 15 shows phthalates in packaging from miscellaneous samples, primarily pet treats, sneakers, tennis balls, and an eyeglass cleaning cloth. DEHP was found in all but the sneaker packaging and at an appreciable level in three samples of tennis balls (202,000 ppm or 20.2%) and two pet treats, smoked pork hide knotted bones (128,000 ppm or 12.8%) and rawhide dog treats (102,000 ppm or 10.2%). The tennis ball packaging also contained DiNP at 20,100 ppm (2.01%) and two other phthalates at lower levels for a total concentration of 222,955 ppm (22.3%).

The first pet treat packaging sample, the smoked pork hide knotted bones, also contained DiDP at 16,600 ppm (1.66%) and DBP at 2,010 ppm (0.20%), BBP at 748 ppm (0.0075%) and DEP at 16.2 ppm for a total concentration of 147,374.2 ppm (14.74%).

DiDP was the only remaining phthalate found at appreciable levels in the packaging of the eyeglass cleaning cloth at 69,200 ppm (6.9%). Small amounts of phthalates were found in the remaining samples. DNHP and DOP were not found in any sample tested.

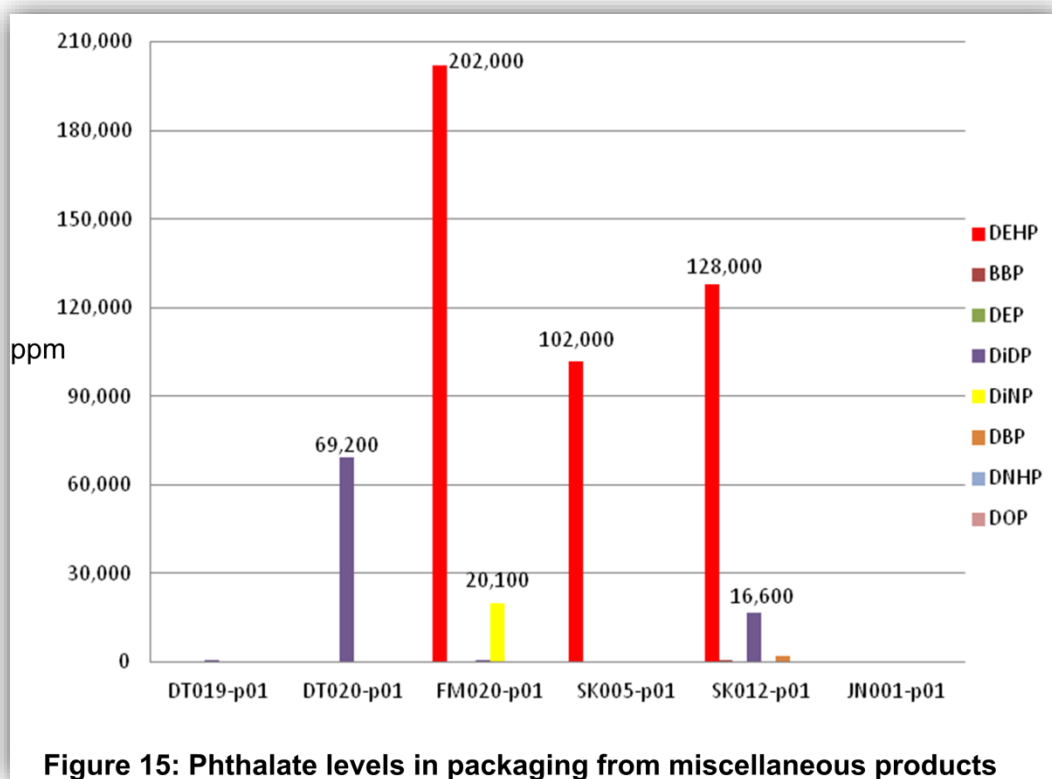
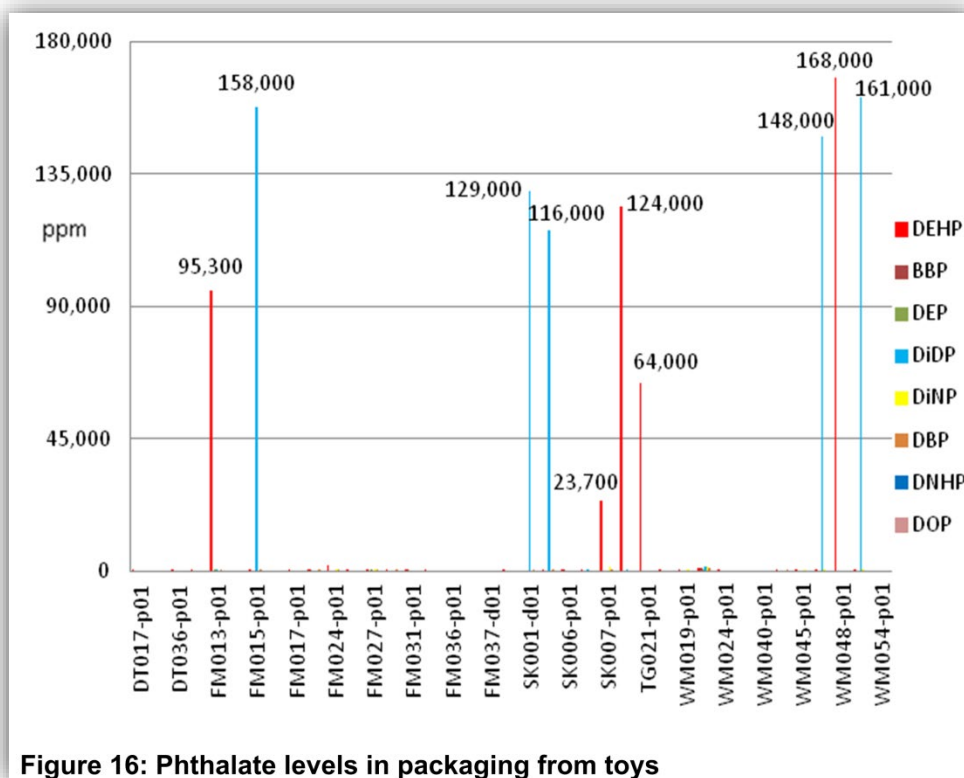




