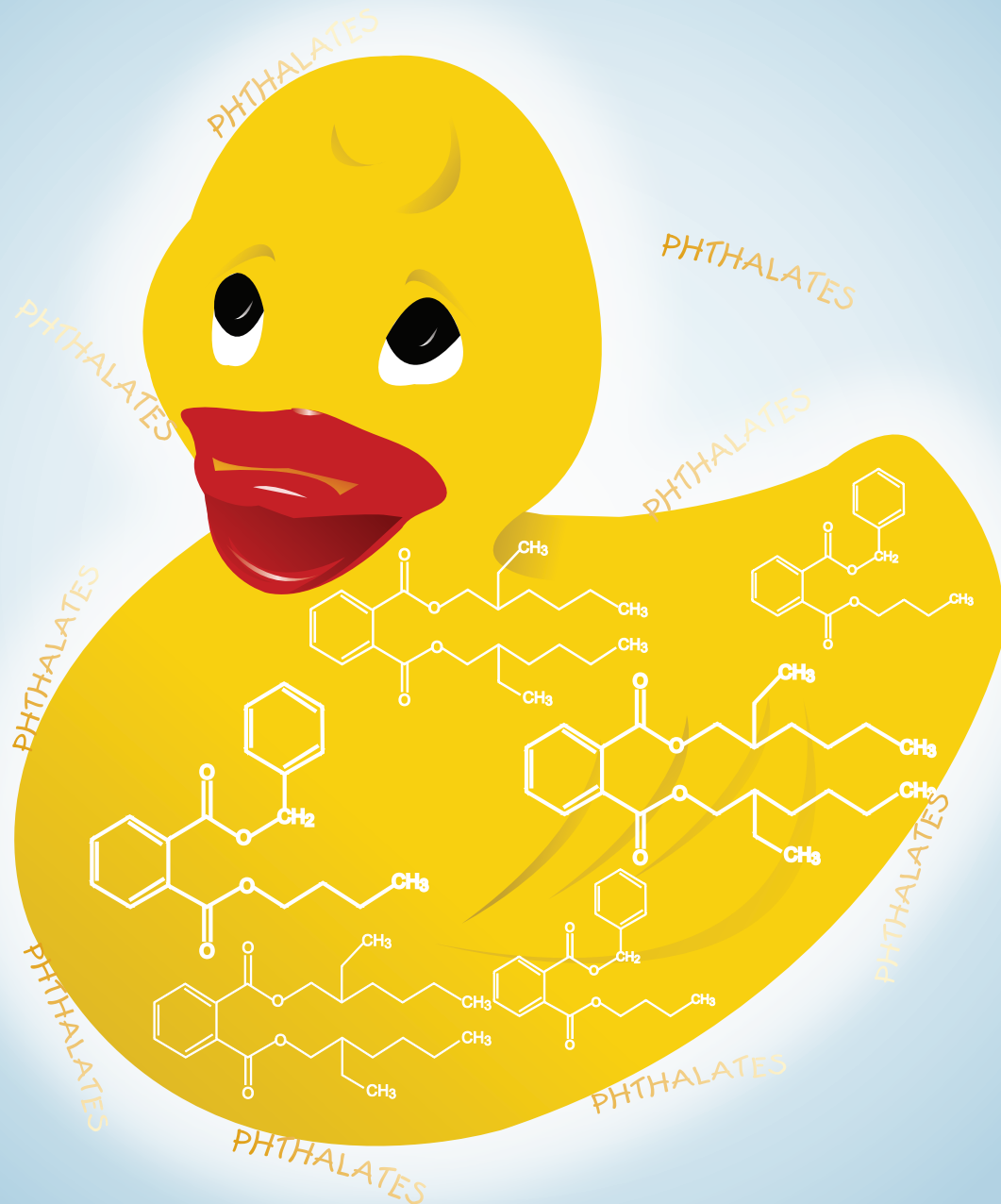


# NOT SO SQUEAKY CLEAN

## A Study of Phthalates in Toys



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Not So Squeaky Clean is a Washington Toxics Coalition report for the Toxic-Free Legacy Coalition.

