

The background of the entire page is a dense, overlapping pattern of metallic can lids. The lids are primarily a vibrant blue color, with some showing a reddish or purple hue, possibly due to lighting or the material's finish. They are arranged in a somewhat random, scattered pattern, creating a textured, circular background.

# No Silver Lining

An Investigation into Bisphenol A in Canned Foods

National Workgroup  
for Safe Markets

May 2010

## Acknowledgements

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## Contents

- 3 Executive Summary**
- 6 Introduction**
- 9 What We Found**
- 12 Alternatives to BPA Can Linings**
- 13 Market and Policy Actions on Bisphenol A**
- 15 Solutions and Recommendations**
- 18 Endnotes**
- 21 Resources**
- 22 Appendix I: Methodology**
- 23 Appendix II: Detailed Data**





## Executive Summary

A public health debate is raging around the world about the safety of bisphenol A (BPA). Chemical manufacturing and packaging companies claim BPA is safe and necessary to protect food from metal can corrosion and bacterial contamination.

However, scientists, health professionals, and children's and environmental health advocates are concerned that hundreds of independent peer-reviewed scientific studies have found negative health outcomes resulting from low doses of BPA.

Canada, Denmark, five U.S. states, three New York State counties, and the city of Chicago have restricted the use of BPA in certain children's products, like baby bottles and infant formula can linings. Other countries and U.S. states are actively considering BPA restrictions and bans.

This report provides new data about the amount of BPA that could be consumed from eating canned food and drinks available in the U.S. and Canada. For *No Silver Lining*, we tested the food and beverage contents of 50 cans collected from 19 U.S. states and Ontario, Canada. The report reveals that BPA is a routine contaminant in canned foods. Our study details potential exposure to BPA from not just one

can, but from meals prepared with canned food and drink that an ordinary North American person might consume over the course of a day.

It shows that meals involving one or more cans of food can cause a pregnant woman to ingest levels of BPA that have been shown to cause health effects in developing fetuses in laboratory animal studies.<sup>1</sup>

Our findings quantify exposure through only one BPA source—canned foods. Other potential routes of exposure to BPA include air, dust, and water, common products like polycarbonate water and baby bottles, 5-gallon water coolers, and printer inks, toners and thermal receipt paper (used by most gas stations and supermarkets),<sup>2</sup> where BPA can rub off paper onto our hands and into our mouths.

Exposure of animals to low doses of BPA has been linked<sup>3</sup> to cancer, abnormal behavior,<sup>4</sup> diabetes and heart disease,<sup>5</sup> infertility,<sup>6</sup> developmental<sup>7</sup> and reproductive<sup>8</sup> harm, obesity,<sup>9</sup> and early puberty,<sup>10</sup> a known risk factor for breast cancer.<sup>11</sup>

We know exposures to low doses can be harmful, and we know BPA is on our bodies. Independent, peer-reviewed scientific studies have found harm from low doses of BPA occurring at the same or similar levels found in the general



population, according to Centers for Disease Control and Prevention (CDC). CDC found BPA in the urine of 93% of the U.S. population.<sup>12</sup> The Environmental Working Group found BPA in the cord blood of newborn babies.<sup>13</sup>

### Test Methods

To determine the amount of BPA a person could be exposed to by eating a “real-life” amount of canned food, *No Silver Lining* enlisted 20 people from 19 U.S. states and Ontario, Canada to donate 50 food and beverage containers from their home pantry shelves and local groceries. Cans were collected from Alaska, California, Connecticut, Illinois, Indiana, Iowa, Kentucky, Maine, Massachusetts, Michigan, Minnesota, Montana, New Jersey, New York, North Carolina, Oregon, Vermont, Washington, Wisconsin, and Ontario, Canada.

In most cases, two cans per location were submitted: one can from a home pantry or kitchen cupboard, and a matching or similar product purchased from a chain grocery store specifically for this project. The double sampling allowed us to investigate the possible correlation between the amount of BPA in the canned food and the age of canned products.

We selected a wide variety of products, including fish, fruits, vegetables, beans, soups, tomato products, sodas, and milks, which are common ingredients and meal options for a wide range of North American consumers.

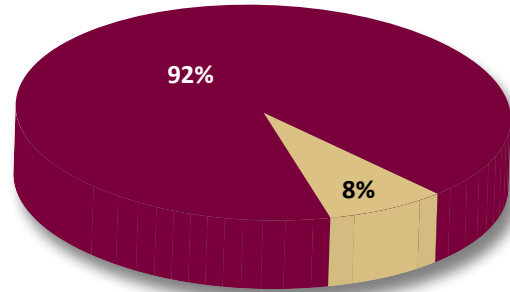
We sent the unopened cans to Anresco Laboratories, an independent laboratory in San Francisco, California. To determine the concentrations of BPA in the food within the can, the laboratory tested the food contents, not the cans themselves, for BPA. Foods were homogenized and then analyzed.

We estimated a daily ingestion of BPA based on three hypothetical menus that aggregated consumption of several canned goods throughout a day. We then calculated daily BPA totals and ingestion by body weight for an average 20-something American woman.

### Results

BPA was detected in 46 of 50, or 92%, of the canned food samples. The highest level of BPA—1,140 part per billion (ppb), to our knowledge the highest level ever found in the U.S.—was detected in DelMonte French Style Green Beans from a participant’s pantry in Wisconsin. Other high scorers included Walmart’s Great Value Green Peas from a store in Kentucky, and Healthy Choice Old Fashioned Chicken Noodle Soup from a pantry in Montana. On average, the products contained 77.36 ppb of bisphenol A.

We did not find a correlation between the age of the product—whether it came from a pantry or a store shelf—and the amount of BPA in the food.



**BPA was detected in 46 of 50, or 92%, of the canned food samples. BPA levels in canned food cannot be predicted by the price of the product, the quality, or relative nutrition value of the product, or where it was purchased.**

BPA exposure is particularly of concern for pregnant women, for babies, and for children. Other reports have focused on BPA leaching from baby bottles and polycarbonate containers, so for this study we imagined a pregnant woman in her 20s, of average build (71 kg or 156.5 lbs<sup>14</sup>) as the individual eating the meals we put together from different products tested. We found that, just from eating the foods below, she could easily raise her BPA intake to levels known to cause health problems in animals (see detailed summary on page 10). For example:

- By eating a serving of canned peaches with breakfast, a can of ravioli for lunch, having a snack of a can of chicken noodle soup, chili for dinner, and using coconut milk in a dessert she could ingest 75.4  $\mu\text{g}$ , or 1.06  $\mu\text{g}/\text{kg}$  body-weight of BPA;
- By eating a serving of canned peaches with breakfast, a can of lentil soup for lunch, and making tuna casserole with canned tuna, peas, cream of mushroom soup and vegetable broth for dinner, followed by bananas in canned coconut milk for dessert, a woman could ingest 87.28  $\mu\text{g}$ , or 1.23  $\mu\text{g}/\text{kg}$  bodyweight of BPA through canned foods alone; and
- By eating no canned goods in the morning and afternoon, and just one can of soda and a single serving of green beans at dinnertime, a woman could ingest 138.19  $\mu\text{g}$ , or 1.95  $\mu\text{g}/\text{kg}$  bodyweight of BPA.

This study also shows that BPA levels in canned food cannot be predicted by the price of the product, the quality, or relative nutrition value of the product, or where it was

purchased. So, a mother preparing a meal with Whole Foods' 365 brand Organic Lite Coconut Milk (74.6 ppb BPA) in Canada could expose herself and her family to as much BPA as a mother cooking with a can of Goya Lite Coconut Milk (77.6 ppb BPA) purchased from a mainstream grocery store in Vermont. And, a father serving his child a can of Healthy Choice Old Fashioned Chicken with Rice Soup (323.6 ppb BPA) that he finds in his own pantry in Montana may be dishing up more than eight times the amount of BPA than a Canadian father serving his child a can Health Valley Organic Vegetable Soup (37.7 ppb BPA).

Even cans from different batches of the same product may result in widely different BPA levels: a can of DelMonte Green Beans could contain significantly more BPA one week than the next (1,140 ppb in one can—the highest finding in the study—versus 296.2 ppb in another can).

### Key Participants in the Study

While CDC data suggests that nearly all North Americans have BPA in their bodies,<sup>15</sup> three of the participants in this study know for sure, as they have had their blood and urine tested for BPA and other toxic chemicals.<sup>16</sup> Additionally, four of the study participants are new mothers. One of them was pregnant at the time of the study.

Based on studies of infant cord blood and breast milk,<sup>17</sup> it is very likely that BPA in the blood of the pregnant study participant passed through the placenta and entered her baby's body. Those nursing mothers who ate from BPA-contaminated food cans are expected to have passed BPA on to their babies as they nursed.

### Alternatives are Emerging

Already, researchers have identified several possible substitutes for BPA in food and beverage can linings. Some companies, such as Eden Foods, offer food in BPA-free cans. Muir Glen, a subsidiary of General Mills, will begin packaging their tomato products in BPA-free cans in 2010. In addition, we know that there are other BPA-free container options, including glass and less toxic plastics (some are on the market and others are under development). Safer substitutions would help to break the cycle of chemical contamination and the myriad health problems linked to chronic, daily BPA exposures.

### Recommendations

**Congress should act to reduce BPA exposure by banning the chemical in food and drink containers.** A number of states have taken action on BPA in baby bottles, but so far, no legislation is in place that will move companies away from BPA in all food cans.

### Case Study: Bobbi Chase Wilding



One of the people who supplied samples for this project was Bobbi Chase Wilding, also a co-author of this report. At the time of the can collection, Bobbi was six months pregnant with her second child, a girl. "I wanted to be a part

of this project because I've seen the information about the role BPA can play in disrupting normal fetal development," said Bobbi. "Throughout this pregnancy, I've worked hard to avoid BPA exposure, and haven't eaten canned goods at home, but I know there are many other sources of exposure, like canned goods used at restaurants and in commercial settings, and receipt paper from weekly grocery shopping and trips to the gas station. "As a mother of two daughters, I'll always wonder if BPA exposure during pregnancy and while breast feeding will play a role in their health. It's a risk I wouldn't have taken willingly, and one no mother should have to take at all."

