



## Bisphenol-A (BPA) Fact Sheet

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In August 2008, the California Senate voted against SB 1713, the "Toxin-Free (*sic*) Toddlers and Babies Act". The bill would have capped the levels of Bisphenol-A (BPA) in food and beverages intended for children under three at 0.1 ppb (parts per billion).

### What is BPA?

Bisphenol-A was first synthesized in 1891. As early as the 1930s, it was documented that BPA mimicked estrogen in the human body. In the 1940s, chemical engineers began to make plastic and epoxy from BPA<sup>1</sup>. Today, about 4 million tons of BPA are produced annually worldwide. Over 90% of BPA is made by Bayer, Mitsubishi, Teijin Chemicals, Dow Chemicals, and GE Plastics (which was recently acquired by Saudi Basic Industries Corporation)<sup>2</sup>.

### What are the uses of BPA?

The most widely known use of BPA is as the building block of polycarbonate plastic (which often has the number 7, the resin code for "other," in the chasing arrows symbol). Polycarbonate is used to make most baby bottles, 5-gallon water cooler bottles, and many other products. Since Canada declared BPA toxic in April 2008, Wal-Mart, REI, and even Nalgene have promised to phase out the sale of polycarbonate bottles.

An investigative report by the *Milwaukee Journal Sentinel* (Nov 15, 2008) found that all ten plastic food containers that they heated (via microwave or in conventional ovens) leached enough BPA to cause the toxic effects noted in low-dose laboratory studies. All of these containers were marked "microwave-safe."

We absorb BPA through our skin when we touch gas station receipts and other thermal carbonless papers coated with BPA dust. Because it is used in some printer inks, BPA has even contaminated the recycled paper stream. Paperboard food packing (such as pizza boxes) now contains traces of BPA<sup>3</sup>.

Almost all metal food and beverage cans in the US are lined with an epoxy coating that leaches BPA. BPA is also used as a flame retardant (both as BPA and in a brominated form) in other plastics, especially PVC.

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<sup>1</sup> [www.ewg.org/node/26291](http://www.ewg.org/node/26291)

<sup>2</sup> R Senjen. Blissfully unaware of Bisphenol A: Reasons why regulators should live up to their responsibilities (A comprehensive review of the scientific knowledge available regarding controversial Bisphenol A), Friends of the Earth Europe. June 2008

<sup>3</sup> LN Vandenberg et al. Human Exposure to BPA *Reproductive Toxicology* 24 (2007) 139-177

A Ozaki et al. Chemical analysis and genotoxicological safety assessment of paper and paperboard used for food packaging. *Food and Chemical Toxicology* 42 (2004) 1323-1337.



BPA is an ingredient in many other products, including dental sealants, pesticides, nail polish and paints. It is not possible to compile a complete list, since US law protects the secrecy of proprietary formulations.

**A study conducted by the federal government found BPA in the urine of 93% of the US population<sup>4</sup>.** The concentrations detected ranged from 0.4 µg/l (micrograms per liter) to 149 µg/l.

### Why is BPA a problem?

Like natural hormones, BPA appears to follow what is called a non-monotonic dose response curve. This means that a lower dose of BPA does NOT necessarily lead to a weaker effect. In fact, the smallest doses can lead to powerful effects that cannot be predicted by studying only higher doses.

Consider Tamoxifen. This drug treats breast cancer at high doses, but at much smaller doses can actually promote breast cancer cell proliferation<sup>5</sup>. Similarly, BPA can cause different effects at different doses.

In August 2008, researchers found that BPA (at doses to which we are already exposed) inhibits the release of adiponectin, a hormone made by fat cells. This appears to lead to metabolic syndrome: abdominal obesity, glucose intolerance, high blood sugar levels, high triglycerides, and high blood pressure, all of which increases the risk of diabetes and cardiovascular disease<sup>6</sup>.