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# Executive Summary

2007 was the year of the toxic toy, in which major toy companies recalled millions of toys due to lead contamination. Despite the recalls, testing of 1,200 toys by the Washington Toxics Coalition, the Michigan-based Ecology Center and others in late 2007 found that the problem hasn't been solved: more than a third of the toys tested positive for lead, and nearly 50% were made of PVC (polyvinyl chloride, also known as vinyl), a plastic associated with the use of toxic additives.<sup>1</sup> The testing also revealed that toys made of PVC were more likely to contain toxic metals such as lead and cadmium.

To learn if PVC toys contain other hidden dangers, we sent 20 PVC toys to an accredited laboratory to test for the plasticizers known as phthalates. Because PVC is by nature a brittle plastic, manufacturers add in additional chemicals (known as plasticizers) to make PVC toys pliable. Phthalates are the most commonly added plasticizers today, but have been under increasing scrutiny because of their potential harmful health effects, particularly on reproductive development.

Toys and other children's products made for the European market today are likely to contain alternative plasticizers, as the European Union bans phthalates from most toys and children's products. The state of California passed legislation in 2007 with the same restrictions. Although Washington state has been a leader in protecting children's health from toxic chemicals, no restrictions on phthalate use are currently in place for products sold in Washington.

We purchased toys at major retailers including Target, Fred Meyer, Meijer, and Toys "R" Us, drugstores such as Bartell Drugs and Rite Aid, toy stores, and dollar stores. We tested the toys using an XRF (x-ray fluorescence) analyzer to determine whether they were made of PVC. We selected 20 PVC toys to be tested for phthalates, including toys used by children of a range of ages but with a focus on those that could be used by small children.

# Key Findings

**1. Many toys contain phthalates.** Laboratory testing detected phthalates in 9 of the 20 toys we submitted for testing. Toys with phthalates included dolls, squeeze toys, animal figurines, a Tinkertoys component, and a ball.

**2. Phthalates are present at high levels in toys.** In many cases, phthalates make up a large proportion of the total content of the product: six of the toys we tested were made of between 28% and 47% phthalates.

For example:

- A green ball purchased at Toys 'R' Us contained more than 47%.
- A "rubber ducky" purchased at Fred Meyer contained more than 36%.
- A dinosaur figurine purchased at Wal-Mart contained more than 28%.

**3. Some manufacturers are making toys without phthalates.** A doll manufactured by the European toy company Götz tested free of the chemicals. Products by toy industry giant Mattel, which distributes widely in Europe, also tested free of phthalates.

**4. Phthalates are a hidden hazard.** Parents and consumers don't have access to information on whether toys contain phthalates because they are not listed on product labels. None of the phthalate-containing toys we tested were labeled as such.

In many cases, phthalates make up a large proportion of the total content of the product: six of the toys we tested were made of between 28% and 47% phthalates.