**Can manufacturers should move quickly to identify and adopt alternatives.** Some companies have already replaced BPA with safer substitutes, and others should do the same. Moreover, as Eden Foods did successfully, food processors should demand safer cans for their products.

**Congress should strengthen and pass the Safe Chemicals Act.** The outdated and ineffective Toxic Substances Control Act has not prevented our exposure to thousands of toxic chemicals, including BPA. Congress should ensure that the Safe Chemicals Act includes provisions for swift action to reduce the use of chemicals like BPA that are linked to cancer, hormone disruption, and reproductive and nervous system harm.

As these broad policy and market shifts occur, individuals should opt for fresh foods whenever possible followed by frozen or dried foods, and when packaged foods are needed, choose glass, aseptic packages, or less toxic plastic containers when possible. Individuals should also let food manufacturers and policymakers know they want BPA-free packaging for all foods and beverages.



# Introduction

## The Origins of BPA

**A**lthough bisphenol A (BPA) has been getting a lot of media attention in recent years, scientists have known for nearly 80 years that BPA acts like a synthetic estrogen. BPA was first synthesized in the 1890s. It was identified as a synthetic estrogen in the 1930s and considered for pharmaceutical use, but it was ultimately not pursued due to the identification of DES as a stronger synthetic estrogen.<sup>18</sup>

Decades after millions of women had been prescribed DES in a misguided attempt to prevent miscarriages, doctors discovered its link to a rare form of cancer and reproductive problems in women whose mothers took the drug. These studies went on to determine that more than 90 percent of DES daughters (those exposed to DES while in the womb) have abnormalities of the reproductive tract.<sup>19</sup>

Animal research sounded an early warning that human exposure to DES in the womb could lead to serious reproductive tract harm and hormone-sensitive cancers later in life.<sup>20</sup> This was later confirmed by real life tragedies as many women who were exposed to DES in the womb developed those diseases and fertility problems in adolescence and adulthood. More than two decades of research on the low dose effects of BPA show similar patterns of reproductive problems in animals and cells exposed to BPA.<sup>21</sup>

Unlike the relatively limited human exposure to DES, nearly all of us living in North America are exposed to BPA from a myriad of sources on a daily basis, like canned foods, which could pose serious health problems for ourselves and future generations.

## Modern Uses of BPA

Chemists discovered that BPA was useful in making polymers (the foundation of plastic materials) and epoxy resins during the chemical revolution of the 1940s and '50s. In 1963, the Food and Drug Administration determined that BPA was "Generally Regarded as Safe," allowing its use in food contact substances such as baby bottles and food cans. When the federal Toxic Substances Control Act (TSCA) was enacted in 1976, it "grandfathered in" BPA along with 62,000 other chemicals, allowing their use without requiring them to be tested or shown to be safe.

Studies of BPA have until recently been based on traditional toxicology, which assumes that if large amounts of a chemical can cause harm, then smaller amounts of the same chemical must cause less harm or no harm. In essence, this approach assumes that "the dose makes the poison" and



that looking at the effects of high doses of a chemical allows one to make educated guesses about the effects—or safety—of lower doses.<sup>22</sup> Decades ago, scientists looked at high doses of BPA and determined that it could cause weight loss, and set the safety levels based on these higher-dose studies.

We know now that some chemicals that affect our hormones, like BPA, can actually have stronger effects in smaller amounts, especially during critical windows of development,<sup>23</sup> and that BPA can cause a wide range of adverse effects in laboratory studies at levels lower than those found in people's bodies throughout the developed world.<sup>24</sup>

BPA is now widely used in many different consumer products, from food can linings to DVDs and from baby bottles to thermal receipt paper and printer toner.

Because of the widespread use of, and eventual exposure to, bisphenol A, the U.S. Centers for Disease Control and Prevention have documented BPA's presence in 93% of Americans<sup>25</sup> over the age of six. Adolescents had higher levels than adults, and younger children had the highest levels. In a separate study, premature babies were found to have ten times as much BPA in their bodies as CDC found in adults and five times as much as older children.<sup>26</sup> This is thought to be in part due in part to BPA leaching from some medical devices used in the NICU.<sup>27</sup>

Some members of the population may be exposed to higher-than-average levels of BPA due to circumstances beyond their control, such as income and product availability. Low-income people may consume greater quantities of canned foods because they live in areas where fresh, affordable produce is unavailable, they are more reliant on canned foods from food banks or government agencies. In addition, low-income consumers may purchase canned goods (or polycarbonate containers) from discount stores where products are likely to stay on the market even after companies and other retailers have switched over to a safer alternative.

Workers in factories producing BPA, in steel canning or plating industries or in plastics facilities may also be exposed to higher levels of BPA. Unfortunately, little data exists on the exact nature and extent of these exposures.

### Bisphenol A & Health Effects

BPA can disrupt how hormones carry messages in our body, and as such is part of a group of chemicals known as **endocrine disruptors**. Because it doesn't take very many hormone molecules to transmit messages in our bodies, endocrine disruptors can interrupt healthy signals at very low concentrations—in fact, even a few *parts per trillion* of BPA has

***“Although estrogen is thought of as a female hormone, it’s found in both males and females, and the prostate gland is rich in estrogen receptors. There are also estrogen receptors in other parts of the body, including the cardiovascular system and the brain. That’s why estrogen-mimics like BPA can influence the reproductive tract and other parts of the body as well.”***

**Gail Prins, Professor of Physiology  
at the University of Illinois at Chicago.<sup>32</sup>**

been shown to disrupt normal communication that may lead to health problems.<sup>28</sup> (See chart on page 11.)

Endocrine disruptors often act differently at lower levels than at higher levels—in stark contrast to the outdated adage “the dose makes the poison.”

The U.S. EPA’s Lowest Observed Adverse Effect Level (LOAEL) of BPA in animal studies is 50 milligrams/ kilogram body weight/day (or 50 parts per million per day), which was set in the early 1980s based on observed weight loss in rodents.<sup>29</sup> EPA then set the “safe dose” a thousand times lower, or 50 micrograms/kilogram body weight per day

(50 µg/kg/day, or 50 parts per billion per day). For the purposes of this report, “low doses” of bisphenol A are considered those that fall below 50 µg/kg body weight/day.

Studies that are paid for by the chemical or plastics industry consistently find no harm from exposure to BPA.<sup>30</sup> By contrast, 202 of the 217 government-funded studies assessing health outcomes in laboratory animals related to low doses of BPA have found a variety of negative impacts on a range of organs.<sup>31</sup>

Health impacts linked to low-level exposure to BPA (in either animals or humans) include:<sup>33</sup>

- Obesity<sup>34</sup>
- Low sperm count<sup>35</sup>
- Damage to developing eggs<sup>36</sup>
- Miscarriage<sup>37</sup>
- Placental cell death<sup>38</sup>
- Infertility<sup>39</sup>
- Heart disease<sup>40</sup>
- Diabetes<sup>41</sup>
- Changes in brain development<sup>42</sup>
- Predisposition to breast and prostate cancer.<sup>43</sup>

The U.S. National Toxicology Program has publicly expressed *some concern* for effects on the brain, behavior, and prostate gland in fetuses, infants, and children at current human exposures to bisphenol A,<sup>44</sup> and recently, the U.S. FDA concurred.<sup>45</sup> The Canadian government has declared bisphenol A to be toxic and is taking steps to end the sale of polycarbonate baby bottles and sippy cups in Canada.<sup>46</sup>

A consensus statement signed by 38 of the world’s leading researchers on BPA concluded that current levels of BPA in people were higher than those linked to health problems in laboratory studies.<sup>47</sup>

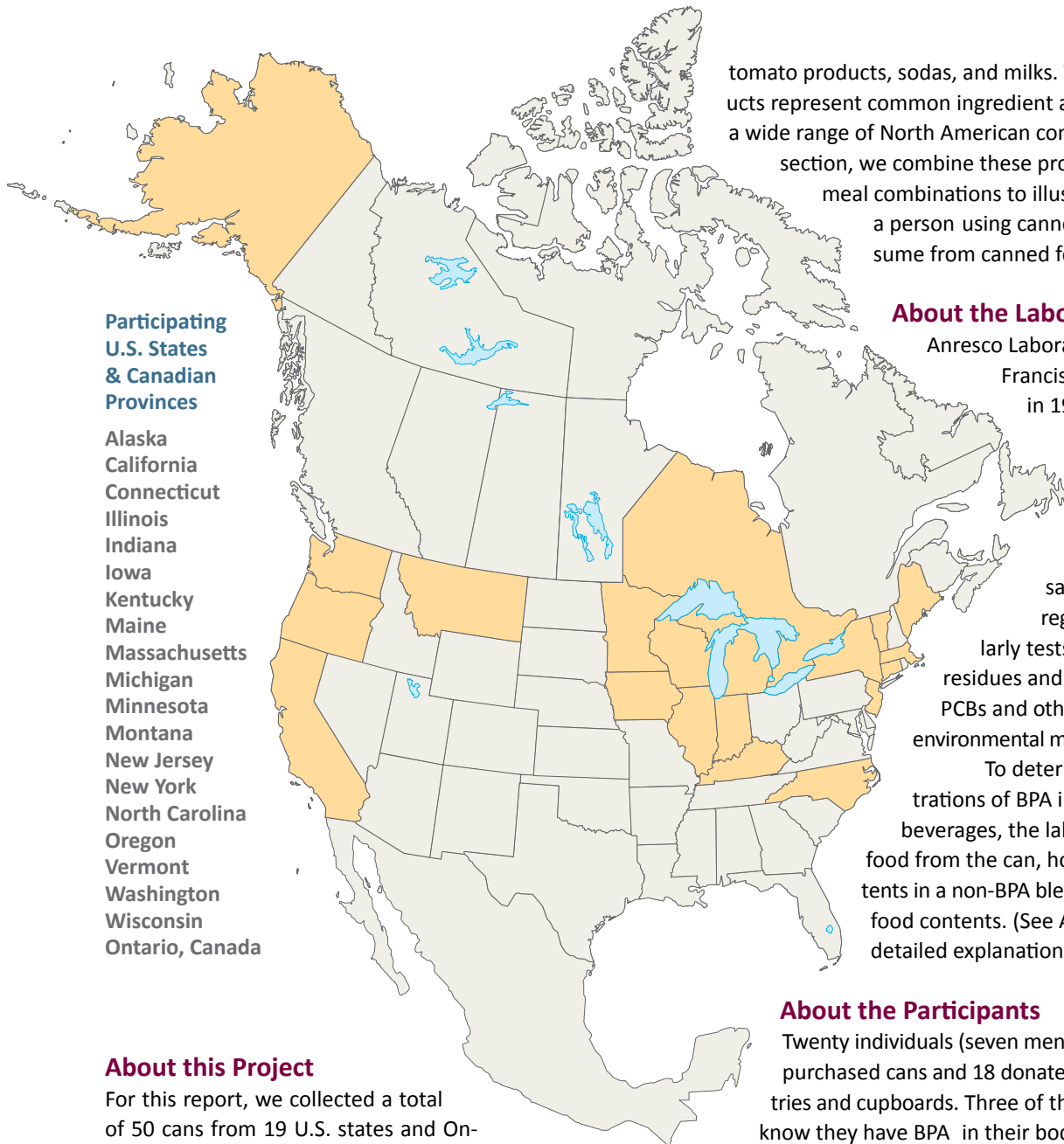
### Where Products Came From

#### Products were purchased from these retailers:

- Albertson’s
- Hannaford
- Jewel-Osco
- Kroger
- Rainbow
- Safeway
- Shoprite
- Stop & Shop
- Walmart
- Whole Foods

