



CLEAN WATER ACTION

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Written Testimony of Sarah A. Uhl
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Before the Connecticut General Assembly Environment Committee
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Testimony in Support of:

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Raised HB No. 6572

An Act Banning Bisphenol-A in Children's Products and Food Products and Prohibiting Certain Alternative Substances

Dear Senator Meyer, Representative Roy, and honorable members of the Environment Committee,

My name is Sarah Uhl. I am the Environmental health Coordinator for Clean Water Action, and I submit this testimony on behalf of our organization, in support of Raised HB No. 6572 *An Act Banning Bisphenol-A in Children's Products and Food Products and Prohibiting Certain Alternative Substances*. I applaud the committee for focusing on reducing exposure to this chemical of concern. HB 6572 would address a widespread public health and environmental hazard by requiring that bisphenol A (BPA) be gradually phased out of the consumer products that scientists believe are responsible for most human exposure (food cans, reusable food containers, and baby products such as baby bottles and spill-proof cups). The bill would also restrict certain substitutions with other toxic hazards, and require labeling on products prior to the implementation of the longer phase-outs. With the vast majority of Americans carrying BPA in their bodies, and evidence mounting linking this body burden to a long list of chronic diseases and disorders that are on the rise, there is no time to waste in shifting to safer alternatives. Unlike S.B. No. 791, which aims to curb exposure from a small fraction of the problem products and leaves open the possibility that new toxic plastics will be used instead, HB 6572 would solve the problem by both addressing the products at the heart of the exposure issue (those that hold foods and beverages) and preventing manufacturers from replacing BPA with other toxic chemicals. I urge the passage of HB 6572, without amendments.

BPA Overview

Today, bisphenol-A (BPA) is manufactured in excess of six billion pounds per year. BPA is most commonly used as the building block of polycarbonate plastic for products such as baby bottles and water bottles, epoxy resins (coatings that line food containers), and white dental sealants.

BPA molecules are bound by "ester bonds" to form a polymer used to make polycarbonate plastic. As the building block of polycarbonate, BPA is the primary chemical in polycarbonate, and it thus does not exist in only trace amounts. While plastics are typically thought of as stable, scientists have known for many years that **the chemical bond between BPA molecules is unstable**. The bond is disrupted by heat and acidic or basic conditions that release BPA into food or beverages in

contact with the plastics. Warmth is known to accelerate this leaching process, such as when a food container is microwaved, or when a hot liquid is added to a polycarbonate container.

In brief, this summary reveals that there is **extensive scientific literature reporting adverse effects of BPA** at doses lower than the current level considered safe by U.S. EPA, a **high rate of leaching of BPA from food and beverage containers**, and evidence that the **median BPA level in humans is higher than the level that causes adverse effects in lab studies.**¹

Children are Most at Risk

Growing children are particularly at risk to chemicals in their environment because they face greater exposure per pound of body weight and are physiologically more susceptible to them.² ***Children's exposures begin at conception, as chemicals, including BPA, cross the placenta in a pregnant woman's body³ and can affect the embryo or fetus during critical periods of development.*** Fetuses do not possess the enzymes necessary for metabolizing, or breaking down, BPA. This means that high levels of the chemical remain inside the fetus during the development of the key organs and body systems. Even after birth, children's bodies remain immature, with underdeveloped detoxification mechanisms to protect them from BPA as well as drugs. Their brains and other organ systems are constantly developing, undergoing periods of particular sensitivity to damage or disruption. Especially because growing children are particularly at risk from BPA exposure and adverse effects on intellectual ability, social behaviors, fertility, and potential for disease may take decades to detect, precautionary measures must be taken to protect children from exposure to products containing BPA that they use everyday.

Recently, scientists created a well-documented website that visually explains the effects of BPA (and two other chemicals of concern) on the development of the fetus. Please visit:
http://www.criticalwindows.com/go_display.php

BPA Levels in Humans are Above Harmful Levels Found in Studies to Cause Harm

According to the U.S. Centers for Disease Control, 95% of Americans have detectable levels of bisphenol-A in their bodies.⁴ In a recent CDC study, the observed BPA levels detected—0.1 to 9 parts per billion (ppb)—were at and above the concentrations known to reliably cause adverse effects in laboratory experiments. Despite the fact that BPA is metabolized by the body of people older than 2-4 months, the findings provide strong evidence that exposure to BPA is very frequent or nearly continuous.