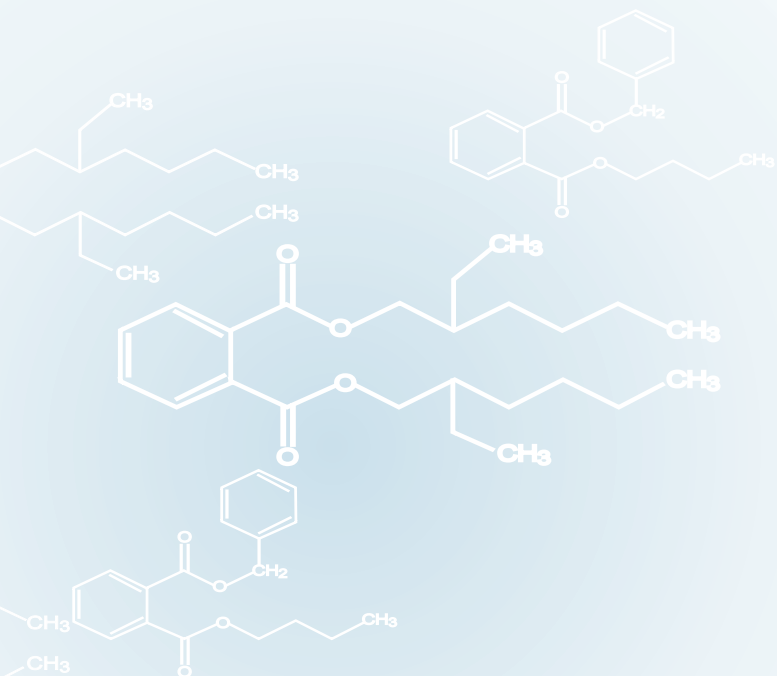
# Recommendations

Washington state should pass legislation in 2008 to ensure that toys and other children's products sold in Washington are safe. Legislation should include the following three elements:

**1. Washington state should ban phthalates from toys and other children's products.** The European Union and state of California have already taken action to prevent phthalates from being used in toys and other items used by children. Washington lawmakers should take action so that our state's children also have access to safer toys.

**2. Manufacturers should provide information on the toxic chemicals they use in children's products.** Studies such as this one provide important information about what toxic chemicals are present in toys and other children's products. Unfortunately, parents and other consumers have no other way to identify which toys are safe for their children. Manufacturers should provide information on the chemical content of toys directly to the state Department of Ecology, which can make it available to consumers.

**3. The state Department of Ecology should study whether other chemical hazards can be found in children's products.** Ecology should collect information on whether chemicals that may cause learning or reproductive problems, cancer, or hormone disruption are present in children's products, so that the state can take action to address the most serious hazards.





36.3% phthalates

A Target-brand penguin tested at more than 30% phthalate content.

## Phthalates: Hidden Danger in the Toy Box

Phthalates are a widely used family of plasticizers and fragrance carriers, with global use estimated at more than 3.5 million metric tons each year.<sup>b</sup> They are the most commonly used plasticizer in PVC plastic.

Phthalates can be found in PVC wallpaper, flooring, shower curtains, raincoats, packaging, medical equipment, and toys. Because they are not chemically bound to the PVC, phthalates can leach out of products over time and are found in air inside buildings as well as in household dust.<sup>3,4</sup> Children and adults are exposed to phthalates through air and dust, with children also being exposed through sucking and chewing on phthalate-containing items such as toys.<sup>5</sup>

With such broad use in common household products, it's not surprising that phthalates are widespread in the environment. Often present in urban stormwater runoff and released in the hundreds of thousands of pounds every year from industries, phthalates are found in groundwater, surface water, and sediment.<sup>6,7</sup>

### Phthalate syndrome, in the lab and in people

"Phthalate syndrome" may sound like the name of a science fiction movie, but it's actually what scientists have termed a pattern of reproductive problems that appear after prenatal exposure to phthalates. Decades of laboratory research have crystallized the problems. They include undescended testes, small or otherwise abnormal testes, and a condition known as hypospadias, in which the urethral opening is on the underside of the penis instead of the end — all signs of abnormal development of the male reproductive system.<sup>8</sup>

Further studies have begun to elucidate the cause: a number of phthalates, including DEHP, DBP, BBzP, and DINP (see Table 2 for full chemical names), have been found to reduce testosterone production by the fetus, which can result in off-target reproductive development and abnormal genitals.<sup>9,10,11,12</sup> Recently, researchers have turned their attention to a growing concern: whether these chemicals may prove to be more powerful when acting in combination. In 2007, U.S. Environmental Protection Agency and North Carolina State University researchers published the striking results of a trial examining the cumulative effects of two phthalates, DEHP and DBP.<sup>13</sup> In that study, the two phthalates together had much greater impact than either alone: 43% of the animals

exposed to the combination dose were born with hypospadias, compared to none or 2% in the single dose groups. Testosterone production was also significantly reduced in the animals exposed to both phthalates.