#### Product Manufacturers:

- Campbell’s
- Coca Cola
- ConAgra (Chef Boyardee)
- DelMonte
- Goya
- Hain Celestial
- Muir Glen
- Walmart
- Whole Foods



### Participating U.S. States & Canadian Provinces

Alaska  
California  
Connecticut  
Illinois  
Indiana  
Iowa  
Kentucky  
Maine  
Massachusetts  
Michigan  
Minnesota  
Montana  
New Jersey  
New York  
North Carolina  
Oregon  
Vermont  
Washington  
Wisconsin  
Ontario, Canada

### About this Project

For this report, we collected a total of 50 cans from 19 U.S. states and Ontario, Canada. States were selected based on the organizations' involvement in the Workgroup for Safe Markets, or because there is concern about the impacts of daily, repeated exposure to this chemical. In most cases, individuals submitted a can from their pantry or cupboard and purchased a matching or similar product from a national publicly traded grocery chain. We were interested in exploring potential correlations between BPA levels and the age of canned products.

A wide variety of products were tested for this investigation, including fish, fruits, vegetables, beans, soups,

tomato products, sodas, and milks. Together, these products represent common ingredient and meal options for a wide range of North American consumers. In the results section, we combine these products into possible meal combinations to illustrate how much BPA a person using canned foods may consume from canned foods alone.

### About the Laboratory

Anresco Laboratories,<sup>48</sup> based in San Francisco, CA, was founded in 1943. It is an FDA accredited laboratory specializing in testing foods for nutritional analysis, food quality, food safety, and FDA import regulations. The lab regularly tests foods for pesticide residues and conducts tests for PCBs and other toxic chemicals in environmental media.

To determine the concentrations of BPA in canned foods and beverages, the laboratory removed the food from the can, homogenized the contents in a non-BPA blender, and tested the food contents. (See Appendix I for more a detailed explanation of the methodology.)

### About the Participants

Twenty individuals (seven men and 13 women) purchased cans and 18 donated cans from their pantries and cupboards. Three of the participants already know they have BPA in their bodies because they previously had their blood and urine tested for BPA and other toxic chemicals.<sup>49</sup>

Four of the study participants are new mothers, one of whom was pregnant at the time of the study. Another participant is a breast cancer survivor. Many are parents of young children. Based on studies of infant cord blood and breast milk, we would expect that BPA in the blood of our pregnant participant reached her developing fetus and that those nursing mothers who ate from BPA-contaminated food cans likely passed BPA on to their babies as they nursed.



## What We Found

### Summary

Our investigation found that BPA is widespread in canned food purchased across the U.S. and Canada. Bisphenol A was detected in 46 of 50 samples tested (or 92%). 43 of 50 samples tested (or 86%) were above the level of quantification. (Laboratory equipment could detect the presence of BPA below 0.5 parts per billion (ppb), but not determine the exact amounts.)

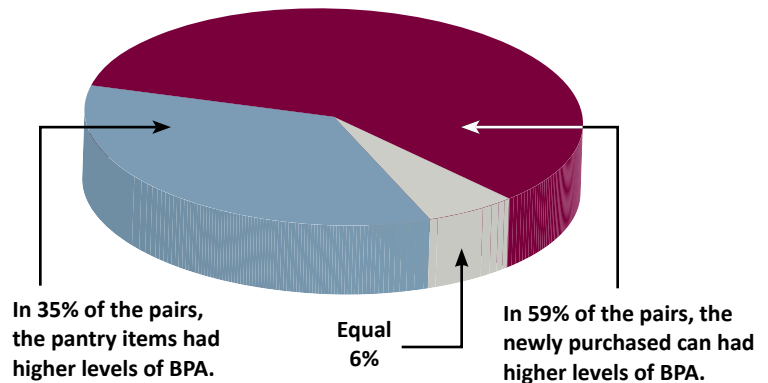
Detected levels of BPA ranged from below 1 ppb, to over a part per million (a thousand times more BPA than the lowest amounts found). To our knowledge, no other study has found such a high level of BPA, with the results in other studies topping out at less than 500 ppb. On average, the products contained 77.36 parts per billion of bisphenol A, with a middle value (median) of 35 parts per billion. A chart of all individual cans is presented in Appendix II.

### BPA in Pantries vs. BPA on Store Shelves

In our investigation, we were interested in exploring whether or not cans in household pantries (where they might sit on the shelf for months or longer) would have higher values than those newly purchased from stores. We found no consistent pattern, as can be seen from the following two examples:

- In some cases where two cans of the same product were tested, widely different levels of BPA were detected. For example, one can of Great Value Sweet Peas from Kentucky,

### No Correlation Found between Age or Canned Food and BPA Levels



which had a 2010 “best-by” date, had 6.5 ppb of BPA, while the identical product newly-purchased from Walmart with a “best-by” date of 2012 had 329.3 ppb—the second highest levels of any food in this study.

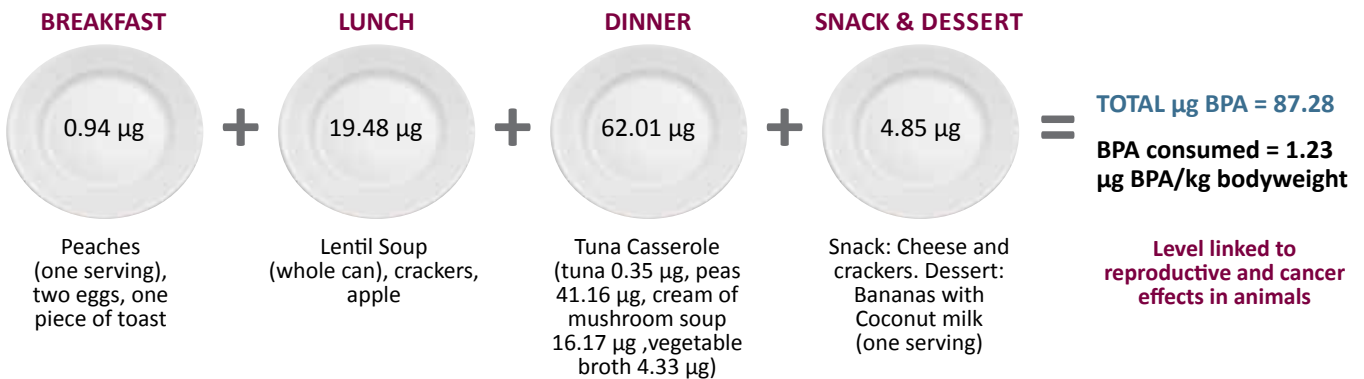
- In a number of cases, one can of a particular product contained roughly twice as much as the other, including Chef Boyardee Beef Ravioli (9.7 ppb from a Kroger’s in Michigan and 21.5 ppb from a Michigan pantry), and College Inn Vegetable Broth (18 ppb from a Connecticut pantry and 40.8 ppb from a Connecticut Stop and Shop).



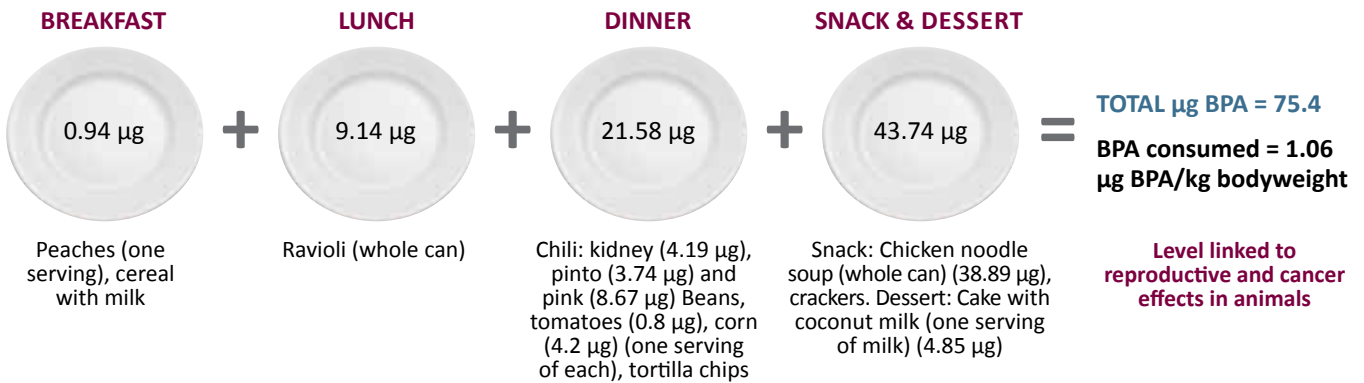
### Daily Estimated Exposure to BPA Reaches Levels Shown to Cause Harm in Laboratory Studies