In fact, one recent study found significant increases in calcium inflow even at the lowest levels of BPA exposure in the parts per trillion (ppt) level.⁵ Increases in calcium within the cell initiate a wide array of processes within the cell such as regulating hormone secretion and controlling gene activity. The CDC data show that people contain BPA in the *parts per billion* (ppb) level—1,000 times higher than the lowest exposure at which an effect was seen on calcium influx. These CDC findings are confirmed by numerous studies conducted in other countries showing virtually identical levels of BPA in blood and tissues collected from human fetuses and adults.

Dangers of BPA are Confirmed by Weight of the Science

Bisphenol-A can alter the expression of several hundred genes with effects varying among specific tissues and also depending upon the timing of exposure. **More than 185 peer-reviewed studies** suggest that BPA exposure at very low doses is linked to a staggering number of health problems, including prostate and breast cancer, obesity, attention deficit and hyperactivity disorder, brain damage, altered immune system, lowered sperm counts, and early puberty.

Although the safe level of BPA exposure set by U.S. EPA based on experiments conducted prior to 1988 is 50 ppb, some examples of effects at significantly lower doses of BPA include:

Behavioral changes: Many laboratory studies show that low-dose exposure to BPA causes behavioral effects, including hyperactivity (at 30 ppb);⁶ increase in aggression (at 2 to 40 ppb);⁷ changes in response to painful or fear-provoking stimuli (at 40 ppb);⁸ impaired learning (at 100 ppb);⁹ reversal of normal sex differences in the brain structure and elimination of sex differences in behavior (at 30 ppb);¹⁰ decreased maternal behavior such as reductions in time spent nursing, increases in time resting away from offspring, and increases in time spent out of the nest (at 10 ppb);¹¹ altered play and other socio-sexual behaviors (at 40 ppb);¹² and increased susceptibility to drug addiction (at 40-300 ppb).¹³

Diabetes, heart disease, and liver problems: A study published in the Journal of the American Medical Association found that BPA levels in adult humans were associated with diabetes, heart disease, and clinically abnormal concentrations of liver enzymes. The authors conclude that higher BPA exposure may be associated with avoidable morbidity.¹⁴

Obesity: Low-level, chronic exposure to BPA causes insulin resistance in adult mice.¹⁵ Such insulin resistance leads to Type II diabetes in people as well as hypertension and cardiovascular disease. A recent study shows that even a single dose of BPA at levels currently found in humans can result in altered levels of blood glucose and insulin, and twice-daily exposure for just four days results in insulin resistance. Several studies show an increased rate of postnatal growth in both males and females as a result of maternal doses between 2.4 and 500 ppb per day, and accelerated postnatal growth is associated with obesity, insulin-resistant diabetes, hypertension, and heart disease.¹⁶

Early puberty: Low-dose exposure to BPA can affect the timing of the onset of puberty. Several studies reveal the early onset of sexual maturation in females occurring at maternal doses between 2.4 and 50 ppb per day.¹⁷

Down Syndrome: BPA exposure is linked to an error in cell division called aneuploidy, which causes 10-20% of all birth defects in people, including Down Syndrome. In studies with mice, BPA causes aneuploidy even at extremely low doses.¹⁸

Reduced sperm count: Several studies show that low-dose developmental or adult exposure at levels between 0.2 and 20 ppb reduces daily sperm production and fertility in males.¹⁹ In one such study, low-dose exposure to male rats caused decreased sperm count and affected testicular weight and structure.²⁰ The authors concluded that "BPA alter[s] spermatogenesis in a linear manner in a dose range which is perhaps relevant to the daily level of exposure in man." An important aspect of this finding is that BPA decreases the levels of testosterone in males.

Breast cancer: Studies show that low-dose BPA exposure stimulates mammary gland development.²¹ In one study, scientists exposed mouse fetuses to a daily dose of 250 nanograms per kilogram of their body weight—less than 1% the amount deemed safe for humans in the U.S.—causing increased breast tissue development. Higher density breast tissue is a risk factor for cancer. One study author, Dr. Ana Soto, indicated the results lead her to believe that BPA likely increases the risk of breast cancer in humans.