Figure 16 shows phthalates in toy packaging. DEHP and DEP were found at appreciable levels in ten of the 39 toy packaging samples, 25.6% of the samples tested. DEHP ranged from 23,700 ppm (2.37% by weight) to 168,000 ppm (16.8%) and DiDP ranged from 129,000 ppm (12.9%) to 161,000 ppm (16.1%). Twenty-nine of the 39 samples (74%) contain some level of DEHP. The highest DEHP levels were found in packaging from aqua jewelry (168,000 ppm or 16.8%) and a Blobby Robby Junior (124,000 ppm or 12.4%).

DiDP was found at higher levels than DEHP although in fewer samples. Four samples were found above 116,000 ppm (11.6%). The highest concentrations occurred in packaging from wooden whistles (161,000 ppm or 16.1%), toy soldiers (158,000 ppm or 15.8%), and fish bath toys (148,000 ppm or 14.8%). Two packaging samples for tennis rackets reported high levels of DiDP at 129,000 (12.9%) and 116,000 ppm (11.6%).

Interestingly, one sample, packaging from a squirty bath toy, contained low levels of six of the phthalates for a total concentration of 6,483 ppm (0.65%). Small amounts of phthalates were found in the remaining samples. DNHP and DOP were not found in any sample tested.



Sampling results are available (Appendix 3).

## Conclusions: Packaging

Based upon the results discussed above, the following conclusions can be reached:

- DEHP, one of the phthalates of highest environmental concern, is being used in packaging. As many legislation banning the use of DEHP also exempted packaging, phthalates continue to be used and are likely a potential source of exposure for children and consumers.
- Other phthalates such as DEP, DiDP, and DiNP are also used in packaging at appreciable levels.
- DNHP and DOP do not appear to be used in packaging at an appreciable level.
- Packaging from a wide range of products can be analyzed for the eight phthalates.
- Phthalates can be detected at less than 1 ppm levels in most product packaging.