To better understand how a person’s health might be impacted by consuming a normal diet that includes canned foods, we estimated daily exposure to BPA using different hypothetical menus. The table below shows three days of meals and the BPA exposures that could result based on the data from these product tests. We based our calculations on the weight of an average 20- to 29-year-old woman, according to the CDC<sup>50</sup> (71kg or 156.5 lb), and imagined this woman was in the first trimester of pregnancy since exposure to BPA in the womb is of particular concern. We divided the amount of BPA in micrograms (µg) by her weight (kg) to obtain a weight-adjusted exposure value. **These hypothetical diets show that a pregnant woman may be exposed to potentially harmful levels of BPA that have been shown to alter fetal development in laboratory animals, as evidenced in the table on page 11.**

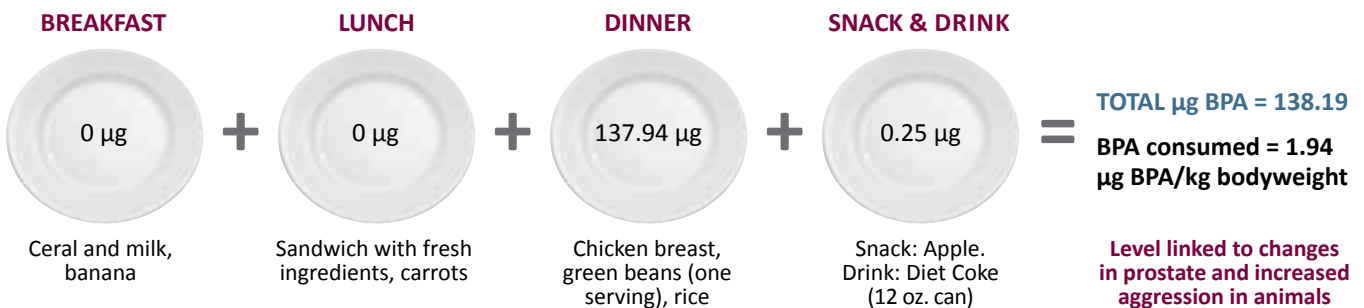
#### DAY 1



#### DAY 2



#### DAY 3



**Case Study: Alma Feldpauch**



Alma Feldpauch participated in a 2009 biomonitoring project in Washington State. Alma was pregnant at the time of the biomonitoring study, and she had tried to avoid the chemicals that she knew, as a scientist, could have harmful

health effects for herself and her baby. She had stopped drinking from plastic bottles, but was not aware of BPA in can linings. “I find it disturbing that some chemicals are not listed in product ingredient lists,” says Alma. She was glad when Washington State passed restrictions on BPA in baby bottles, but thinks the federal government needs to also protect the public from unwanted chemical exposure. “I don’t use plastic baby bottles or canned baby food for my son,” she says. “But chemicals are so ubiquitous, it’s hard to avoid them.”

Thirty-four samples were paired, with either identical items from both store and pantry (28 items or 14 pairs) or similar items (six items or three pairs). As the chart above shows, there was not correlation with the length time an item was stored after purchase and the levels of BPA found in the food, which implies that amount of BPA contamination is a result of manufacturing or production.

Many factors could contribute to this variation, including BPA contamination of the food prior to canning, differences in the amount of BPA in can linings, and differences in can processing or storage temperatures. Given the variability of the results, the information in this report should not be considered representative of a specific brand or kind of food, but rather an indicator of the contamination that is possible in a variety of products. Essentially, this study reveals that it is very difficult to know when a particular can could have higher or lower amounts of BPA, and further highlights the need to find safer solutions to BPA for all canned food.

**Canned Foods With the Highest Levels of BPA**

(above 100 ppb):

- DelMonte French Style Green Beans: 296.2 ppb (store) and 1,140 ppb (pantry)
- Great Value (Walmart’s in-store brand) Sweet Peas: 329.3 ppb (store)
- Healthy Choice Old Fashioned Chicken Noodle Soup: 323.6 ppb (pantry)
- Healthy Choice Old Fashioned Chicken with Rice Soup: 172.4 ppb (store)
- Campbell’s Cream of Mushroom Soup: 130.4 ppb (pantry)
- Campbell’s Chicken Noodle Soup: 120.7 ppb (pantry) and 127.5 ppb (store)

**Canned Foods With the Lowest Levels of BPA**

(below 2 ppb—values below the 0.5 ppb level of quantification are estimates, indicated by an asterisk. ND means BPA was not detected.):

- Coca-Cola—diet, caffeine-free: ND (store) and 0.4 ppb\* (pantry)
- Coca-Cola—diet: ND (pantry) and 0.7 ppb (store)
- Coca-Cola Classic: 0.2 ppb (store) and 0.4 ppb\* (pantry)
- Star-Kist Tuna: 0.7 ppb (pantry) and 1.6 ppb (store)
- DelMonte Yellow Freestone Peaches in Light Syrup: 1.2 ppb (pantry)
- Muir Glen Organic Fire Roasted Crushed Tomatoes: 1.9 ppb (pantry)






DAILY BPA EXPOSURE IN (µg/kg body weight)	HEALTH EFFECTS OBSERVED IN LABORATORY STUDIES <sup>51</sup>
0.0001	Alterations in cell signaling pathways <sup>52</sup>
0.025	Persistent changes to breast tissue, predisposes cells to hormones <sup>53</sup>
0.025	Permanent changes to genital tract <sup>54</sup>
0.2	Decreased antioxidant enzymes <sup>55</sup>
0.25	Altered development of fetal mammary glands <sup>56</sup>
1	Long-term adverse reproductive and carcinogenic effects <sup>57</sup>
2	Increased prostate weight <sup>58</sup>
2	Increased aggression <sup>59</sup>
2.4	Weight gain and early onset of puberty <sup>60</sup>
2.4	Signs of early puberty, increased anogenital distance <sup>61</sup>
2.4	Decline in testicular testosterone <sup>62</sup>
2.5	Predisposes breast cells to cancer <sup>63</sup>



## Alternatives to BPA Can Linings

The good news is that there are a number of ways to preserve food without using bisphenol A. The chart below explores a number of the BPA-free canning methods currently used in the marketplace today. A number of companies are working to develop safer BPA-

free can linings that can be used as a direct replacement for the BPA-based epoxy now in widespread use. This research and development is a direct response to consumer demand for safer products, and the extensive scientific evidence documenting health problems linked to BPA exposure.

Alternatives to BPA Can Linings			
Type of Product	Examples	Description/Benefits	Information needed <sup>64</sup>
<b>Metal Can lining: Polyester Coatings</b> 	Toray Polyester, PET (polyethylene terephthalate) Film	Polyester coatings have been used instead of BPA in can linings since the 1990s, when Japanese can manufacturers voluntarily reformulated their can coating process due to public concern about BPA. One technology uses polyester coatings in place of BPA liners, eliminating BPA from the product. <sup>65</sup> Another uses BPA-based epoxy to glue a PET lining, which reduces BPA leaching by 95%. <sup>66</sup>	Companies are reluctant to disclose use of epoxy adhesives, making evaluating the technology difficult.
<b>Metal Can Lining: Baked-on Resins (oleoresins)</b> 	Eden Foods Canned Beans	Natural oils and resins can be used as an alternative to BPA linings. Oleoresin is a natural mixture of an oil and a resin extracted from various plants, such as pine or balsam fir. <sup>67</sup> This product works for low-acid foods, like beans, not high-acid foods. These linings have only a slightly higher cost than BPA-based linings. <sup>68</sup>	More information about the primer used as a base for these resins is needed.
<b>Glass Jar</b> 	Tomato Sauce	Glass is generally regarded as inert in products like this. Linings of metal lids are lined with BPA-based epoxy at this time. However, less BPA leaches into food.	Manufacturers should reveal the chemicals used for lid linings
<b>Aseptic Packaging (multi-layer boxes)</b> 	Tetra Pak	Aseptic boxes are made of 70 percent paperboard, with thin layers of low density polyethylene (LDPE) and aluminum foil. <sup>69</sup> They are used widely in Europe and are used in the U.S. for juice, soups, tomatoes, liquid dairy products, and wine. Unlike other alternatives here, recycling of these boxes is not widely available. <sup>70</sup>	Manufacturers should fully disclose all materials used for each of the layers.
<b>Polyethylene/ Polypropylene Plastic Jars</b> 	Fruit Cup	Some manufacturers have started packaging fruits in plastic containers that do not use BPA in any part of the product. <sup>71</sup>	Manufacturers should disclose the chemical additives that are mixed with the polyethylene and/or polypropylene.

# Market and Policy Actions on Bisphenol A

## Leading Retailers & Manufacturers Phasing Out Bisphenol A (BPA)

In response to growing scientific and public concern, leading U.S. retailers and baby bottle and water bottle manufacturers pledged to phase out bisphenol A (BPA) in favor of safer cost-effective alternatives.

### U.S. Retailers Phasing Out Bisphenol A Baby Bottles

- CVS
- Kmart
- Safeway
- Sears
- Toys R Us
- Walmart
- Wegmans Foods
- Whole Foods

### Baby Bottle Manufacturers Reducing or Phasing Out Bisphenol A

- Avent
- Born Free
- Evenflo
- Gerber
- Handi-Craft Company, makers of Dr. Brown's
- Munchkin
- Playtex
- Think Baby

### Water Bottle Manufacturers Phasing Out Bisphenol A

- ALADDIN / Pacific Market International
- CamelBak
- Nalgene
- Polar Bottle

### Food Packaging Companies Exploring BPA-Free Alternatives

- In 1999, the health foods company Eden Foods phased out the use of BPA in some of their canned foods. The company has eliminated BPA in cans for products such as beans, but they are still searching for alternatives for cans that hold tomatoes.
- Gerber and Nestlé Nutrition have publicly stated they are committed to making all food and formula packaging BPA-free as soon as possible.
- General Mills has announced that it is phasing out BPA for use in Muir Glen brand of organic tomatoes.



### Canadian Retailers Phasing Out BPA in Some Products

- Home Depot Canada
- Members of the Canadian Council of Grocery Distributors
- Mountain Equipment Co-op
- Rexall Pharmacies
- Sears Canada
- Walmart Canada

### Manufacturers Responding to Market Trends

- Sunoco, which makes BPA, announced it would refuse to supply BPA to companies that would use the BPA for children's products.
- Formosa Plastics announced it is investing in a new plant to make stainless steel products in response to consumer trends. Purchase of stainless steel water bottles has gone up in response to rising BPA awareness.
- Glass giant Owens-Illinois has re-opened at least one glass baby bottle plant in Michigan and expanded another in Texas to accommodate demand for safer bottles as consumer awareness about BPA's hazards grows.