Prostate disease and cancer: Low-dose exposure to BPA can significantly increase prostate size. Several studies show an increase in prostate size in male offspring at maternal doses between 2 and 50 ppb.²² Another study shows extremely low doses of BPA initiate the proliferation of prostate cancer cells.²³

Impaired immune function: Studies show altered immune function occurring at BPA doses between 2.5 and 30 ppb.²⁴

Decreased anti-oxidant enzyme levels: A decrease in antioxidant enzymes (required to protect against cell damage) occurred at the very low dose of 200 parts per trillion (ppt) in adult male rats.²⁵

Brain damage: Low doses of BPA can disrupt important effects of estrogen in the developing brain, causing brain damage. In most studies, BPA has been found to mimic the actions of estrogen in developing neurons, but in specific areas of the brain, BPA can have the paradoxical effect of inhibiting the activity of estrogen, which normally increases the growth and regulates the viability of connections between neurons. The concern relating to this finding is that this type of disruption is associated with impaired learning and memory.²⁶

Changes in brain chemistry: Low-dose exposure to BPA causes changes in the brain, including an increase in progesterone receptor mRNA levels at 400 ppb of BPA,²⁷ increase in estrogen receptor alpha mRNA levels at 40 ppb of BPA,²⁸ increase in estrogen receptor beta mRNA levels at 25 ppb of BPA,²⁹ and a change in brain somatostatin receptors at 400 ppb of BPA.³⁰ These receptors are involved in regulating the brain control systems that coordinate the functioning of the reproductive system as well as reproductive and other social behaviors.

The U.S. government has concluded that animal studies are a vital guide to identifying health risks for humans.³¹ Furthermore, there is now extensive evidence that the sensitivity of tissues to BPA in the animals used in the experiments cited above is virtually identical to the sensitivity of human tissues to BPA. There are some strains of rat that are particularly insensitive to BPA as well as any other estrogenic chemical or drug, but these highly insensitive animals are considered by regulatory agencies to be inappropriate for use in toxicological studies aimed at predicting the potential risks to human health posed by exposure to low, environmentally relevant doses of BPA. Still, some trade groups like the Grocery Manufacturers Association cite studies using these rats as evidence of BPA safety.

Miscarriage and polycystic ovarian disease in women: Low-dose BPA exposure is also associated with miscarriages in women.³² In one recent study, scientists found levels of BPA in women with a history of recurrent miscarriage three times higher than in women who had normal pregnancies.³³ Specifically, the scientists examined patients who had suffered three or more consecutive miscarriages and compared the BPA levels of women who had subsequent successful pregnancies with women who miscarried again. In another study, women who had polycystic ovary syndrome (PCOS) had higher levels of BPA, were more obese, and had higher levels of male sex hormones, suggesting a range of physiological abnormalities, relative to normal, non-obese women without PCOS.³⁴

Polycarbonate Plastic Breaks Down and Leaches BPA

Numerous studies show that polycarbonate plastics break down and leach BPA into food or beverages in contact with the plastic.³⁵ In one study, BPA leaching was detected in 12 polycarbonate baby bottles after dishwashing, brushing, and boiling. Levels of BPA detected in liquid held in these bottles exceeded 8 ppb.³⁶

Independent Science Shows Harmful Effects from BPA, while Industry Science Shows None

A review of the scientific literature shows that none of the 14 studies funded by the chemical industry reported adverse effects at low levels, whereas 189 of 204 government-funded studies

found effects. These many studies were conducted in academic laboratories in the U.S. and abroad.

Even the 14 industry-funded studies have flaws, however. Of the industry studies, two had its positive control fail—an indication that the entire experiment had failed, not that BPA had not caused an effect.

	Adverse Effect	No Effect
<u>Industry Funded</u>	0	14
<u>Government Funded</u>	189	15

Another industry study concluded BPA caused no effect, but an independent analysis of the experiment's data by scientists convened by the National Toxicology Program of the U.S. Department of Health & Human Services concluded that in fact there was an effect. Industry scientists had misreported their own results.