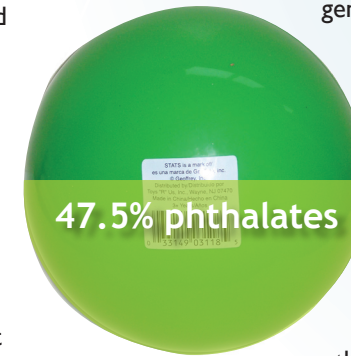
Researchers are now finding that these problems aren't limited to the laboratory. In a study looking at the reproductive health of baby boys with varying levels of phthalate exposure, Shanna Swan of the University of Rochester<sup>14</sup> found a link between greater exposure to several phthalates and altered genital development. Boys exposed to higher levels of phthalates before birth had a reduced anogenital distance, an indicator of feminization; these boys also had smaller penis size and a higher prevalence of undescended testes. Disturbingly, these effects occurred at exposure levels common in U.S. women today.

A second study of infants looked at levels of reproductive hormones in baby boys after birth, in comparison to their phthalate levels (measured in urine).<sup>15</sup> Exposure to several phthalates was correlated with decreased hormone production, an indication that the testes were not functioning properly. Evidence is also implicating phthalates in reproductive problems later in life. A series of studies in Massachusetts has explored the link between

phthalates and problems with sperm quality that affect fertility.<sup>16,17</sup> Laboratory studies have found that some phthalates can impact sperm production: to test whether this holds true in people, researchers evaluated sperm quality and measured urinary concentrations of phthalate metabolites, most recently in 379 men. Associations between exposure to four different phthalates and sperm damage were found at phthalate levels comparable to those in the general population today, potentially accounting to some degree for infertility problems.

A green ball purchased at Toys 'R' Us contained more than 47% phthalates.

Other phthalate-related health concerns include liver and kidney damage as well as asthma.<sup>18</sup> Researchers have found that children in homes with greater levels of phthalates are more likely to have asthma and allergic symptoms, with higher levels of DEHP associated with asthma and BBP levels associated with rhinitis and eczema.<sup>19</sup> In adult men, phthalate exposure has been correlated with reduced lung capacity.<sup>20</sup>



47.5% phthalates

## Phthalate Testing Results

Name of Toy	Manufacturer (Brand)	Total Phthalate Content (%)	Total Phthalate Content (ppm)	Unid C8 Phthalate	Bis(2-ethylhexyl) DEHP	Butyl Benzyl BBP	Di-n-butyl DBP	Di-n-octyl DNOP	Diethyl DEP	Diisobutyl DIBP	Diisodecyl DIDP	Diisononyl DINP	Dimethyl DMP
Dora Loves Me Doll	Mattel (Fisher-Price)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Barbie Doll	Mattel	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Disney Ariel Doll	Mattel (Disney Princess)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Götz Doll	Götz	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Baby I'm Yours Doll	Target	32.5%	325,000	ND	ND	ND	ND	ND	ND	ND	35,000	290,000	ND
Laura Doll	NA	5.1%	51,220	ND	51,000	ND	110	ND	ND	110	ND	ND	ND
My Little Pony	Hasbro	0.4%	3,800	3,800	ND	ND	ND	ND	ND	ND	ND	ND	ND
Squeeze Toy - Pooh	Mattel (Fisher-Price)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Squeeze Toy - Penguin	Target	36.3%	363,000	ND	ND	ND	ND	ND	ND	ND	13,000	350,000	ND
Squeeze Toy - Whale	Geoffrey (Toys R Us)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Squeeze Toy - Pink Duck	Wal-Mart	32.1%	321,000	ND	ND	ND	ND	ND	ND	ND	21,000	300,000	ND
Squeeze Toy - Yellow Duck	NA	36.6%	365,600	ND	ND	ND	ND	ND	ND	ND	5,600	360,000	ND
Squeeze Toy - Starfish	Kmart (Just Kidz)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Squeeze Toy - Elmo	Mattel (Fisher-Price)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Cake Slice	Learning Resources	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Taco	Lakeshore Learning	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Green Ball	Geoffrey (Toys R Us)	47.5%	475,000	ND	ND	ND	ND	ND	ND	ND	15,000	460,000	ND
Dinosaur	Wal-Mart	28.6%	286,000	ND	ND	ND	ND	ND	ND	ND	56,000	230,000	ND
Tonka Car	Hasbro (Playskool)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Tinkertoys Tubing	Hasbro (Playskool)	20%	200,000	200,000	ND	ND	ND	ND	ND	ND	ND	ND	ND