## References

Barr, L., G. Metaxas, C. A. J. Harbach, L.A. Savoy and P. D. Darbre, 2012. Measurement of paraben concentrations in human breast tissue at serial locations across the breast from axilla to sternum, *J. Applied Tox.*, 32, pages 219-232.

Calafat, A.M., X Ye, L-Y. Wong, A. M. Bishop and L. L. Needham, 2010; Urinary concentrations of four parabens in the U.S. population, 2005-2006. *Environ Health Perspect*, 118, pages 679-85.

Centers for Disease Control and Prevention (CDC), 2012; National Report Human Exposure to Environmental Chemicals, Summary of Parabens,

Washington Department of Ecology (Ecology), 2009. The Reporting List of Chemicals of High Concern to Children (CHCC).

Ecology, 2011. Chapter 173-334 WAC, Children's Safe Product Act.

Ecology, 2012a. Quality Assurance Project Plan (QAPP) Parabens and Metals in Children's Cosmetic and Personal Care Products, 22 p.

Ecology, 2012b. QAPP Phthalates and Metals in Children's Products, 20 p.

Ecology, 2012c. QAPP Formaldehyde, Volatile Organic Compounds and Metals in Children's Products, 24 p.

Frederiksen, H., N. Jorgensen, A-M. Andersson, 2011; Parabens in urine, serum and seminal plasma from healthy Danish men determined by liquid chromatography—tandem mass spectrometry (LC—MS/MS). *J. Expos Sci Environ Epidemiol.*, May-Jun, 21(3), pages 262-71.

Stone, Alex and Damon Delistraty, 2010; 'Sources of toxicity and exposure information for identifying chemicals of high concern to children', *Env. Impact Assess. Review*, 30, pages 380–387.

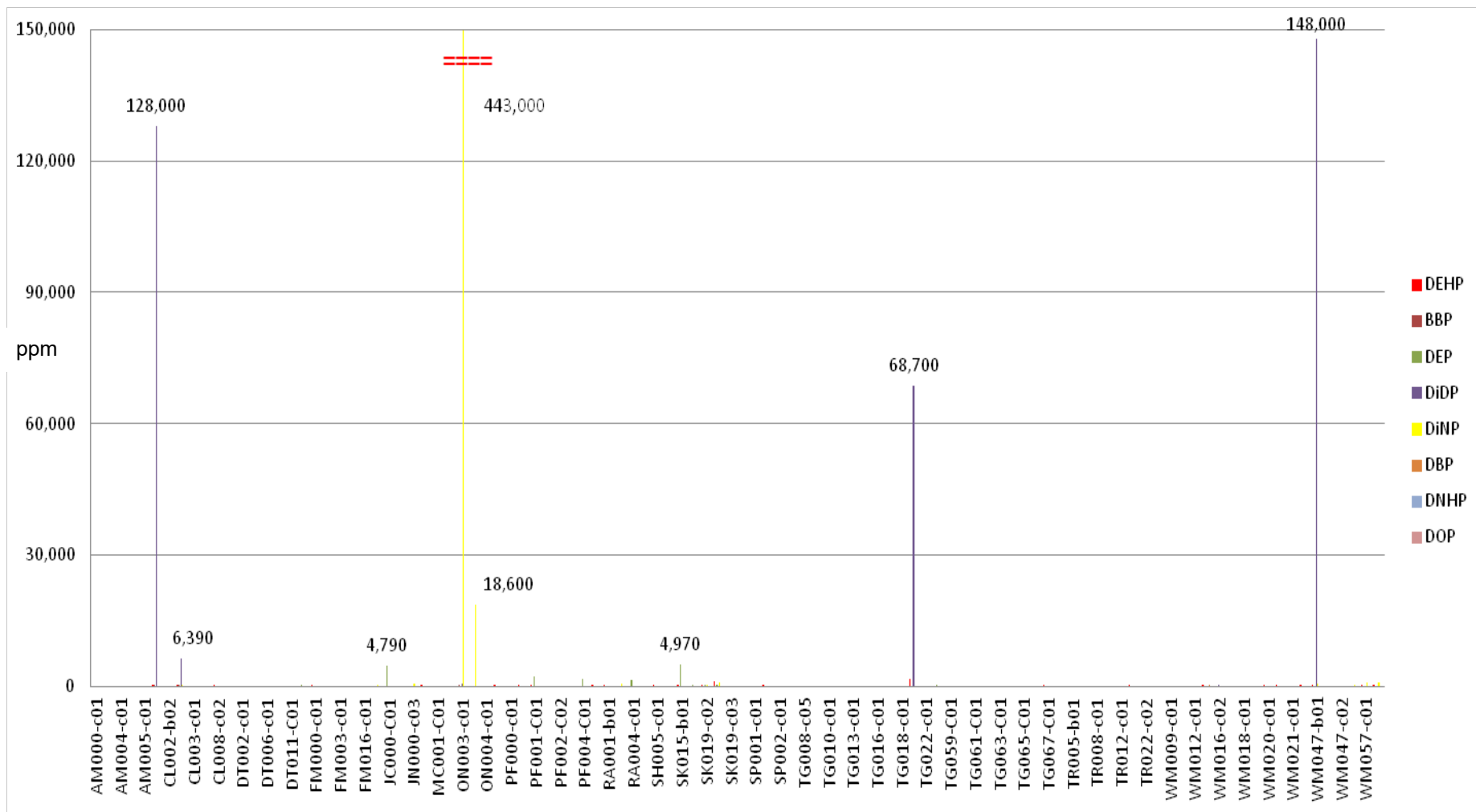
United States Food and Drug Administration (USFDA), 2012; Paraben website, accessed 1/3/2012.

