

# Health Care Provider Guide to Safer Plastics:

## Phthalates and Bisphenol A

### Phthalates

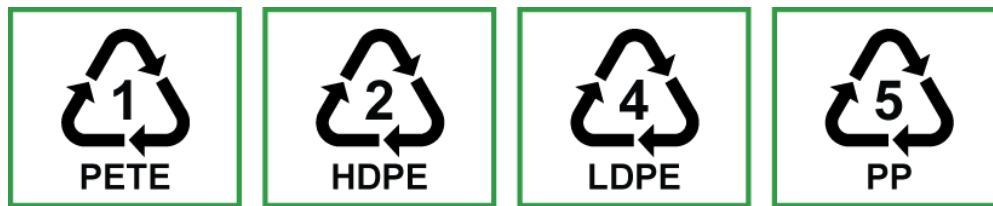
Phthalates are man-made chemicals used in soft, flexible plastics, polyvinyl chloride (PVC) products, and in a variety of personal care products (shampoos, lotions, etc.). These chemicals are anti-androgenic and can adversely impact androgen-sensitive tissues during specific windows of development.

### Bisphenol A

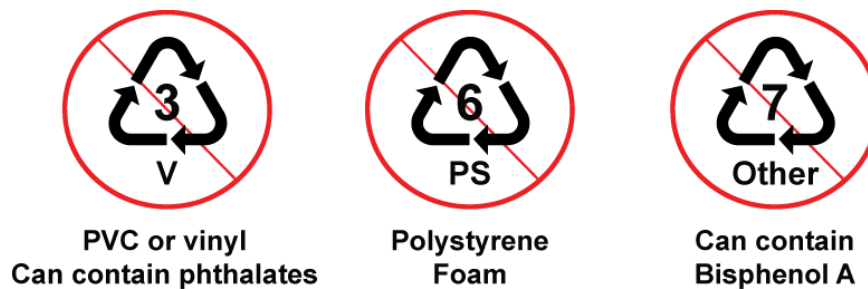
Bisphenol A, or BPA is a man-made chemical used in hard, polycarbonate plastics and in food can linings to prevent degradation of the metal. BPA acts as a weak estrogen in animals and probably does so in humans as well. It has chemical properties similar to estradiol and can impact biological systems in very low doses.

- Children may be exposed to phthalates or bisphenol A from ingestion through diet and sucking/mouthing plastics, inhalation through dust, and dermal exposures.
- Because evidence is still emerging, the Pediatric Environmental Health Specialty Units (PEHSU) recommends a precautionary approach. The information below will help avoid exposures.
- You can use the following guide to counsel families on how to choose safer plastics. Consumers should be instructed to check the symbol on the bottom of the plastic items before buying.

### *The safer plastic choices for toys and food and beverage containers:<sup>1</sup>*



### *Plastics to avoid:<sup>2,3</sup>*



1. Luz Claudio and Reeve Chace. Quick Guide to Plastics. Staying Healthy in a Changing Environment #3. Mount Sinai Community Health Bulletin. June 2006.
2. Code #6: Styrene, a potentially toxic chemical, may be released from containers made from polystyrene foam (Styrofoam and related brands) when they are used to heat or store foods or liquids at temperatures exceeding 80°C (176°F).
3. Code #7 covers "other" plastics, which includes polycarbonate. Therefore not all code #7 plastic bottles contain polycarbonate and leach BPA. Also, BPA can be given off from other products.

## Possible Human Health Impact:

Both phthalates and bisphenol A are endocrine disruptors - chemicals that may interfere with the production/function of hormones leading to adverse health effects.

---

### Phthalates

#### *Animal Studies (all are high dose exposures in utero)*

- significant **testicular toxicity** in utero and in early development (testicular dysgenesis syndrome)
- increased incidence of **male reproductive tract abnormalities** in offspring of prenatally exposed rats including hypospadias, cryptorchidism, and testicular tumors
- **decreased birth weight** after prenatal exposure
- malignant kidney and liver tumors (not thought to be relevant to human exposures)

#### *Human Studies*

- prenatal phthalate exposure associated with a **decreased anogenital distance** (marker of androgenization)
- phthalate exposure through breast milk has been associated with **increased LH, decreased free testosterone** and **increased serum human binding globulin** in 3 month old male infants
- early childhood exposure to phthalates has been associated with increased **rhinitis, eczema, asthma and wheezing**
- several studies relate phthalate exposure with abnormal sperm morphology/sperm DNA damage in adult males

### Bisphenol A

#### *Animal Studies*

- **neurotoxic**, stimulates estrogen receptors in brain, prenatal exposures lead to changes in behavior including **hyperactivity, increased aggression, impaired learning**
- low dose prenatal exposure is associated with **early puberty** and **increased mammary tumors** in offspring, increased risk of **prostate hypertrophy**
- prenatal exposure associated with **increased adipocytes and increased body weight** in offspring
- adult exposure associated with modulation of helper T1 and T2 cells which in turn adversely affects antibody production

#### *Human Studies*

- extensive evidence that **humans are exposed to concentrations similar or higher than doses used in several animal studies that document adverse health effects.**
- no epidemiologic studies published examining human health effects.