DEHP	= Bis(2-ethylhexyl), or diethylhexyl phthalate
BBP	= Butyl Benzyl phthalate
DBP	= Di-n-butyl phthalate
DNOP	= Di-n-octyl phthalate
DEP	= Diethyl phthalate
DIBP	= Diisobutyl phthalate
DIDP	= Diisodecyl phthalate
DINP	= Diisononyl phthalate
DMP	= Dimethyl phthalate

## Results

To determine the extent to which phthalates are still common in children's toys, we tested 20 easily available PVC toys. Toys were purchased in Washington and Michigan at retailers including Fred Meyer, Toys "R" Us, Target, Kmart, Wal-Mart, Rite Aid, Bartell Drugs, toy stores, and dollar stores.

Washington Toxics Coalition staff screened toys for the presence of PVC using an XRF analyzer. The analyzer determines whether a plastic is PVC based on the presence of chlorine (see Appendix I for more details).

We selected items to represent several classes of toys, including dolls, figurines, balls, blocks and building toys, squeeze toys, vehicles, and play food. Nearly all of the toys are designed to be used by young children, including those under three. We sent the toys to a laboratory in Chicago, STAT Analysis. The laboratory tested for 17 phthalates using gas chromatography/mass spectroscopy (detailed methods can be found in Appendix I).

### Our findings are as follows:

## Many toys contain phthalates.

The laboratory analysis detected phthalates in 9 of the 20 toys, including dolls, figurines, a ball, squeeze toys, and a building toy. Five different phthalates were found, including DEHP, DBP, DIDP, DINP, and an unidentified octyl phthalate, with DINP and DIDP most commonly identified (see Table I).



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## Phthalates are present at high levels in toys.

Six of the toys we tested had phthalate levels between 28% and 47%:

- A green ball purchased at Toys "R" Us contained the highest amount of phthalates, with more than 47% of the ball made up of phthalates.
- Several squeeze toys, including a rubber ducky purchased at Fred Meyer and a Target-brand penguin, tested at more than 30% phthalate content.
- A Target-brand "Baby I'm Yours" doll contained more than 30% total phthalates.
- A dinosaur figurine purchased at Wal-Mart contained more than 28% total phthalates.

A dollar-store fashion doll also tested positive for phthalates.

My Little Pony and a component of Tinkertoys, two well-known toys manufactured by Hasbro, tested positive for an octyl phthalate that the laboratory's assay is not calibrated to identify. This phthalate is not one restricted in Europe or California.

Six of the toys we tested—two dolls, a dinosaur, and three squeeze toys—would not be allowed for sale in the European Union because of their phthalate content. In Europe, no toys or other child-care items may contain any of three phthalates, DEHP, DBP, and BBP; three additional phthalates, DINP, DNOP, and DIDP, are banned from toys and child-care items that may be placed in a child's mouth. California has passed an identical ban that will go into effect in January 2009.