Washington Department of Health (DOH), 2011; Rationale for Reporting List of Chemicals of High Concern to Children Prepared by the Washington State Department of Health for the Children's Safe Product Act, 46 p.

Washington State Legislature (WSL), 1991. Chapter 70.95 RCW Packages Containing Metals.

Ye, X, A. M. Bishop, J. A. Reidy, L. L. Needham, and A. M. Calafat, 2006; Parabens as urinary biomarkers of exposure in humans, *Environ Health Perspect.*, 114, pages 1843-1846.

# Appendix 1: Results of phthalate analyses for all product components tested



## Appendix 2: Data from analysis of products for phthalates

Art Accessories	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Colored moldable "play" dough	DT006-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Colored moldable "play" dough	DT006-c02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Washable, no run school glue	SK009-b01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Assorted play-doh	TG022-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Minnie Mouse Pencil Case	WM046-b01	20.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pirate Pencil Case	WM049-b01	0.0	0.0	0.0	0.0	298.0	0.0	0.0	0.0

Baby Accessories	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Natural Rubber Teething Giraffe	AM000-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Soft baby toothbrush teether	AM003-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bumpy raspberry teething pacifier	AM004-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bumpy raspberry teething pacifier	AM004-c02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baby tooth brush	AM005-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 Pack silicone nipples	DT000-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scrub-bubble bath book	DT002-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Disposable baby bibs	DT005-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bedtime Baby Cream	DT033-b01	0.0	0.0	47.6	0.0	0.0	0.0	0.0	0.0
Floating stars teether	FM000-c01	49.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Blue teething ring	FM001-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 Pacifier set	FM010-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pacifier	SP002-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 Pacifier set	TG000-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Easy squeeze spoon	TG008-c05	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Assorted baby spoons	TG009-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 Pacifier set	TG010-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 Teething rings	TG012-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Baby Accessories	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Contact nipple shield	TG013-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wide base nipples	TG014-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Teething rings	TG016-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ernie book	TG017-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 Pacifier set	TG018-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Silicone nipples	TR000-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pacifier	TR005-b01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pacifier	TR005-c02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pink teething ring	TR009-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Dr. Suess bib	TR012-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pee protector with basketball motif	TR022-c02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Small baby bottle	WM005-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Basketball pacifiers	WM009-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Basketball pacifiers	WM009-c03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Soothie pacifier	WM012-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pink bib	WM015-c01	28.30	0.0	0.0	0.0	0.0	11.9	0.0	0.0
Striped blue/green bib	WM016-c02	0.0	0.0	0.0	277.0	0.0	0.0	0.0	0.0
3 Teething rings	WM017-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
4 Baby feeding spoons	WM018-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Assorted baby spoons	WM021-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Bath Accessories	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Squishy squirty fish	FM016-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinkerbell bubble bath	RA001-b01	19.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinkerbell bubble bath	RA001-b02	0.0	0.0	0.0	0.0	565	0.0	0.0	0.0
Body Care , shower gel, body lotion & mist, loofah	SK015-b01	22.7	0.0	4,970	0.0	0.0	0.0	0.0	0.0
Bath book	TG021-c01	1,630.0	0.0	0.0	68,700.0	0.0	0.0	0.0	0.0