The chemical industry relies on an incomplete review of scientific studies by an effort funded by the American Plastics Council at the Harvard Center for Risk Analysis. The panel funded by the American Plastics Council only considered 19 studies in concluding in 2004 that the weight of the evidence for low-dose effects of BPA was weak.³⁷ As of November 2005, there were 151 published studies on the low-dose effects of BPA.

Safer alternatives are here, and leading companies are shifting

In April 2008, the federal government of Canada proposed to designate BPA as "toxic" under the Canadian Environmental Protection Act and move towards banning it in baby bottles. In declaring BPA toxic, government officials expressed concern that infants are exposed to bisphenol A at levels that could cause health effects. Canada is now the first national jurisdiction to consider designating bisphenol A as 'toxic' to human health and the environment, and to begin implementing regulation on the use of this chemical. Since the Canadian government proposed to designate BPA as "toxic", there's been a major market movement and backlash away from BPA among baby and water bottle companies as well as retailers in both the U.S. and Canada. These actions are summarized below.

U.S. retailers phasing out BPA: U.S. retailers Wal-Mart, CVS, Toys"R"Us, Kmart, Safeway, Sears, Wegmans Foods, and Whole Foods have all committed to phase out BPA-contaminated baby bottles.

Baby bottle manufacturers phasing out BPA: Playtex has announced they will replace infant feeding products made with BPA with a BPA-free material by the end of 2008. Other baby bottle manufacturers reducing or phasing out BPA baby bottles include Avent, Born Free, Evenflo, Gerber, Handi-Craft Company (makers of Dr. Brown's), Munchkin and Think Baby. Other companies that offer BPA-free baby bottles include Aidiri, Green to Grow, Lansinoh, Medela, Momo Baby, Mother's Milkmate, Nuby, and Sassy.

Infant formula companies moving toward alternatives: Similac has BPA-free liquid and dry formula products on store shelves now. Gerber and Nestlé Nutrition have publicly stated they are committed to making all food and formula packaging BPA-free as soon as possible. Mead-Johnson and PBM (maker of store brands) have all said they would look into BPA alternatives in response to a congressional investigation led by John Dingell.

BPA in food can linings: 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.

Water bottle companies eliminating BPA: Nalgene, a company that has been a staunch defender of BPA in recent years, announced they will phase out BPA in water bottles they sell and has already begun to sell many BPA-free safer products. Other water bottle manufacturers phasing out BPA or selling BPA-free bottles include Aladdin / Pacific Market International, CamelBak, Klean Kanteen, and Polar Bottle.

Canadian retailers and BPA: In December 2007, two major Canadian-based retailers, Mountain Equipment Co-op and Lulemon, announced they would stop selling BPA-laden water bottles. In 2008, Sears Canada, Wal-Mart Canada, Rexall Pharmacies, London Drugs and Home Depot Canada announced they would remove plastic baby bottles, reusable water bottles and other products made with bisphenol A (BPA) from their shelves. Sears Canada announced it has removed from sale baby products and sport bottles which contain bisphenol A and are designed to come into direct contact with the mouth. Other Canadian companies removing BPA-contaminated products include Canadian Tire, the Forzani Group Ltd., and Hudson's Bay Company.

Canadian grocery distributors and BPA: Members of the Canadian Council of Grocery Distributors also announced they will stop selling all polycarbonate baby bottles in April 2008. Members include Canada Safeway Limited, Colabor, L.P., Colemans Food Centre, Co-op Atlantic, Costco Wholesale Canada Ltd., Flanagan Foodservices Inc., Federated Co-operatives Limited, GFS Canada Company, H.Y. Louie Co Limited, Jean-Paul Beaudry Ltd., the Kitchen Table Incorporated, Loblaw Companies Limited, METRO INC., Neate Roller Limited, Sobeys Inc., Summit-Cambridge, SYSCO Foodservices of Canada Inc., Tannis Food Distributors, Thrifty Foods – Sobeys Inc., and Wallace & Carey Inc.