**A Target-brand "Baby I'm Yours" doll contained more than 30% total phthalates.**

## Some manufacturers are making toys without phthalates.

The results of our testing indicate that very high levels of phthalates are still in common use for toys on the U.S. market, even as other major markets have prohibited them. They also indicate, however, that some manufacturers may have phased out their use. We tested five products manufactured by Mattel: Barbie, Ariel, and Dora dolls, and Winnie-the-Pooh and Elmo squeeze toys, none of which tested positive for phthalates. While this is no guarantee that all Mattel products are free of phthalates, it does indicate that at least for these popular products, a major manufacturer has found an alternative plasticizer that will allow the sale of its products in Europe as well as the U.S.

A number of European toy companies have stated that they have phased out the use of phthalates for all products in order to comply with the European Union restrictions. We tested a doll manufactured by one of those companies, Götz, and found it to be free of phthalates.

Other toys that tested free of phthalates include a Tonka car (a Playskool/Hasbro product), a Kmart-brand squeeze toy, and two play-food items from Learning Resources and Lakeshore Learning.

A number of retailers are also taking action to reduce phthalates in their products, in many cases by phasing out PVC. By eliminating PVC, they are also addressing other hazards created during its production, use, and disposal, as well as avoiding the other chemical additives in PVC plastic. Target, for example, aims to eliminate phthalates from Target-brand toys by Fall of 2008, and its bibs are already PVC-free. Wal-Mart has stopped selling PVC bibs and lunchboxes.

**A rubber ducky purchased at Fred Meyer tested at more than 30% phthalate content.**

## Phthalates are a hidden hazard.

No law in Washington requires labeling of the contents of toys and other children's products. Therefore, parents and consumers don't have access to information on whether toys contain phthalates because they are not listed on product labels. In some cases, manufacturers do label their products as PVC or vinyl. None of the phthalate-containing toys we tested, however, were labeled as having phthalates. Only the doll by German toymaker Götz, which has eliminated phthalates, was labeled as phthalate-free.

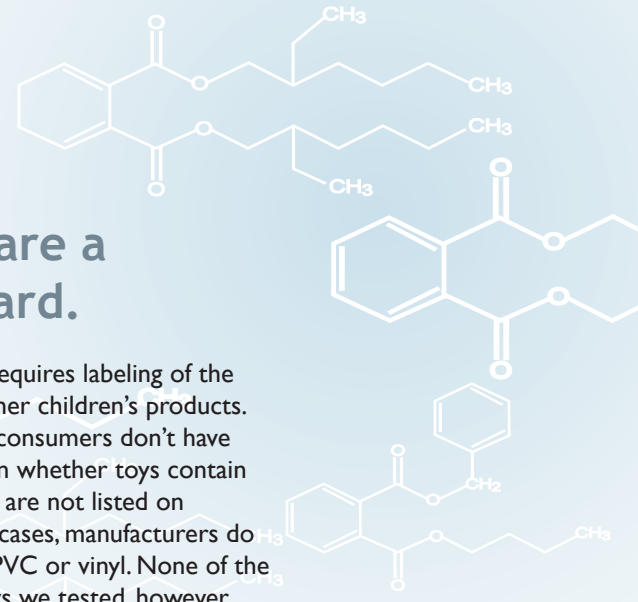
### Europe Gets the Phthalate-free Ball Rolling

The European Union has a relatively long history of concern about phthalates. In 1999, it banned six phthalates in toys and other childcare articles intended for children under three. In 2005, after extensive study, the European Commission voted to extend the ban to all toys and childcare articles for three phthalates.

California became the first state in the nation to follow suit in 2007, passing legislation to end the use of the same six phthalates in toys and other children's products.



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## Solutions

Phthalates are clearly a problem beyond Washington's borders, but action at the federal level to put U.S. safety standards on par with Europe is regrettably far from imminent. Washington state, on the other hand, has a strong history of leadership on important environmental health issues, from establishing the nation's first program to address persistent bioaccumulative toxics to passing legislation restricting mercury and toxic flame retardants.

