

Phthalates

And Your Health

Alaska Community Action on Toxics

September 2007

WHAT ARE PHTHALATES?

Phthalates are a group of industrial chemicals that add flexibility and resilience to many consumer products. Of particular concern are di-2-ethylhexyl (DEHP), benzylbutyl phthalate (BzBP), dibutyl phthalate (DBP), and very likely diethyl phthalate (DEP). DEHP and BzBP are primarily used as plasticizers in polyvinyl chloride (PVC)-based plastics, as well as other flexible plastics, and found in tablecloths, furniture, vinyl flooring, shower curtains, garden hoses, inflatable swimming pools, plastic clothing such as raincoats, children's toys, automobile upholstery and tops, medical tubing, and blood storage bags.^{1,2} DEP and DBP are used in non-plastic consumer items as fixatives, detergents, lubricating oils, and solvents and can be found in carpets, paints, glue, insect repellents, time release capsules, and personal care products such as soap, shampoo, hair spray, nail polish, deodorants, and fragrances.²⁻⁶

PHTHALATES IN OUR BODIES

In a nationwide assessment of the exposure of the U.S. population to phthalates, scientists from the Centers for Disease Control and Prevention (CDC) measured levels of urinary phthalate monoesters (breakdown products of phthalates) in 289 people and found phthalates at unexpectedly high levels in every person tested.^{7,8} According to this assessment, researchers determined that “from a public health perspective, these data provide evidence that phthalate exposure is both higher and more common than previously suspected.”⁷ Though not representative of the population due to the small sample size, this study found that women of reproductive age (20 to 40 years) had substantially higher levels of DBP than the rest of the study group.⁷

In the 2005 CDC study, phthalates were once again widely detected in human urine samples with an increased sample size of over 2,500 Americans.³ Overall, the study indicated that, with the exception of MEP (mono-ethyl phthalate, the urinary metabolite of DEP), children age 6 to 11 years of age excreted higher concentrations of phthalate metabolites than the older age groups.¹ In the same report, researchers found that women had higher levels of MEP, MBP (mono-butyl phthalate, a urinary metabolite of DBP), MBzP (mono-benzyl phthalate, the urinary metabolite of BzBP), and three urinary metabolites of DEHP: MEHP (mono-2-ethylhexyl phthalate), MEOHP (mono-(2-ethyl-5-oxohexyl) phthalate), and MEHHP (mono-(2ethyl-5-hydroxyhexyl) phthalate).¹

In a more recent study, the phthalate monoesters MEHHP, MEOHP, and MEP were found to be present in 100% of 90 girls age 6 to 9, and MBP, MBzP, and MEHP were found in over 94%.¹⁰

HOW ARE WE EXPOSED TO PHTHALATES?

There are multiple human exposure routes for phthalates including oral, inhalation, ingestion, dermal, and intravenous—through transfusions and other medical devices and procedures.^{1,2,5,6,8} Phthalates are easily released from the plastic products in which they are used as they are not part of the polymer chain which forms the plastic.⁶ People are exposed to phthalates through direct contact with consumer products containing phthalates, consumption of contaminated water or food (as the phthalates in plastic packaging may leach into the food they hold), inhalation of

contaminated air, and during the manufacturing and disposal of products containing phthalates.^{2,6,11}

Individual phthalates have various routes of exposure:

- The largest source of DEHP exposure for the general population is diet, followed by inhalation of contaminated indoor air.¹¹ Exposures in food result from DEHP accumulating in foods and from the leaching of DEHP while processing, packaging, and storing.¹¹ The single largest use of DEHP is as a plasticizer for poly-vinyl chloride plastic (PVC). DEHP can leach from PVC under certain circumstances, causing direct human exposures.^{3,4,10}
- DEP exposure results mainly from direct use consumer products containing fragrances and personal care products such as shampoos, scents, soap, lotions, and cosmetics, and from inhalation of air containing these chemicals.^{3,10} Exposure to DEP is also found in products such as toothbrushes, tools, food packaging, insecticides, and aspirin.⁶
- Exposure to DBP has been linked most commonly to cosmetics, mainly nail polish, but DBP is also found in pharmaceutical coatings, insecticides, and some printing inks.^{3,4,10}
- BzBP is an industrial solvent and found within adhesives, vinyl flooring, sealants, car-care products, and some personal care products such as hair spray.^{3,4,10}

WHAT DOES PHTHALATE EXPOSURE MEAN FOR OUR HEALTH?