<b>Bath Accessories</b>	<b>Sample</b>	<b>DEHP</b>	<b>BBP</b>	<b>DEP</b>	<b>DiDP</b>	<b>DiNP</b>	<b>DBP</b>	<b>DNHP</b>	<b>DOP</b>
Detangling spray - double Dutch apple	TG059-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bubble Bath	TG060-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 in 1 Shampoo conditioner body wash	TG061-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Body Wash - Vanilla Swirl	TG062-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bubble Bath Sweet Strawberry	TG063-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 in 1 conditioning detangler	TG064-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Strawberry body wash	TG066-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bath fish book	TR008-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Rubber duckies	TR013-c01	58.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Squirty bath toys	WM019-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fish bath toys	WM047-b01	117.0	0.0	0.0	148,000.0	604.0	0.0	0.0	0.0
Fish bath toys	WM047-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Fish bath toys	WM047-c02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

<b>Cosmetics</b>	<b>Sample</b>	<b>DEHP</b>	<b>BBP</b>	<b>DEP</b>	<b>DiDP</b>	<b>DiNP</b>	<b>DBP</b>	<b>DNHP</b>	<b>DOP</b>
Princess lip gloss/nail polish	CL002-b01	25.3	13.7	0.0	128,000.0	0.0	0.0	0.0	0.0
Princess lip gloss/nail polish	CL002-b02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Princess lip gloss/nail polish	CL002-b03	19.7	11.9	0.0	6,390.0	443.0	0.0	0.0	0.0
Nerds scented nail polish pack	CL003-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Make up pack	CL007-b01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pink Coin Purse	CL008-c02	14.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scented neon nail polish set	FM003-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Scented Nail Polish	RA004-c01	0.0	0	1390.0	0.0	0	0.0	0.0	0.0
12 Roll-on lip glosses	SK019-c01	0.0	0	78.9	0.0	0	0.0	0.0	0.0
12 Roll-on lip glosses	SK019-c02	1,030.0	0	14.6	0.0	869.0	0.0	0.0	0.0
12 Roll-on lip glosses	SK019-c03	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

<b>Fragrances</b>	<b>Sample</b>	<b>DEHP</b>	<b>BBP</b>	<b>DEP</b>	<b>DiDP</b>	<b>DiNP</b>	<b>DBP</b>	<b>DNHP</b>	<b>DOP</b>
Body "splash" (body spray)	DT011-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eau de toilette	JC000-C01	0.0	0.0	4790.0	0.0	0.0	0.0	0.0	0.0
Eau de parfum spray and body lotion	MC001-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eau de parfum spray and body lotion	MC001-C02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perfume and Body Wash	PF000-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Perfume and Body Wash	PF000-C02	35.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eau de toilette	PF001-C01	51.7	0.0	2330.0	0.0	0.0	0.0	0.0	0.0
Eau de toilette and body lotion	PF002-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eau de toilette and body lotion	PF002-C02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Body spray	PF003-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mickey Eau de Toilette	PF004-C01	0.0	0.0	1630.0	0.0	0.0	0.0	0.0	0.0
Adorable Eau de Toilette	PF005-CO1	46.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Body mist	TG058-C01	0.0	0.0	285.0	0.0	0.0	0.0	0.0	0.0
Most Wanted fragrance body spray	TG065-C01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Someday eau de parfum spray	TG067-C01	54.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0