### Government Policies to Restrict BPA Use

Over the past few years, there has been significant legislative momentum to restrict the use of BPA in children's products, starting at the city and county level and reaching the federal governments internationally.

Suffolk County, New York, with a population over one million people, was the first county in the United States to restrict the sale of products made with bisphenol A. Their law, signed in spring 2009, ended the sale of BPA-based baby bottles and sippy cups. This was quickly followed by a similar restriction in Chicago, Illinois. In the summer of 2009, Albany and Schenectady Counties in New York State followed suit.

### Case Study: George Lundgren



George Lundgren is a Minnesota-based physician who has been practicing family medicine for over 35 years. In 2009, he participated in a biomonitoring project with Physicians for Social Responsibility, Clean Water Action, and Clean

New York, where he discovered that his body was, as he describes it, filled with a “chemical stew” from so many unwanted chemical contaminants. BPA was one of the chemicals found in George’s body. He has been seeing increasing numbers of patients with health effects that may be linked to BPA exposure, primarily an “epidemic” of obesity and diabetes. He now sees at least one diabetic patient per week, and recently saw an 11-year-old boy who weighs two hundred pounds. “It’s hard to think that bad diet and lack of exercise alone could cause these kinds of endocrine system health effects,” he says. “We just don’t know how all this chemical exposure is interacting in our bodies. I have tried finding out what chemicals are in some products—the labeling is not adequate, and we just don’t know when we are being exposed. We need regulatory legislation that at least allows a person to choose if they are exposed to chemicals like BPA.”

States have been moving to protect their residents from bisphenol A. Over twenty state legislatures have introduced bills addressing BPA, and five states have had bills signed into law: Connecticut, Maryland, Minnesota, Washington, and Wisconsin. Both Connecticut’s and Massachusetts’ Departments of Public Health have issued warnings about BPA, and the Massachusetts Department of Public Health will likely take regulatory action to restrict BPA in children’s products.

At the U.S. Federal level, two bills have been introduced in each house. Senator Dianne Feinstein (CA) and Representative Edward Markey (MA) introduced legislation to direct the Food and Drug Administration to limit BPA in food and beverage containers, and Senator Charles Schumer (NY) and Representative Anthony Weiner (NY) introduced legislation directing the Consumer Product Safety Commission to end the sale of BPA-based products in a different set of food contact products.

In early 2010, the Food and Drug Administration and the Department of Health and Human Services issued statements expressing concern about the impact of BPA exposure on human health, mirroring earlier concern raised by the National Toxicology Program. The U.S. EPA added BPA to its chemical concern list, and has developed a “Chemical Action Plan” that requires more testing for BPA in environmental media and recommends more proactive transitions to safer products. In addition, the National Institute for Environmental Health Sciences (NIEHS) has announced \$20 million in funding for BPA research.

On March 11, 2010, the Canadian prohibition on the advertisement, sale, and importation of BPA-containing polycarbonate baby bottles came into force. The government took this precautionary action because they were concerned that “Polycarbonate baby bottles that contain 4,4’isopropylidenediphenol (bisphenol A) have the potential to cause harmful effects in newborns and infants up to the age of 18 months.”

There is growing momentum in European countries to restrict BPA: bills have been introduced in the United Kingdom and France, and Denmark has issued a temporary ban on BPA in products for children ages three and under. The French Food Safety Agency (AFSSA) has recommended that a labeling system be introduced to alert European consumers to the presence of BPA in food containers and household utensils.



## Solutions and Recommendations

**F**or most North Americans it is simply not possible to avoid canned food and beverages. This is particularly true for low-income people who are more reliant on non-perishable canned goods. With the recent recession, more and more people have had to rely on canned good from food banks. Companies that produce BPA, companies that use it in food and beverage containers, and companies that sell these products need to aggressively research and implement safer solutions to BPA packaging. We have a right to safe products.

### What Product Manufacturers Can Do

Canned goods manufacturers, producers, and retailers can play an important role in making the transition to safer products and promoting greener jobs.

As we have shown, contaminated food is sold on the shelves of all retailers, large and small, in products made by leading companies. Canned good producers should work with can manufacturers to ensure new technologies work with their food products, with the purpose of finding safe, effective can linings made without BPA or other hormone disrupting or otherwise harmful chemicals.

### What Can Makers Can Do

Can makers and can lining makers should continue the research that is underway to identify an effective can lining that protects food from microbes and toxic contaminants. We recommend continued aggressive research utilizing green chemistry principles, which guide design of chemical products and processes to reduce or eliminate the use or generation of hazardous substances.<sup>72</sup>

### What Retailers Can Do

Retailers should continue to ask both private label and brand name manufacturers to develop and implement safer solutions to BPA linings, and to phase out BPA can linings in as quickly as possible.

### What Shareholders Can Do

Shareholders in these publicly traded companies can engage in dialogue with companies, introduce and vote for resolutions that require companies to develop a plan to phase out BPA, and require companies to report their progress publicly.

### What Government Can Do

Government entities should help drive this product sector transformation by expanding laws restricting use of BPA in



Making a selection at a food pantry.

***“Every day, consumers rely on household products that contain thousands of chemicals. The American public expects the federal government to do all it can to ensure these chemicals are safe before they reach the market.”***

Senator Frank Lautenberg (D-NJ)

baby bottles and sippy cups, prohibiting the use of BPA in canned goods, and providing funding for research into safer alternatives to BPA and other harmful chemicals.

At the same time, federal and state governments should take action to address other sources of exposure to toxic chemicals in household products, such as water cooler containers and thermal receipt paper.

In addition to restricting the use of BPA specifically, state and federal governments must significantly improve the overall framework for managing all chemicals. BPA has become the ubiquitous problem that it is today in part because federal laws and regulations fail to require information about a chemical’s toxicity to ensure chemicals are safe before they are allowed into the marketplace. Moreover,



current laws, including the Toxic Substances Control Act (TSCA), which grants EPA limited authority to address toxic chemicals in the environment, and Food and Drug laws, which include FDA's Food Contact Notification program and petition-and-review of chemicals, provide insufficient authority for government agencies to take action when information about products and chemicals comes to light.

Therefore, in addition to restricting the use of bisphenol A specifically, state and federal governments must significantly improve the overall framework for managing all chemicals.

#### Real reforms are needed, including:

- **Taking immediate action on the most dangerous chemicals.** Persistent, bioaccumulative toxicants (PBTs) are uniquely hazardous. Any such chemical to which people could be exposed should be phased out of commerce. Exposure to other toxic chemicals, such as formaldehyde, that have already been extensively studied, should be reduced to the maximum extent feasible.
- **Holding manufacturers responsible for the safety of their chemicals and products.** Since TSCA was adopted in 1976, EPA has only required testing of only a few hundred of the more than 60,000 chemicals that were on the market at the time. Those chemicals still constitute the majority of chemicals in commerce today. Companies should be required to provide full information about the impact their chemicals can have on the environment and our health, including whether or not those chemicals mimic or block the effects of human hormones.
- **Using the best science to ensure all people, especially vulnerable and sensitive groups, are protected.** Sensitive, vulnerable, and overburdened populations include children, pregnant women and their fetuses, workers, people of color, people with low incomes and indigenous communities. These people bear the highest costs of toxic chemical exposures. EPA and other state and federal agencies should revise how they assess risk, and expand development and use of information gathered through testing human blood, urine and hair samples, to reduce the burden now placed on these populations.

### What Individuals Can Do

Canned food can play a significant role in contaminating people with BPA at levels linked to health problems in laboratory animals. **The solution must be sustainable, non-toxic packaging.** Metal cans are easily recyclable, so for manufacturers, identifying and using safer can linings is an obvious need. In the meantime, there are actions that individuals can take to help prevent their personal exposure to BPA in packaged goods. No option is a no-impact option, and we all have to work with financial constraints and limited access. When choosing from the range of options to limit BPA exposure, consider:

- **Choose fresh foods (preferably local and sustainably grown) whenever possible, followed by dried or frozen products over canned goods.** (Dried beans, for example, are much less expensive than canned and can be cooked and frozen in advance to make meal preparation nearly as simple as using canned beans.)
- **For room temperature packaged products, try to choose products in glass jars when available (such as tomato sauce), followed by aseptic (boxed) packaging or less toxic plastics.** Keep in mind that we don't know enough about unlabeled additives in even "safer" plastics, which can be identified by the recycling numbers 1, 2, 4 and 5, but we do know that #3 plastic, polyvinyl chloride (PVC), has a toxic lifecycle, as does #6, polystyrene (PS). #7 plastics that are polycarbonate (hard, clear plastics, sometimes with a "PC" near the recycling triangle) should also be avoided, since BPA is the building block of polycarbonate plastics.

Canned food can play a significant role in contaminating people  
with BPA at levels linked to health problems in laboratory animals.  
The solution must be sustainable, non-toxic packaging.



## Endnotes

- 1 Daily menus developed based on results reported here could result in consumption of as much as 1.94 ug BPA /kg bodyweight. Laboratory studies have reported prostate enlargement and predisposition toward breast cancer in offspring of female animals exposed to similar levels of BPA. See, for example:  
  
Nagel SC, vom Saal FS, Thayer KA, Dhar MG, Boechler M, Welshons WV (1997). Relative binding affinity-serum modified access (RBA-SMA) assay predicts the relative in vivo bioactivity of the xenoestrogens bisphenol A and octylphenol. *Environmental Health Perspectives* 105:70-6.  
  