Evidence that exposure to phthalates has possible adverse health effects has been building over recent years. Phthalate exposure has been linked to the following health concerns:

Reproductive and Developmental Effects: Phthalate exposure can begin *in utero* and in one study is strongly associated with a shorter pregnancy duration.¹² Another study also found that prenatal phthalate exposure at environmental levels is associated with altered male reproductive development in humans, including shortened anogenital distance (signifying feminization), an increased likelihood of testicular maldescent, small and indistinct scrotum, and smaller penile size.¹³ Later research documented altered male reproductive hormone levels in baby boys most highly exposed to phthalates in their mother's breast milk.¹⁴ Phthalate exposure has also been linked to lower sperm counts, reduced sperm motility, and damaged sperm in men.¹⁵

Respiratory System: Studies have shown concentrations of phthalates in house dust are associated with asthma and rhinitis in children.¹⁶ Exposure to PVC flooring containing phthalates has also been linked to increased bronchial obstruction during the first two years.⁹ In adult men, exposure to certain phthalates has been linked to reduced lung capacity at magnitudes similar to those observed with tobacco smoke.¹⁷

Effects in Laboratory Animals: Depending on the exposure level, exposure to DEHP resulted in observed effects on the pituitary, thyroid, thymus, ovaries, testes, lung, kidneys, liver, and blood.¹¹

REDUCING OUR EXPOSURE

Scientific evidence indicates that phthalates readily exit our bodies through urinary metabolites. Although people are continually exposed to phthalates because they are ubiquitous, you can minimize re-exposure to phthalates by:

Avoid products containing PVC plastic:

- Avoid the use of PVC/vinyl in building and home remodeling. Use safe alternatives such as those recommended by the Healthy Building Network (www.healthybuilding.net).
- Purchase natural fibers, polyester, or nylon shower curtains instead of vinyl.
- Avoid plastics marked with the #3 symbol; these are likely to contain PVC.
- Check with your children's toy manufacturers to see if they have pledged to stop using PVC. Toymakers Brio, Chicco, Early Start, Evenflo, Gerber, Lego, Prime Time, Sassy, and Tiny Love have already made the commitment.

Awareness of Household Products:

- Educate yourself as to whether the adhesives, caulk, grout, and sealants you use contain phthalates. In the National Institutes of Health's Household Products Database, you can search for phthalate as an ingredient. It can be found at: www.householdproducts.nlm.nih.gov/

Phthalate-free Personal Care Products:

- Look at ingredient lists and avoid products listing "fragrance" or phthalates.
- Choose products from companies that have signed the Compact for Safe Cosmetics. For a listing, check out: www.safecosmetics.org.
- Research the ingredients of your personal care products, beyond what is on the ingredient label. Check out the Skin Deep Database at www.ewg.org/reports/skindeep2/index.php for a more complete listing.

Know What Is In Your Food:

- Grow and harvest your own food without using pesticides, or purchase organic foods if possible.

REGULATIONS FOR PHTHALATES

In the United States, federal regulation of phthalates fall under the Toxic Substances Control Act which was passed in 1976 and has not been updated since.¹⁸ Though phthalates are considered a hazardous waste and are regulated as pollutants when released into the environment in the U.S., they remain basically unregulated in consumer products.^{18,19} Several states have tried and failed to pass laws banning phthalates in certain consumer products. However, in September, 2007 the California State Senate successfully passed a bill that would ban 6 phthalates in children's toys beginning in 2009.²⁰ On the global level, the European Union banned the use of six phthalates in children's toys and products in 2005, and prior to that, fourteen countries had restricted or banned their use.²¹

Alaska Community Action on Toxics
505 West Northern Lights Blvd, Suite 205, Anchorage, Alaska 99503
907-222-7714 _ www.akaction.org _ info@akaction.net

References:

- ¹ Agency for Toxic Substances and Disease Registry (ATSDR). 2002. Public Health Statement Di(2-ethylhexyl)phthalate (DEHP). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry.
- ² Schettler, T. 2006. Human exposure to phthalates via consumer products. *International Journal of Andrology* 29:134-139.
- ³ Centers for Disease Control and Prevention (CDC). 2005. Third National Report on Human Exposure to Environmental Chemicals. Atlanta, GA: CDC.
- ⁴ Houlihan J, Brody C, Schwan B. 2002. Not Too Pretty. Environmental Working Group. Available: <http://www.ewg.org/reports/nottoopretty>
- ⁵ ATSDR. 2001. Toxicological Profile for Di-n-butyl Phthalate (DBP). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. Available: <http://www.atsdr.cdc.gov/toxpro2.html>
- ⁶ ATSDR. 1995. Toxicological Profile for Diethyl Phthalate (DEP). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service, Agency for Toxic Substances and Disease Registry. Available: <http://www.atsdr.cdc.gov/toxpro2.html>
- ⁷ Blount BC, Silva MJ, Caudill SP, Needham LL, Pirkle JL, Sampson EJ, et al. 2000. Levels of seven urinary phthalate metabolites in a human reference population. *Environmental Health Perspectives* 108(10):979-82.
- ⁸ CDC. 2001. National Report on Human Exposure to Environmental Chemicals. Atlanta, GA: CDC.
- ⁹ Kohn MC, Parham F, et al. 2000. Human exposure estimates for phthalates. *Environmental Health Perspectives* 108(10):A440-2.
- ¹⁰ Wolff MS, Teitelbaum SL, Windham G, Pinney SM, Britton JA, Chelimo C, et al. 2007. Pilot study of urinary biomarkers of phytoestrogens, phthalates, and phenols in girls. *Environmental Health Perspectives* 115(1):116-121.
- ¹¹ Center for the Evaluation of Risks to Human Reproduction (CERHR). 2000. NTP-CERHR Expert Panel Report on Di(2-ethylhexyl)phthalate. U.S. Department of Health and Human Services, National Toxicology Program, Center for the Evaluation of Risks to Human Reproduction. Available: <http://cerhr.niehs.nih.gov/>
- ¹² Latini G, De Felice C, Presta G, Del Vecchio G, Paris I, Ruggieri F, et al. 2003. *In utero* exposure to di-(2-ethylhexyl)phthalate and duration of human pregnancy. *Environmental Health Perspectives* 111(14):1783-1785.
- ¹³ Swan SH, Maine KM, Liu F, Stewart SL, Kruse RL, Calafat AM, et al. 2005. Decrease in anogenital distance among male infants with prenatal phthalate exposure. *Environmental Health Perspectives* 113(8):1056-1061.
- ¹⁴ Main KM, Mortensen GK, et al. 2006. Human breast milk contamination with phthalates and alterations of endogenous reproductive hormones in infants three months of age. *Environmental Health Perspectives* 114(2):270-6.
- ¹⁵ Duty SM, Singh NP, et al. 2005. The relationship between environmental exposures to phthalates and DNA damage in human sperm using the neutral comet assay. *Environmental Health Perspectives* 111(9):1164-1169.
- ¹⁶ Bornehag C, Sundell J, Weschler CJ. 2004. The association between asthma and allergic symptoms in children and phthalates in house dust: A nested case-control study. *Environmental Health Perspectives* 112:1393-1397.
- ¹⁷ Hoppin JA, Ulmer R, London SJ. 2004. Phthalate exposure and pulmonary function. *Environmental Health Perspectives* 112(5):571-574.
- ¹⁸ Sutton R, Jackson J, Walker B, Tupper G, Horenstein B (eds.). 2007, July 12. Down the Drain: Sources of Hormone-Disrupting Chemicals in San Francisco Bay. Oakland, CA: Environmental Working Group. Available: <http://www.ewg.org/reports/downthedrain>. [Accessed 10 September 2007].
- ¹⁹ EPA. 2006. Inventory Update Reporting. Environmental Protection Agency. Available: <http://www.epa.gov/oppt/iur/>
- ²⁰ Environment California. 2007, September 4. Senate Passes Bill to Protect Kids From Toxic Toys: Bill Now Moves to the Governor's Desk. Environmental Health News: Environment California. Available: <http://www.environmentcalifornia.org/news-releases>. [Accessed 13 September 2007].
- ²¹ Environment California. 2007. Phthalate Overview. Stop Toxic Toys. Environment California. Available: <http://www.environmentcalifornia.org/environmental-health/stop-toxic-toys>. [Accessed 13 September 2007].