## Tips on Teaching Patients & Parents How to Avoid Exposure

*Disclaimer: Based upon interpretation of the current literature, the PEHSU program is providing this guidance for persons who wish to take a precautionary approach to personal decisions, and is not meant to substitute for personal medical consultation with your health care provider.*

### Phthalates

- Do not microwave food/beverages in plastic
- Do not microwave or heat plastic cling wraps
- Do not place plastics in the dishwasher
- Use safe alternatives such as glass or polyethylene plastic (symbol #1)
- Buy products labeled as “phthalate-free” or “BPA-free”

### Bisphenol A

- If using hard polycarbonate plastics (water bottles/baby bottles/sippy cups), do not use for warm/hot liquids
- Use safe alternatives such as glass or polyethylene plastic (symbol #1)
- Avoid canned foods when possible (BPA may be used in can linings)

You or your patients may contact your local Pediatric Environmental Health Specialty Unit. Find our contact information at [www.pehsu.net](http://www.pehsu.net) or call 1-888-347-2632

June 2008

## **Key References**

- Ahmad M, Bajahlan AS. Leaching of styrene and other aromatic compounds in drinking water from PS bottles. *J Environ Sci (China)*. 2007; 19(4):421-6.
- Bornehag CG, Sundell J, Weschler CJ, Sigsgaard T, Lundgren B, Hasselgren M, Hagerhed-Engman L. The association between asthma and allergic symptoms in children and phthalates in house dust: a nested case-control study. *Environ Health Perspect*. 2004 Oct; 112(14):1393-7.
- Calafat AM, Ye X, Wong LY, Reidy JA, Needham LL. Exposure of the U.S. population to bisphenol A and 4-tertiary-octylphenol: 2003-2004. *Environ Health Perspect*. 2008 Jan; 116(1):39-44.
- Claudio L, Chace R. Quick Guide to Plastics. *Staying Healthy in a Changing Environment #3*. New York: Mount Sinai Community Health Bulletin; 2006.
- Gray LE, Jr., Wilson VS, Stoker T, Lambright C, Furr J, Noriega N, Howdeshell K, Ankley GT, Guillette L. Adverse effects of environmental antiandrogens and androgens on reproductive development in mammals. *Int J Androl*. 2006 Feb; 29(1):96-104; discussion 5-8.
- Hauser R, Meeker JD, Duty S, Silva MJ, Calafat AM. Altered semen quality in relation to urinary concentrations of phthalate monoester and oxidative metabolites. *Epidemiology*. 2006 Nov; 17(6):682-91.
- Main KM, Mortensen GK, Kaleva MM, Boisen KA, Damgaard IN, Chellakooty M, Schmidt IM, Suomi AM, Virtanen HE, Petersen DV, Andersson AM, Toppari J, Skakkebaek NE. Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age. *Environ Health Perspect*. 2006 Feb; 114(2):270-6.
- NIEHS. *Since You Asked - Bisphenol A*. NTP Brief; 2008.
- Richter CA, Birnbaum LS, Farabollini F, Newbold RR, Rubin BS, Talsness CE, Vandenberg JG, Walser-Kuntz DR, von Saal FS. In vivo effects of bisphenol A in laboratory rodent studies. *Reproductive Toxicology*. [Review]. 2007; 24(2):199-224.
- Swan SH, Main KM, Liu F, Stewart SL, Kruse RL, Calafat AM, Mao CS, Redmon JB, Ternand CL, Sullivan S, Teague JL. Decrease in anogenital distance among male infants with prenatal phthalate exposure. *Environ Health Perspect*. 2005 Aug; 113(8):1056-61.
- Vandenberg LN, Hauser R, Marcus M, Olea N, Welshons WV. Human exposure to bisphenol A (BPA). *Reprod Toxicol*. 2007 Aug-Sep; 24(2):139-77.
- Vom Saal FS. *Plastic Promises: Better Living or Bodily Harm* [Slide presentation]. Seattle; 2006.
- Wetherill YB, Akingbemi BT, Kanno J, McLachlan JA, Nadal A, Sonnenschein C, Watson CS, Zoeller RT, Belcher SM. In vitro molecular mechanisms of bisphenol A action. *Reprod Toxicol*. 2007 Aug-Sep; 24(2):178-98.

*Acknowledgment: S. Sathyanarayana, MD, MPH, C. Karr, MD, PhD, Northwest PEHSU. M. Galvez, MD, MPH, P.E. Sheffield, MD, Mount Sinai PEHSU. R. Geller, MD, Southeast PEHSU. M. Sandel, MD, MPH, R. Goldman, MD, MPH, New England PEHSU. S. Buchanan, MD, MPH, The Great Lakes Center for Children's Environmental Health. I. Buka, FRCPC Misericordia & Stollery Children's Hospital, Canada. L. Gordon, MPH, Fellow – U.S. Environmental Protection Agency. M. Miller MD, MPH, University of California – San Francisco PEHSU. J. Paulson, MD, Mid-Atlantic Center for Children's Health and Environment.*