Murray TJ, Maffini MV, Ucci AA, Sonnenschein C, Soto SM (2007). Induction of mammary gland ductal hyperplasias and carcinoma in situ following fetal bisphenol A exposure. *Reproductive Toxicology* 23(3):383-90.
- 2 Greiner, et al. (2004). Bisphenol A, CEH Product Review, 2004 *Chemical Economics Handbook*—SRI Consulting.
- 3 The Endocrine Disruptor Exchange, led by Dr. Theo Colburn, has conducted an extensive review of 319 studies that looked at health outcomes from BPA exposure at 1 part per million or less. They document with references many different health endpoints, including the effects listed here. [www.endocrine-disruption.com/endocrine.bisphenol.summary.php](http://www.endocrine-disruption.com/endocrine.bisphenol.summary.php). Accessed April 9, 2010.
- 4 Rubin BS, Lenkowski JR, Schaeberle CM, Vandenberg LN, Ronshheim PM, Soto AM (2006). Evidence of altered brain sexual differentiation in mice exposed perinatally to low environmentally relevant levels of bisphenol A. *Endocrinology* 147:3681-3691
- 5 Lang IA, Galloway TS, Scarlett A, Henley WE, Depledge M, Wallace RB, Melzer D (2008). Association of urinary bisphenol A concentration with medical disorders and laboratory abnormalities in adults. *Journal of the American Medical Association* 300:1303-1310.
- 6 Salian S, Doshi T, Vanage G (2009). Perinatal exposure of rats to bisphenol A affects the fertility of male offspring. *Life Science*. 85(21-22):742-52.
- 7 Rubin BS, Lenkowski JR, Schaeberle CM, Vandenberg LN, Ronshheim PM, Soto AM (2006). Evidence of altered brain sexual differentiation in mice exposed perinatally to low environmentally relevant levels of bisphenol A. *Endocrinology* 147:3681-3691.
- 8 Sugiura-Ogasawara M, Ozaki Y, Sonta S-I, Makino T, Suzumori K (2005). Exposure to bisphenol A is associated with recurrent miscarriage. *Human Reproduction* 20:2325-2329.
- 9 Howdeshell K, Hotchkiss AK, Thayer KA, Vandenberg JG, vom Saal FS (1999). Plastic bisphenol A speeds growth and puberty. *Nature* 401:762-764.
- 10 Kaplowitz PB, Slora EJ, Wasserman RC, Pedlow SE, Herman-Giddens ME (2001). Earlier Onset of Puberty in Girls: Relation to Increased Body Mass Index and Race. *Pediatrics* 108(2): 347-353.
- 11 Stole B (1998). Western diet, early puberty, and breast cancer risk. *Breast Cancer Research and Treatment* 49:187-193.
- 12 Calafat AM, Ye X, Wong LY, Reidy JA, Needham LL (2008). Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003–2004. *Environmental Health Perspectives* 116(1):39-44.
- 13 Environmental Working Group. Human Toxome Project. 20 samples of infant cord blood were tested and more than 200 chemicals were found in each. [www.ewg.org/sites/humantoxome/participants/participant-group.php?group=In+Utero/newborn](http://www.ewg.org/sites/humantoxome/participants/participant-group.php?group=In+Utero/newborn). Accessed April 9, 2010.
- 14 Ogden CL, Fryar CD, Carroll MD, Flegal KM.(2004). Mean Body Weight, Height, and Body Mass Index, United States 1960–2002. *CDC Advance Data from Vital and Health Statistics*. Number 347.
- 15 Calafat AM, Ye X, Wong LY, Reidy JA, Needham LL (2008). Exposure of the U.S. Population to Bisphenol A and 4-tertiary-Octylphenol: 2003–2004. *Environmental Health Perspectives* 116(1):39-44.
- 16 These participants were tested as part of three non-profit organizations' biomonitoring projects: Is It In Us? ([www.isitinus.org](http://www.isitinus.org), 2007), Hazardous Chemicals in Health Care ([www.psr.org/resources/hazardous-chemicals-in-health.html](http://www.psr.org/resources/hazardous-chemicals-in-health.html), 2009), Earliest Exposures ([www.watoxics.org/publications/earliest-exposures](http://www.watoxics.org/publications/earliest-exposures), 2009). Accessed April 9, 2010.
- 17 Vandenberg LN, et al (2007). Human Exposure to Bisphenol A. *Reproductive Toxicology* 24(2):139-177.
- 18 Vandenberg LN, Maffini MV, Sonnenschein C, Rubin BS, Soto AM (2009). Bisphenol-A and the great divide: a review of controversies in the field of endocrine disruption. *Endocrine Reviews* 30(1):75-95.
- 19 Colborn T, Dumanoski D, Myers JP (1997). *Our Stolen Future*. p52.
- 20 Newbold RR, Padilla-Banks E, Jefferson WN (2006). Adverse effects of the model environmental estrogen diethylstilbestrol are transmitted to subsequent generations. *Endocrinology* 147(Suppl 6):S11-S7.
- 21 See, for example:  
  
Schönfelder G, et al. (2002). *In Utero* Exposure to Low Doses of Bisphenol A Lead to Long-term Deleterious Effects in the Vagina. *Neoplasia* 4(2):98–102.  
  
Richter CA, Birnbaum LS, Farabollini F, Newbold RR, Rubin BS, Talsness CE, Vandenberg JG, Walser-Kuntz DR, vom Saal FS (2007) In vivo effects of bisphenol A in laboratory rodent studies. *Reproductive Toxicology* 24(2):199-224.
- 22 Vandenberg LN, Maffini MV, Sonnenschein C, Rubin BS, Soto AM (2009). Bisphenol-A and the great divide: a review of controversies in the field of endocrine disruption. *Endocrine Reviews* 30(1):75-95.

- 23 Richter CA, Birnbaum LS, Farabollini F, Newbold RR, Rubin BS, Talsness CE, Vandenberg JG, Walsler-Kuntz DR, vom Saal FS (2007). In vivo effects of bisphenol A in laboratory rodent studies. *Reproductive Toxicology* 24(2):199-224.
- 24 Vandenberg LN, Hauser R, Marcus M, Olea N, Welshons WV (2007). Human exposure to bisphenol-A (BPA). *Reproductive Toxicology* 24:139-177.
- 25 Calafat AM, Ye X, Wong LY, Reidy JA, Needham LL (2008). Exposure of the U.S. Population to Bisphenol A and 4-tertiary-Octylphenol: 2003–2004. *Environmental Health Perspectives* 116(1):39-44.
- 26 Calafat AM, Weuve J, Ye X, Jia LT, Hu H, Ringer S, Huttner K, Hauser R (2009). Exposure to bisphenol A and other phenols in neonatal intensive care unit premature infants. *Environmental Health Perspectives* 117(4):639-44.
- 27 Ibid.
- 28 For more information about endocrine disruptors, visit The Endocrine Disruption Exchange's website at [www.endocrinedisruption.com](http://www.endocrinedisruption.com).
- 29 [www.epa.gov/IRIS/subst/0356.htm](http://www.epa.gov/IRIS/subst/0356.htm). Accessed April 9, 2010.
- 30 vom Saal, FS. 2009 Bisphenol A References. [endocrinedisruptors.missouri.edu/vomsaal/vomsaal.html](http://endocrinedisruptors.missouri.edu/vomsaal/vomsaal.html). Accessed on April 9, 2010.
- 31 Ibid.
- 32 As quoted in "Is BPA the New Lead?" By Lisa Farino for MSN Health & Fitness. <http://health.msn.com/health-topics/cancer/articlepage.aspx?cp-documentid=100176176>. Accessed April 29, 2010.
- 33 The Endocrine Disruptor Exchange, led by Dr. Theo Colburn, has conducted an extensive review of 319 studies that looked at health outcomes from BPA exposure at 1 part per million or less. They document with references many different health endpoints, including the effects listed here. [www.endocrinedisruption.com/endocrine.bisphenol.summary.php](http://www.endocrinedisruption.com/endocrine.bisphenol.summary.php). Accessed April 9, 2010.
- 34 Miyawaki J, Sakayama K, Kato H, Yamamoto H, Masuno H. (2007). Perinatal and postnatal exposure to bisphenol a increases adipose tissue mass and serum cholesterol level in mice. *Journal of Atherosclerosis and Thrombosis* 14(5):245-52.
- 35 Chitra KC, Latchoumycandane C, Mathur PP (2003). Induction of oxidative stress by bisphenol A in the epididymal sperm of rats. *Toxicology* 185(1-2):119-127.
- 36 Susiarjo M, Hassolf TJ, Freeman E, Hunt PA (2007). Bisphenol A exposure in utero disrupts early oogenesis in the mouse. *PLoS Genet* 3(1):e5.
- 37 Sugiura-Ogasawara M, Ozaki Y, Sonta S, Makino T, Suzumori K (2005). Exposure to bisphenol A is associated with recurrent miscarriage. *Human Reproduction* 20(8):2325-9.
- 38 Benachour N, Aris A (2009). Toxic effects of low doses of bisphenol-A on human placental cells. *Toxicology and Applied Pharmacology* 241(3):322-8.
- 39 Salian S, Doshi T, Vanage G (2009). Perinatal exposure of rats to bisphenol A affects the fertility of male offspring. *Life Sciences* 85(21-22):742-52.
- 40 Lang IA, Galloway TS, Scarlett A, Henley WE, Depledge M, Wallace RB, Melzer D (2008). Association of urinary bisphenol A concentration with medical disorders and laboratory abnormalities in adults. *Journal of the American Medical Association* 300(11):1303-10.
- 41 Ibid.
- 42 Rubin BS, Lenkowski JR, Schaeberle CM, Vandenberg LN, Ronshheim PM, Soto AM (2006). Evidence of altered brain sexual differentiation in mice exposed perinatally to low environmentally relevant levels of bisphenol A. *Endocrinology* 147:3681-3691.
- 43 Keri RA, Ho SM, Hunt PA, Knudsen KE, Soto AM, Prins GS (2007). An evaluation of evidence for the carcinogenic activity of bisphenol A. *Reproductive Toxicology* 24(2):240-52.
- 44 NTP-CERHR Monograph on the Potential Human Reproductive and Developmental Effects of Bisphenol A [cerhr.niehs.nih.gov/chemicals/bisphenol/bisphenol.pdf](http://cerhr.niehs.nih.gov/chemicals/bisphenol/bisphenol.pdf). Accessed on April 9, 2010.
- 45 [www.fda.gov/NewsEvents/PublicHealthFocus/ucm064437.htm](http://www.fda.gov/NewsEvents/PublicHealthFocus/ucm064437.htm). Accessed on April 9, 2010.
- 46 [www.hc-sc.gc.ca/ahc-asc/media/nr-cp/\\_2008/2008\\_59-eng.php](http://www.hc-sc.gc.ca/ahc-asc/media/nr-cp/_2008/2008_59-eng.php). Accessed on April 9, 2010.
- 47 vom Saal FS, Belcher SM, Guillette LJ, Hauser R, Myers JP, Prins GS, Welshons WV, Heindel JJ, et al. (2007). Chapel Hill Bisphenol A Expert Panel Consensus Statement: Integration of mechanisms, effects in animals and potential impact to human health at current exposure levels. *Reproductive Toxicology* 24:131-138.
- 48 [www.anresco.com](http://www.anresco.com). Accessed on April 9, 2010.
- 49 These participants were tested as part of three non-profit organizations' biomonitoring projects: Is It In Us? ([www.isitinus.org](http://www.isitinus.org), 2007), Hazardous Chemicals in Health Care ([www.psr.org/resources/hazardous-chemicals-in-health.html](http://www.psr.org/resources/hazardous-chemicals-in-health.html), 2009), Earliest Exposures ([www.watoxics.org/publications/earliest-exposures](http://www.watoxics.org/publications/earliest-exposures), 2009).
- 50 Ogden CL, Fryar CD, Carroll MD, Flegal KM (2004). Mean Body Weight, Height, and Body Mass Index, United States 1960–2002. *CDC Advance Data from Vital and Health Statistics*. Number 347.
- 51 This table was modified from one created by Environmental Working Group: [www.ewg.org/node/20934](http://www.ewg.org/node/20934). Accessed on April 9, 2010.
- 52 Wozniak AL, et al. (2005). Xenoestrogens at picomolar to nanomolar concentrations trigger membrane estrogen receptor-alpha-mediated Ca<sup>2+</sup> fluxes and prolactin release in GH3/B6 pituitary tumor cells. *Environmental Health Perspectives* 113(4):431-9.
- 53 Muñoz-de-Toro M, Markey C, Wadia PR, Luque EH, Rubin BS, Sonnenschein C, Soto AM (2005). Perinatal Exposure to Bisphenol A Alters Peripubertal Mammary Gland Development in Mice. *Endocrinology* 146:4138-4147.