Representative Mary Lou Dickerson and Senator Debbie Regala introduced the Children's Safe Products Act in January 2008 to put Washington on a path to becoming a leader in ensuring safety of toys and other children's products. The legislation has three primary elements: immediate action on three established hazards, study to determine what hazards might remain, and informing parents and consumers.

### Washington Action to Get Phthalates Out of Toys

The Children's Safe Products Act would take immediate action to ban lead, cadmium, and phthalates from toys and other children's products. Like the European Union and California laws, it bans six phthalates from use in toys and other children's products: DEHP, DEP, DBP, BBP, DINP, and DNOP. The Washington State Department of Ecology would be responsible for enforcement, ensuring that products manufactured or sold in Washington are free of phthalates.

### What Else is in the Toy Box?

Right now, no one knows the content of most toys on store shelves unless they've manufactured them or conducted testing such as in this study. What's more, federal law has almost no restrictions on what chemicals can go into children's products, regardless of toxicity. The Children's Safe Products Act would start Washington down a path to address this problem. To learn what hidden hazards might remain in toys, it would require manufacturers of toys either produced or sold in Washington to report on chemicals in their products that may cause learning or reproductive problems, cancer, or hormone disruption. Armed with this information, our state will be able to take action in the future to ensure products sold in this state are free of toxic chemicals.

### Informing Parents and Consumers

Parents and others deserve information on the contents of toys and other products they buy for children. Under the Children's Safe Products Act, the Department of Ecology would make public information collected on the toxic chemicals present in children's products. Parents and others would then be able to make smart choices for safer products.

**The Washington Toxics Coalition and the Toxic-Free Legacy Coalition call on the Washington State Legislature to pass the Children's Safe Products Act in 2008.**

## Appendix I: Methods

### Toy selection and screening

Toys were selected to include toys used by children of both genders and a variety of ages, focusing on young children. Toys were purchased at major retailers including Target, Meijer, Wal-Mart, Kmart, Toys "R" Us, drug stores including Bartell Drugs and Rite Aid, toy stores, and dollar stores. Purchase locations included Seattle, Washington, and Ann Arbor, Michigan.

Products were screened using a handheld x-ray fluorescence (XRF) analyzer manufactured by Innov-X Systems. The XRF analyzer uses a technology known as x-ray fluorescence (XRF) spectrometry to detect certain chemical elements such as lead, cadmium, chlorine, bromine, tin, and antimony. The analyzer reports the presence of PVC plastic based on detection of chlorine.

Before testing, calibration was assessed using a known standard. Three calibration tests of 120 seconds were conducted and the results compared with the known levels. In all cases, results were within 25% of the known levels. Items were tested in one to several locations. Standard testing time was 30 seconds.

### Laboratory analysis

After screening a larger number of toys for the presence of PVC, we chose for further testing 20 toys to represent several classes of toys, including dolls, figurines, balls, blocks and building toys, squeeze toys, vehicles, and play food. These toys were sent to STAT Analysis in Chicago for laboratory analysis.

Laboratory analysis involved the following procedure:

The samples were prepared for analysis by gas chromatography/mass spectrometry (GC/MS) by solvent extraction.

The extraction was introduced into the GC/MS by injecting the sample extract into a gas chromatograph (GC) equipped with a narrow-bore fused-silica capillary column. The GC column is temperature-programmed to separate the analytes, which are then detected with a mass spectrometer (MS) connected to the gas chromatograph. Analytes eluted from the capillary column were introduced into the mass spectrometer via a jet separator or a direct connection. Identification of target analytes was accomplished by comparing their mass spectra with the electron impact (or electron impact-like) spectra of authentic standards. Quantitation was accomplished by comparing the response of a major (quantitation) ion relative to an internal standard using a five-point calibration curve.

Detection limits for phthalate esters ranged from 92 to 9800 ppm.

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