<b>Halloween Products</b>	<b>Sample</b>	<b>DEHP</b>	<b>BBP</b>	<b>DEP</b>	<b>DiDP</b>	<b>DiNP</b>	<b>DBP</b>	<b>DNHP</b>	<b>DOP</b>
Vampire teeth	SH002-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Necklace	SH005-c01	234.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Elephant Nose	SK021-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ghoul costume	WM057-c01	171.0	0.0	0.0	0.0	841.0	0.0	0.0	0.0
Teeth Paint and Mouth Glow	WM061-c01	15.7	0.0	0.0	0.0	920.0	0.0	0.0	0.0

<b>Footwear</b>	<b>Sample</b>	<b>DEHP</b>	<b>BBP</b>	<b>DEP</b>	<b>DiDP</b>	<b>DiNP</b>	<b>DBP</b>	<b>DNHP</b>	<b>DOP</b>
Egyptian turquoise sandals	GP001-c02	0.0	0.0	0.0	0.0	373.0	0.0	0.0	0.0
White Tennis Shoes and bib	JN000-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
White Tennis Shoes and bib	JN000-c03	0.0	0.0	0.0	0.0	526.0	0.0	0.0	0.0
Tennis Shoes	JN001-c01	52.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0



<b>Footwear</b>	<b>Sample</b>	<b>DEHP</b>	<b>BBP</b>	<b>DEP</b>	<b>DiDP</b>	<b>DiNP</b>	<b>DBP</b>	<b>DNHP</b>	<b>DOP</b>
Baby Sandals	ON003-c01	0.0	12.9	0.0	646.0	443,000.0	0.0	0.0	0.0
Baby Sandals	ON003-c02	0.0	0.0	0.0	0.0	18,600.0	0.0	0.0	0.0
Yellow baby mud boots	ON004-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yellow baby mud boots	ON004-c04	30.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baby Sandals	SP001-c01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baby Sandals	SP001-c03	33.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pink baby ballet slippers	WM020-c01	336.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pink baby ballet slippers	WM020-c02	17.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0

### Appendix 3: Data from analysis of packaging for phthalates

Description	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Super molding compound, looks like styrofoam	DT029-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	18
20 Washable markers	DT035-p01	315.0	0.0	0.0	0.0	288.0	0.0	0.0	0.0
Paint roller	FM018-p01	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Play-doh animal bag	FM028-p01	12.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Play-doh animal bag	FM028-p02	18.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Play-doh animal bag	FM028-p03	0.0	0.0	0.0	1,050	289.0	0.0	0.0	0.0
Paint roller	FM029-p01	107,000.0	0.0	0.0	1,630	42,700.0	0.0	0.0	0.0
Washable, no run school glue	SK009-b01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Assorted play-doh	TG022-p01	14.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Holographic Classroom Accents, smiley faces	WM030-p01	420.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Toilet seat sticker	WM034-p01	23.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
30 Washable fine point markers	WM041-p01	10.6	0.0	0.0	1,070	175,000.0	10.5	0.0	0.0
Minnie Mouse Pencil Case	WM046-b01	20.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pirate Pencil Case	WM049-b01	0.0	0.0	0.0	0.0	298.0	0.0	0.0	0.0