BPA already had been associated with early puberty, aneuploidy (a chromosomal defect which causes birth defects like Down's syndrome), cancer (especially of the breast and prostate), and reduced sperm count. It decreases the levels of testosterone in males.

Also linked to BPA exposure are impaired immune function, miscarriage, thyroid abnormalities, polycystic ovarian syndrome, and decreased anti-oxidant enzyme levels. In developing fetuses, BPA exposure can alter brain development and lead to permanent changes in brain chemistry. Some of these changes are "epigenetic," meaning that they affect the way our genes are expressed. Some effects are transgenerational, affecting not only the exposed man or woman but also subsequent generations.

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<sup>4</sup> Calafat, A. M., Kuklennyik, Z., Reidy, J. A., Caudill, S. P., Ekong, J. and Needham, L. L. Urinary concentrations of bisphenol A and 4-nonylphenol in a human reference population. *Environmental Health Perspectives* 113 (2005) 391-5.

<sup>5</sup> Source: Dr Pete Myers' testimony May 14, 2008 to the US Senate Committee on Commerce

<sup>6</sup> E Hugo et al. Bisphenol A at Environmentally Relevant Doses Inhibits Adiponectin Release from Human Adipose Tissue Explants and Adipocytes. *Environmental Health Perspectives* 2008 (in press)



The evaluation of BPA's safety has been fraught with controversy. The Center for the Evaluation of Risks to Human Reproduction (a part of the National Toxicology Program) terminated their contract with Sciences Intl. after Environmental Working Group drew their attention to serious undeclared conflicts of interest. Sciences Intl. had accepted the assignment to evaluate the safety of bisphenol-A while all three staff members involved in the project were on the payroll of BPA manufacturers.

More recently, the FDA admitted that its own safety guidelines for BPA were ghost-written by the manufacturers. Why is this troubling? A review of BPA research by funding source tends to support suspicions of bias. Of 119 US government-funded studies, 92% found evidence of adverse effects after low-dose BPA treatment. Of 11 studies funded by chemical corporations, none found evidence of harm.<sup>7</sup>

The House of Representatives' Committee on Energy and Commerce has opened an inquiry into the Weinberg Group, a public relations firm that runs an industry-funded campaign to "manufacture uncertainty" about the effects of BPA. One tactic of this campaign is promoting the idea that the science supporting a BPA-ban is preliminary or flawed.

### **What happens to BPA in the environment?**

Much of our trash is burned. This process converts the BPA into other toxic chemicals such as phenol, benzene, toluene, and ethylbenzene.

Some of our BPA-containing trash is taken to landfills. While free BPA usually breaks down in a matter of days outside the body, we don't know how long it lasts while it is bound in plastic, or if it leaches into the soil and water table.

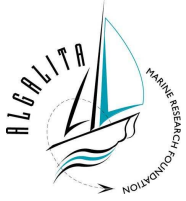
BPA is already in the ocean, where it appears to be more persistent than in fresh water. Because polycarbonate is denser than water, it sinks to the sea floor and mixes with sand and sediment. Seafood tested in Singapore contained up to 213.1 ng/g (nanograms per gram, wet weight) BPA.

### **What can be done?**

Safer alternatives to BPA exist. Green chemists have developed a way to use carbon dioxide instead of BPA to make polycarbonate. Japan has switched to BPA-free linings in their food and beverage cans. Some of these alternative bio-resins are made from soy, corn, and vernonia weed.

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<sup>7</sup> National Resources Defense Council response to the National Toxicology Program's Draft Report (2007)  
<http://cerhr.niehs.nih.gov/chemicals/bisphenol/pubcomm/NRDCcomments.pdf>



In June, Rep. Edward J. Markey (D-Mass.) introduced the “Ban Poisonous Additives (BPA)” Act that would prohibit the use of BPA in all food and beverage containers. (Track the bill's progress at <http://www.opencongress.org/bill/110-h6228/show>)