- 54 Markey CM, Wadia PR, Rubin BS, Sonnenschein C, Soto AM (2005). Long-term Effects of Fetal Exposure to Low Doses of the Xenoestrogen Bisphenol-A in the Female Mouse Genital Tract. *Biology of Reproduction* 72:1344-1351.
- 55 Chitra KC, Latchoumycandane C, Mathur PP (2003). Induction of oxidative stress by bisphenol A in the epididymal sperm of rats. *Toxicology*, 185(1-2):119-127.
- 56 Vandenberg LN, Maffini MV, Wadia PR, Sonnenschein C, Rubin BS, Soto AM (2007). Exposure to environmentally relevant doses of the xenoestrogen bisphenol-A alters development of the fetal mouse mammary gland. *Endocrinology* 148(1): 116-27.
- 57 Newbold R, Jefferson N, Padilla-Banks E (2009). Prenatal exposure to bisphenol a at environmentally relevant doses adversely affects the murine female reproductive tract later in life. *Environmental Health Perspectives* 117(6):879-885.
- 58 Nagel SC, vom Saal FS, Thayer KA, Dhar MG, Boechler M, Welshons WV (1997). Relative Binding Affinity-Serum Modified Access (RBA-SMA) Assay Predicts the Relative *in vivo* Bio-activity of the Xenoestrogens Bisphenol A and Octylphenol. *Environmental Health Perspectives* 105(1):70-76.
- 59 Kawai K, Nozaki T, Nishikata H, Aou S, Takii M, Kubo C (2003). Aggressive Behavior and Serum Testosterone Concentration During the Maturation Process of Male Mice: The Effects of Fetal Exposure to Bisphenol A. *Environmental Health Perspectives* 111:175-178.
- 60 Howdeshell K, Hotchkiss AK, Thayer KA, Vandenberg JG, vom Saal FS (1999). Plastic bisphenol A speeds growth and puberty. *Nature* 401:762-764.
- 61 Honma S, Suzuki A, Buchanan DL, Katsu Y, Watanabe H, Iguchi T (2002). Low dose effect of *in utero* exposure to bisphenol A and diethylstilbestrol on female mouse reproduction. *Reproductive Toxicology* 16:117-22.
- 62 Akingbemi BT, Sottas CM, Koulova AI, Klinefelter GR, Hardy MP (2004). Inhibition of testicular steroidogenesis by the xenoestrogen bisphenol A is associated with reduced pituitary luteinizing hormone secretion and decreased steroidogenic enzyme gene expression in rat Leydig cells. *Endocrinology* 145(2):592-603.
- 63 Murray TJ, Maffini MV, Ucci AA, Sonnenschein C, Soto AM (2007). Induction of Mammary Gland Ductal Hyperplasias and Carcinoma *in situ* Following Fetal Bisphenol A Exposure. *Reproductive Toxicology* 23:383-390.
- 64 Across the board, companies are unwilling to provide information upon request, written or verbal. This makes even researching alternatives for reports such as this difficult, let alone making decisions as a consumer.
- 65 Toray Patent. Biaxially oriented polyester film to be formed into containers. US Patent: 6610378.
- 66 As You Sow (2009). Seeking Safer Packaging: Ranking Food Packaged Food Companies on BPA. [www.asyousow.org/publications/2009/bpa-scorecard-2009.pdf](http://www.asyousow.org/publications/2009/bpa-scorecard-2009.pdf). Accessed November 16, 2009.
- 67 Coppen and Hone 1995. Gum naval stores: Turpentine and rosin from pine resin. Natural Resources Institute. Food and Agriculture Organization of the United Nations. ISBN 92-5-103584-5.
- 68 Deardoff J (2008). Where to find BPA free cans. *Julie's Health Club*. [featuresblogs.chicagotribune.com/features\\_julieshealthclub/2008/06/where-to-find-b.html](http://featuresblogs.chicagotribune.com/features_julieshealthclub/2008/06/where-to-find-b.html). Accessed on April 6, 2009.
- 69 Tetra Pak Corporation (2009). Carton Structure and Purpose. [www.tetrapakrecycling.co.uk/tp\\_structure.asp](http://www.tetrapakrecycling.co.uk/tp_structure.asp). Accessed on November 16, 2009.
- 70 Recycling programs that accept aseptic packaging are listed at [www.aseptic.org](http://www.aseptic.org). When accessed on April 9, 2010, a number of states had no facilities for recycling this kind of material, and many states had only a limited number of recycling programs.
- 71 Personal communication with Customer Service Representative at Dole Foods, March 30, 2010.
- 72 [www.epa.gov/greenchemistry](http://www.epa.gov/greenchemistry). Accessed on April 9, 2010.



## Resources

**Baby's Toxic Bottle** is a report by the National Workgroup for Safe Markets investigating BPA leaching from baby bottles. [www.babystoxicbottle.org](http://www.babystoxicbottle.org)

**Breast Cancer Fund** is a nonprofit organization with an informative fact sheet on BPA's link to breast cancer. [www.breastcancerfund.org](http://www.breastcancerfund.org)

**Consumers Union**, the research and advocacy arm of Consumer Reports, has conducted research on BPA in food cans, and has information about BPA on their site. [www.greenerchoices.org/products.cfm?product=bpapress](http://www.greenerchoices.org/products.cfm?product=bpapress)

**Contaminated without Consent** is an DVD and set of resources for talking about chemical contamination in our bodies. [www.contaminatedwithoutconsent.org](http://www.contaminatedwithoutconsent.org)

The **Earliest Exposures** report by Washington Toxics Coalition *in collaboration with the Commonwealth Biomonitoring Resource Center and the Toxic-Free Legacy Coalition tested pregnant women for a variety of chemicals.* [www.watoxics.org/publications/earliest-exposures](http://www.watoxics.org/publications/earliest-exposures)

**The Endocrine Disruptor Exchange (TEDX)** has extensive scientific information about bisphenol A and other hormone disruptors, including an interactive timeline of fetal development and points where studies show chemicals can disrupt the process. [www.endocrinedisruption.com](http://www.endocrinedisruption.com)

**Environmental Working Group** has excellent information about BPA in products and in people. [www.ewg.org](http://www.ewg.org)

**Hazardous Chemicals in Health Care** is a report by Physicians for Social Responsibility that documents toxic chemicals in the bodies of physicians and nurses. [www.psr.org/resources/hazardous-chemicals-in-health.html](http://www.psr.org/resources/hazardous-chemicals-in-health.html)

**Is It In Us?** is a collaborative report that tested 35 people from seven states for toxic chemicals. [www.isitinus.org](http://www.isitinus.org)

**Safer Chemicals, Healthy Families** is a nationwide effort to pass smart federal policies that protect us from toxic chemicals. [www.saferchemicals.org](http://www.saferchemicals.org)

**SAFER States** is a collaboration of state networks championing solutions to protect public health and communities from toxic chemicals. [www.saferstates.org](http://www.saferstates.org)

### NATIONAL WORKGROUP FOR SAFE MARKETS

**Alliance for a Healthy Tomorrow**  
[www.healthytomorrow.org](http://www.healthytomorrow.org)

**Breast Cancer Fund**  
[www.breastcancerfund.org](http://www.breastcancerfund.org)

**Center for Health, Environment & Justice**  
[www.chej.org](http://www.chej.org)

**Clean New York**  
[www.clean-ny.org](http://www.clean-ny.org)

**Clean Water Action**  
[www.cleanwateraction.org](http://www.cleanwateraction.org)

**Coalition for a Safe & Healthy Connecticut**  
[www.safehealthyct.org](http://www.safehealthyct.org)

**Ecology Center**  
[www.ecocenter.org](http://www.ecocenter.org)

**Environmental Defence (Canada)**  
[www.environmentaldefence.ca](http://www.environmentaldefence.ca)

**Environmental Health Fund**  
[www.environmentalhealthfund.org](http://www.environmentalhealthfund.org)

**Environmental Health Strategy Center**  
[www.preventharm.org](http://www.preventharm.org)

**Environment Illinois**  
[www.environmentillinois.org](http://www.environmentillinois.org)

**Healthy Legacy Coalition**  
[www.healthylegacy.org](http://www.healthylegacy.org)

**Indiana Toxics Action Project**

**Kentucky Environmental Foundation**  
[www.kyenvironmentalfoundation.org](http://www.kyenvironmentalfoundation.org)

**Learning Disabilities Association of America**  
[www.ldanatl.org](http://www.ldanatl.org)

**Oregon Environmental Council**  
[www.oconline.org](http://www.oconline.org)

**US PIRG**  
[www.uspirg.org](http://www.uspirg.org)

**Washington Toxics Coalition**  
[www.watoxics.org](http://www.watoxics.org)

**Women's Voices for the Earth**  
[www.womenandenvironment.org](http://www.womenandenvironment.org)

## Appendix I: Methodology

Products were selected for testing according to several overlapping criteria: collection from as diverse a geographic area as possible, inclusion of products made by major manufacturers, collection from leading publicly traded retailers and the ability to compare older cans stored on home pantry shelves with new products purchased directly from a retailer.