Description	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Bedtime Baby Cream	DT033-b01	0.0	0.0	47.6	0.0	0.0	0.0	0.0	0.0
Hooded towel	TG006-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Easy squeeze spoon	TG008-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baby spoon and bowl	TR004-p01	120.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pacifier	TR005-b01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pink teething ring	TR009-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Diaper sacks	WM023-p01	31.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Soothing Breast Wipes	WM026-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Snack food container	WM035-p01	13.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Moist wipes	WM044-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Description	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Mickey Mouse undies	WM050-p01	84,800.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Description	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Cherry body lotion and scent	DT025-p01	22.0	0.0	33.0	683.0	303.0	116.0	0.0	0.0
Tinkerbell bubble bath	RA001-b01	19.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Tinkerbell bubble bath	RA001-b02	0.0	0.0	0.0	0.0	565.0	0.0	0.0	0.0
Body Care, shower gel, body lotion body mist, loofah	SK015-b01	22.7	0.0	4,970.0	0.0	0.0	0.0	0.0	0.0
Body Care, shower gel, body lotion body mist, loofah	SK015-d01	26.7	0.0	185.0	17,900.0	331.0	0.0	0.0	0.0
Body Care, shower gel, body lotion body mist, loofah	SK015-p01	72.9	10.4	257.0	18,100.0	362.0	0.0	0.0	0.0
Watermelon lip smackers bath and body collection	WM037-p01	46.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Description	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Makeup brush	DT030-p01	125,000.0	0.0	28.0	376.0	0.0	0.0	0.0	0.0
Angel tip eye shadow brush	DT032-p01	136,000.0	0.0	9.0	532.0	1,330.0	0.0	0.0	0.0
Princess lip gloss/nail polish	CL002-b01	25.3	13.7	0.0	128,000.0	0.0	0.0	0.0	0.0
Princess lip gloss/nail polish	CL002-b02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Princess lip gloss/nail polish	CL002-b03	19.7	11.9	0.0	6,390.0	443.0	0.0	0.0	0.0
Make up pack	CL007-b01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hello Kitty Nail Polish Pack	CL004-p01	40.9	0.0	0.0	38,200.0	292.0	0.0	0.0	0.0
Herbal escapes clarifying conditioner	DT022-p01	112.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Manicure Set	WM032-p01	123.0	0.0	0.0	0.0	0.0	81.3	0.0	0.0
White sleep mask	SK004-p01	196,000.0	0.0	0.0	0.0	0.0	26.4	0.0	0.0
Purple makeup bag	SK016-p01	52.6	13.1	0.0	0.0	397.0	0.0	0.0	0.0
Pink/purple polka dot bag	SK017-p01	15,400.0	0.0	0.0	0.0	12,200.0	0.0	0.0	0.0
Lip Gloss	WM022-p01	0.0	0.0	0.0	0.0	516.0	0.0	0.0	0.0
Lip balm	WM038-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Description	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Pink fitted crib sheet	WM051-p01	169.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bungee cords	DT024-p01	232.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Turquoise teenage curtain	SK002-p01	168,000.0	0.0	0.0	0.0	0.0	11.5	0.0	0.0
Khaki curtain	SK003-p01	139,000.0	0.0	0.0	1,010.0	0.0	225.0	0.0	0.0
Pizza Slice Bags	WM039-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Hair Rollers	WM036-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Eyebrow razors, 2	DT031-p01	13,900.0	0.0	3.05	42.0	137.0	0.0	0.0	0.0
Yellow vinyl basket	DT034-d01	85.9	0.0	12.2	0.0	157,000	0.0	0.0	0.0
Yellow vinyl basket	DT034-p01	123.0	0.0	14.2	0.0	172,000	0.0	0.0	0.0
Tablecloth clamps	FM035-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Pillow protector	SK013-p01	150,000.0	0.0	0.0	990	1,390	0.0	0.0	0.0
Pillow protector	SK014-p01	75,400.0	0.0	0.0	1,290	0.0	0.0	0.0	0.0
SpongeBob table cloth	WM029-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waterproof pouches	FM026-p01	166,000.0	0.0	0.0	1,570	0.0	25.8	0.0	0.0