BPA-free products promotes greener jobs and a boost to the economy: Due to rising consumer awareness, there is economic growth from the market rejecting BPA and through the growth of safer BPA-free alternatives. Eastman Chemical, a manufacturer of BPA alternatives, has stated the company "is excited by the significant market potential for Eastman Tritan(TM) copolyester," a safer BPA-free alternative. Owens-Illinois has resumed production of glass infant feeding bottles for the first time in about 20 years, re-opening plants and creating much needed jobs in these economically depressed times. SIGG, a 100-year-old maker of aluminum sports bottles, said in a statement that its North American sales were five times what they were a year prior. Canada is moving to ban BPA and BPA could potentially be banned under the European Union's REACH law. Banning BPA encourages our industry to become more competitive with our trading partners.

The U.S. FDA: science for sale?

The FDA recently announced that they will revisit their previous conclusion that BPA is safe. This revisiting process will involve new and continued research. Their most recent assessment was based mainly on a review of a very small number of flawed, chemical industry-funded studies, not the dozens of independent studies that have found BPA causes harm. In fact, a panel of scientists assembled by the FDA to review its assessment found that the agency ignored any independent studies that link the chemical to health problems. This panel recommended the agency abandon its earlier findings that BPA is safe. The reassessment is underway but expected to take years.

Connecticut Must Lead the Way Due to Lack of Federal Action on BPA

The last U.S. EPA risk assessment for BPA was based on research conducted in the 1980s and did not consider that BPA was a chemical estrogen. The most recent risk assessment of BPA was based on a comprehensive review of the scientific literature conducted in 1998 by the European Union, with some selected articles added through 2001, at which time few of the current 204 independently-funded, low-dose BPA studies had been published. The most recent review of scientific studies shows effects from exposure to BPA at levels significantly below the current "safe exposure" level established by the U.S. based on experiments conducted prior to 1988.

With the EPA behind in their reassessment, and the FDA dismissing the advice of their own scientific panel, states must lead the way. I urge the committee to pass legislation to phase out BPA from food and beverage containers and products for infants and toddlers.

Attached: Summary of recent studies

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New Studies Raise Increased Concerns About Common Exposures to Bisphenol A

- **Premature babies hospitalized in neonatal intensive care units had levels of BPA in their urine 10 times higher than the general population.** *Exposure to Bisphenol A and other Phenols in Neonatal Intensive Care Unit Premature Infants*, A M Calafat, J Weuve, X Ye, L Jia, et al, *Environ. Health Perspectives* in Press, Dec. 2008 www.ehponline.org/docs/2008/0800265/abstract.html
In this first study examining infants' exposure to bisphenol A, premature babies hospitalized in neonatal intensive care units had levels of BPA in their urine 10 times higher than the general population. The source of exposure most likely was plastic medical devices used in the hospital, although some could have come from infant formula. BPA is a plastic compound that is linked to various health abnormalities in humans and lab animals. www.environmentalhealthnews.org
- **First evidence that maternal exposure to BPA during lactation increases mammary carcinogenesis.** *Oral Exposure to Bisphenol A Increases Dimethylbenzanthracene-Induced Mammary Cancer in Rats*, S Jenkins, N Raghuraman, I Eltoun, M Carpenter, J Russo, and CA Lamartiniere, *Environ. Health Perspectives* in Press, Jan. 2009 www.ehponline.org/docs/2009/11751/abstract.html
Researchers gave female rats with nursing litters oral doses of BPA. The result: The baby rats matured with higher levels of breast cancer. This study provides the first evidence that maternal exposure to BPA during lactation increases mammary carcinogenesis in rodents. Animals were tested at concentrations of BPA similar to exposures experienced by people. Co-author Lamartiniere noted, "In fact, it's below the concentration that the EPA deems safe. With BPA we're finding changes that are consistent with oncogenesis, or cancer causation." (Quote from Birmingham News, 1-11-09.)
- **BPA exposure linked to heart disease, diabetes and liver abnormalities in humans.** *Association of urinary bisphenol A concentration with medical disorders and laboratory abnormalities in adults*. IA Lang, TS Galloway, A Scarlett, WE Henley, et al. *JAMA*. 2008, 300(11): 1303-10. Bisphenol A (BPA) is widely used in epoxy resins lining food and beverage containers. Evidence of effects in animals has generated concern over low-level chronic exposures in humans. This study examined associations between urinary BPA concentrations and adult health status, using data from the National Health and Nutrition Examination Survey 2003-2004 for 1455 adults aged 18 through 74 years. Higher urinary BPA concentrations were associated with cardiovascular diagnoses in age-, sex-, and fully adjusted models, also with diabetes, and with clinically abnormal concentrations of the liver enzymes gamma-glutamyltransferase and alkaline phosphatase. The authors conclude that higher BPA exposure, reflected in higher urinary concentrations of BPA, may be associated with avoidable morbidity in the community-dwelling adult population.
- **New study demonstrates an adverse effect of BPA on the brains of nonhuman primates.** *Bisphenol A prevents the synaptogenic response to estradiol in hippocampus and prefrontal cortex of ovariectomized nonhuman primates*. Leranath C, Hajszan T, Szigeti-Buck K, Bober J, MacLusky NJ. *Proc Natl Acad Sci U S A*. 2008, 105(37): 14187-91. Exposure measurements from several countries indicate that humans are routinely exposed to low levels of bisphenol A (BPA). Previous studies demonstrated BPA's interference with the development of many organs and ability to alter cognitive functions and mood in rodent studies. This study examined the influence of continuous BPA administration, at a daily dose equal to the current EPA reference safe daily limit, on estradiol-induced spine synapse formation in the hippocampus and prefrontal cortex of a nonhuman primate model. The study found that even at this relatively low exposure level, BPA completely abolishes the synaptogenic response to estradiol. Because remodeling of spine synapses may play a critical role in cognition and mood, the ability of BPA to interfere with spine synapse formation has profound implications. This study is the first to demonstrate an adverse effect of BPA on the brain in a nonhuman primate model and