### Brand Selection

We identified the following publicly traded brands for testing: Campbell's, Coca-Cola, ConAgra (owner of Chef Boyardee and Healthy Choice), DelMonte (owner of College Inn and Star-Kist, in addition to DelMonte brand), General Mills (owner of Muir Glen), Goya, Hain Celestial (owner of brands such as Eden Foods), Kraft, Pepsi, Unilever (makers of Slim Fast), Walmart (which sells its house brand, Great Value), and Whole Foods (which sells its house brand, 365).

### Participant and Product Selection

We recruited 20 individuals in 19 states and Ontario, Canada to collect products. We surveyed participants to determine what products from the brands listed above were in their pantries. Efforts were made to select products from as many different brands as possible. Individuals were told which of the products on their shelves they should submit, and then were asked to purchase matching products from a designated store's shelves. In two cases, California and Ontario, only new products were purchased. In one state, New York, two different kinds of products were selected. In three cases, Maine, Montana, and New York, store-bought products were similar but not identical to products submitted from pantry shelves.

Participants sent cans to a central location in New York where we collected data about each can. Cans were then shipped in two batches to Anresco Laboratories at 1370 Vandyke Ave., San Francisco, CA 94124.

### Laboratory Analysis

Anresco Laboratories<sup>73</sup> used methodology described by Czech J., Food Science, Volume 21, No. 3:85-90 with in-house modifications.

Food samples were composited by stainless steel blender in a Mason jar, from which 15 g were taken for analysis (samples were fortified as needed). BPA was extracted using QuEChERS method with 15 ml ACN. In a plastic centrifuge tube, 15 g sample + 1.5 NaCl + 6 g MgSO<sub>4</sub> + 15 ml ACN were

shaken for 2 minutes. The mixture was centrifuged for 10 minutes at 4000 RPM. 10 ml of ACN top layer were evaporated and taken through derivatization. The BSTFA/TMCS volume was modified to 1 ml and was added to the residue at which point it was placed into an oven for 30 minutes at 80 degrees C. After cooling, the derivatization agent was evaporated under N<sub>2</sub> and the residue was reconstituted in 4 ml of chloroform. Sample was microfuged at 10,000 RPM. 2 µl were injected into the Gas Chromatograph Mass Spectrometer (GCMS).

For beverages, 40 g (fortified as necessary) of each sample were extracted with three 390 ml portions of dichloromethane. Carbonated beverages were opened and allowed to

We recruited 20 individuals in 19 states and Ontario, Canada to collect products. Efforts were made to select products from as many different brands as possible.

lose carbonation for 2 hours before extraction. The dichloromethane layer was passed through sodium sulfate. The extract was evaporated to approximately 3 ml using a KD evaporator and then to dryness under a stream of N<sub>2</sub>. The residue was then derivatized. The BSTFA/TMCS volume was modified to 1 ml and was added to the residue, at which point it was placed into an oven for 30 minutes at 80 degrees C. After cooling, the derivatization agent was evaporated under N<sub>2</sub> and the residue was reconstituted in 4 ml of chloroform. Sample was microfuged at 10,000 RPM. 2 µl were injected into the GCMS.

GCMS operating parameters: Shimadzu GC-17A equipped with MS QP4000. 150 degree C for 2 minutes then 20 degree/minute to 300 C and hold 15 minutes. Flow @ 1.0 ml/minute. Interface at 300 degrees C. Injector at 250 degrees C. SIM (m/z): 372, 357.

Four spiked samples at the level of 20 ppb per sample yielded the following recoveries: Sample #1: 121.5%, Sample #14: 118.5%, Sample #20: 116.5%, Sample #25: 95.6%.

Negative controls were used throughout the process: blanks of de-ionized water were run between every sample and always indicated that no BPA was detected. The estimated level of detection was 0.5 µg/kg.

## Appendix II: Detailed Data

Product	Pantry or Store	State	BPA in sample (µg/kg)	Unit size (g)	Serving size (g)	BPA per serving (in µg)
365 Cannellini beans	P	NC	22.40	425	130	2.91
365 Cannellini beans	S	NC	24.20	425	130	3.15
365 Organic Black Bean Soup	S	CAN	52.50	411	245	12.86
365 Organic Cream of Mushroom Soup	S	CAN	53.50	411	245	13.11
365 Organic Kidney Beans	S	CAN	32.20	425	130	4.19
365 Organic Lentil Soup	S	CAN	47.40	411	411	19.48
365 Organic Light Coconut Milk	S	CA	74.60	400*	59	4.40
365 Organic Pinto Beans	S	CAN	28.80	425	130	3.74
Campbell's chicken noodle Soup	P	OR	120.70	305	305	36.81
Campbell's chicken noodle Soup	S	OR	127.50	305	305	38.89
Campbell's Cream of Mushroom Soup	P	WA	130.40	305	124	16.17
Campbell's Cream of Mushroom Soup: 25% less sodium	S	WA	92.60	305	124	11.48
Chef Boyardee Beef Ravioli	S	MI	9.70	425	252	2.44
Chef Boyardee Beef Ravioli	P	MI	21.50	425	425	9.14
Coca-cola classic	S	NJ	0.20*	360	360	0.07
Coca-cola classic	P	NJ	0.40*	360	360	0.14
College Inn Vegetable broth	P	CT	18.00	425	243	4.37
College Inn Vegetable broth	S	CT	40.80	425	106	4.34
DelMonte French Style Green beans	S	WI	296.20	411	121	35.84
DelMonte French Style Green beans	P	WI	1,140.00	411	121	137.94
DelMonte Lite Sliced Peaches—Yellow cling in extra light syrup	S	ME	7.60	822	124	0.94
DelMonte organic whole kernel corn	S	MN	33.00	432	113	3.74
DelMonte organic whole kernel corn	P	MN	37.10	432	113	4.21
DelMonte Yellow Freestone sliced peaches in light syrup	P	ME	1.20	822	124	0.15
Diet Caffeine-free coke	S	IN	ND*	355*	355	ND
Diet Caffeine-free coke	P	IN	0.40*	355*	355	0.14
Diet Coke	P	MA	ND*	350*	350	ND
Diet Coke	S	MA	0.70	350*	350	0.25
Eagle brand condensed milk	S	NY	ND*	397*	39	ND
Eagle brand condensed milk	P	NY	ND*	397*	39	ND
Goya Coconut Milk	S	VT	77.60	400*	59	4.58
Goya Coconut Milk	P	VT	82.20	400*	59	4.85
Goya Pink Beans	P	IL	76.50	439	113	8.67
Goya Pink Beans	S	IL	80.30	439	113	9.11
Great Value Pinto Beans	P	IA	11.70	439	113	1.33
Great Value Pinto Beans	S	IA	19.40	439	113	2.20
Great Value Sweet Peas	P	KY	6.50	425	125	0.81
Great Value Sweet Peas	S	KY	329.30	425	125	41.16
Health Valley Organic Lentil Soup (No salt)	S	CAN	44.60	439	240	10.70
Health Valley Organic Lentil Soup (No salt)	S	CAN	45.00	439	240	10.80
Health Valley Organic Minestrone Soup (No salt)	S	CAN	38.50	439	240	9.24
Health Valley Organic Minestrone Soup (No salt)	S	CAN	45.40	439	439	19.95
Health Valley Organic Vegetable Soup (No salt)	S	CAN	37.70	439	240	9.05
Health Valley Organic Vegetable Soup (No salt)	S	CAN	51.60	439	240	12.38
Healthy Choice Old Fashioned Chicken Noodle Soup	P	MT	323.60	439	439	142.20
Healthy Choice Old Fashioned Chicken with Rice	S	MT	172.40	439	439	75.76
Muir Glen Organic Fire Roasted Crushed tomatoes	P	NY	1.90	439	110	0.21
Muir Glen Organic Fire Roasted Diced tomatoes	S	NY	7.10	439	110	0.78
Star-Kist Tuna	P	AK	0.70	439	220	0.15
Star-Kist Tuna	S	AK	1.60	439	220	0.35

\* Liquids are measured in ml. For the purposes of this report we considered it sufficiently accurate to assume one ml equals one g.

+ These values were reported by the laboratory but fall below the level of detection. ND means, "Not detected."





# No Silver Lining

## An Investigation into Bisphenol A in Canned Foods

A public health debate is raging around the world about the danger of bisphenol A (BPA). Scientists, health professionals, and children's and environmental health advocates are concerned by the hundreds of independent peer-reviewed scientific studies that have found negative health outcomes in laboratory animals resulting from low doses of BPA. *No Silver Lining* provides new data about the amount of BPA that could be consumed from eating canned food and drinks available in the U.S. and Canada.

Among our findings:

- 92% of the 50 cans we tested had detectable levels of BPA.
- One can of green beans had 1,140 parts per billion of BPA—the highest amount of any published study.
- A daily diet that included canned foods tested for this report could cause a pregnant 20-something woman to ingest levels of BPA shown to cause harm to fetal development in animal studies.
- Alternative materials are available, with more under development.

Canned foods can play a significant role in contaminating people with BPA. The solution must be sustainable, non-toxic packaging. We recommend companies continue to identify and implement safer materials use, and that government bodies require this action to ensure the public's health is protected.

### **The National Workgroup for Safe Markets**

Contact: Bobbi Chase Wilding, BPA Coordinator | 518.708.3875 | [clean.bobbi@gmail.com](mailto:clean.bobbi@gmail.com)

Copies of this report can be downloaded from [www.contaminatedwithoutconsent.org](http://www.contaminatedwithoutconsent.org)