Waterproof pouches	FM026-p02	291.0	0.0	0.0	264,000.0	385.0	10.4	0.0	0.0
Yellow rubber gloves	DT028-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Description	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Mouse traps	DT019-p01	34.1	0.0	0.0	611.0	0.0	0.0	0.0	0.0
Eyeglass cleaning cloth	DT020-p01	36.3	0.0	0.0	69,200.0	296.0	0.0	0.0	0.0
Peanut butter tennis balls (2)	FM020-p01	202,000.0	0.0	131.0	724.0	20,100.0	0.0	0.0	0.0
Rawhide dog treats	SK005-p01	102,000.0	25.2	14.4	0.0	0.0	0.0	0.0	0.0
Smoked two tone porkhide knotted bones	SK012-p01	128,000.0	748.0	16.2	16,600.0	0.0	2,010.0	0.0	0.0
Tennis Shoes	JN001-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Description	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
3 Pack of bubble solution	DT017-p01	18.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Description	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Plastic snakes	DT026-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Baseball set, bases	DT036-p01	10.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Ginormous Grow Frog	FM012-p01	16.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
3 Whiffle balls	FM013-p01	95,300.0	0.0	11.4	491.0	0.0	81.7	0.0	0.0
Orange glow necklace	FM014-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
35 Toy soldiers	FM015-p01	42.3	0.0	0.0	158,000.0	0.0	14.2	0.0	0.0
Squishy squirty fish	FM016-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nerf ammunition	FM017-p01	10.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Little people in plastic balls	FM023-p01	423.0	9.2	0.0	0.0	0.0	14.1	0.0	0.0
Glow in the dark plastic bugs	FM024-p01	2,020.0	0.0	0.0	0.0	326.0	18.3	0.0	0.0
Whoopee cushion	FM025-p01	87.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Plastic farm animals	FM027-p01	10.1	0.0	19.1	0.0	362.0	26.2	0.0	0.0
Pink plastic recorder	FM030-p01	28.0	0.0	0.0	0.0	0.0	9.0	0.0	0.0
Mini whiffle balls	FM031-p01	243.0	16.7	0.0	0.0	0.0	0.0	0.0	0.0
Nerf gun darts	FM033-p01	17.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Green lantern kite	FM036-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Green lantern kite	FM036-p02	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beach/Sand toys	FM037-d01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Beach/Sand toys	FM037-p01	14.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Wow rackets, 2 rackets with ball and birdy	SK001-d01	0.0	0.0	0.0	129,000	0.0	10.5	0.0	0.0
Wow rackets, 2 rackets with ball and birdy	SK001-p01	22.4	0.0	0.0	116,000	0.0	29.6	0.0	0.0
Princess bouncy ball paddle	SK006-p01	59.4	11.5	0.0	0.0	0.0	0.0	0.0	0.0
Princess bouncy ball paddle	SK006-p02	35.6	0.0	0.0	257	0.0	0.0	0.0	0.0
Twistable crayons, 24	SK007-p01	23,700.0	0.0	0.0	0.0	1,590.0	21.6	0.0	0.0
Blobby Robby Junior	SK011-p01	124,000.0	0.0	0.0	487.0	0.0	0.0	0.0	0.0
Bath book	TG021-p01	64,000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Squishy book	WM008-p02	84.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Description	Sample	DEHP	BBP	DEP	DiDP	DiNP	DBP	DNHP	DOP
Squirty bath toys	WM019-p01	13.7	0.0	0.0	0.0	250.0	0.0	0.0	0.0
Squirty bath toys	WM019-p02	920.0	978.0	623.0	1,480.0	1,540.0	942.0	0.0	0.0
Bird Toy	WM024-p01	17.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Party favors: mini tiaras	WM028-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Minnie Mouse noise makers	WM040-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
48 Small army soldiers	WM043-p01	34.4	0.0	0.0	0.0	0.0	10.4	0.0	0.0
Party favors: 4 tractors	WM045-p01	17.0	0.0	0.0	0.0	435.0	0.0	0.0	0.0
Fish bath toys	WM047-b01	117.0	0.0	0.0	148,000.0	604.0	0.0	0.0	0.0
Aqua Jewels	WM048-p01	168,000.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2 Wooden whistles	WM052-p01	307.0	0.0	0.0	161,000.0	466.0	0.0	0.0	0.0
Yellow plastic recorder	WM054-p01	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0