is the first to demonstrate an adverse effect of BPA on the brain in a nonhuman primate model and further amplifies concerns about the widespread use of BPA in medical equipment, and in food preparation and storage.

- **Prenatal exposure to Bisphenol A is linked to significant adverse reproductive and carcinogenic effects.** *Prenatal Exposure to Bisphenol A at Environmentally-Relevant Doses Adversely Affects the Murine Female Reproductive Tract Later in Life.* R R Newbold, W N Jefferson, E Padilla-Banks. *Environ. Health Perspectives* In Press, Jan. 2009. Exposure to endocrine disrupting chemicals like Bisphenol A during critical development periods causes adverse consequences later in life. In this study the pups of pregnant mice treated with BPA were examined at age eighteen months. The study found that ovarian cysts and ovarian cystadenomas were significantly increased in the BPA exposed group. Some BPA exposed animals experienced more severe pathologies that were not observed in controls, for example atypical hyperplasia, sarcoma of the uterine cervix and mammary adenocarcinoma. These data suggest that BPA causes long-term adverse reproductive and carcinogenic effects if exposure occurs during critical periods of differentiation.

- **Study predicts BPA in babies 11 times higher than adults.** *Predicting plasma concentrations of Bisphenol A in young children (< two years) following typical feeding schedules using a physiologically-based toxicokinetic model.* A Edginton, L Ritter. *Environ. Health Perspectives* In Press, Nov. 2008. www.ehponline.org/docs/2008/0800073/abstract.html Using a mathematical model based on enzymatic differences between newborns and adults, scientists estimate that the amount of bisphenol A (BPA) circulating in the blood of babies is more than 11 times higher than the amount in adult blood. The striking disparity is most likely due to natural differences in metabolism and body size between babies and adults. This study points to the need for chemical exposure standards to better incorporate differences in vulnerabilities between children and adults.

- **Early life BPA linked to permanent hormonal changes resulting in early puberty.** *Neonatal Exposure to Bisphenol A Alters Reproductive Parameters and Gonadotropin Releasing Hormone Signaling in Female Rats.* M Fernández, M Bianchi, V Lux-Lantos, C Libertun. *Environ. Health Perspectives* In Press, Jan. 2009. www.ehponline.org/docs/2009/0800267/abstract.html This study examined how BPA affects reproductive development and hormones in female adolescent and adult rats that were exposed during their first couple of weeks of life. The exposure time frame corresponds to infancy through pre-puberty in humans. Neonatal exposure to BPA accelerated puberty onset and altered estrous cycles. Results demonstrate for the first time that neonatal BPA exposure permanently affects reproductive parameters. Past studies have found similar effects when exposures occur during prenatal development.