

IS IT IN US?

CHEMICAL CONTAMINATION IN OUR BODIES



TOXIC TRESPASS, REGULATORY FAILURE & OPPORTUNITIES FOR ACTION

A REPORT FROM THE BODY BURDEN WORK GROUP &
COMMONWEAL BIOMONITORING RESOURCE CENTER

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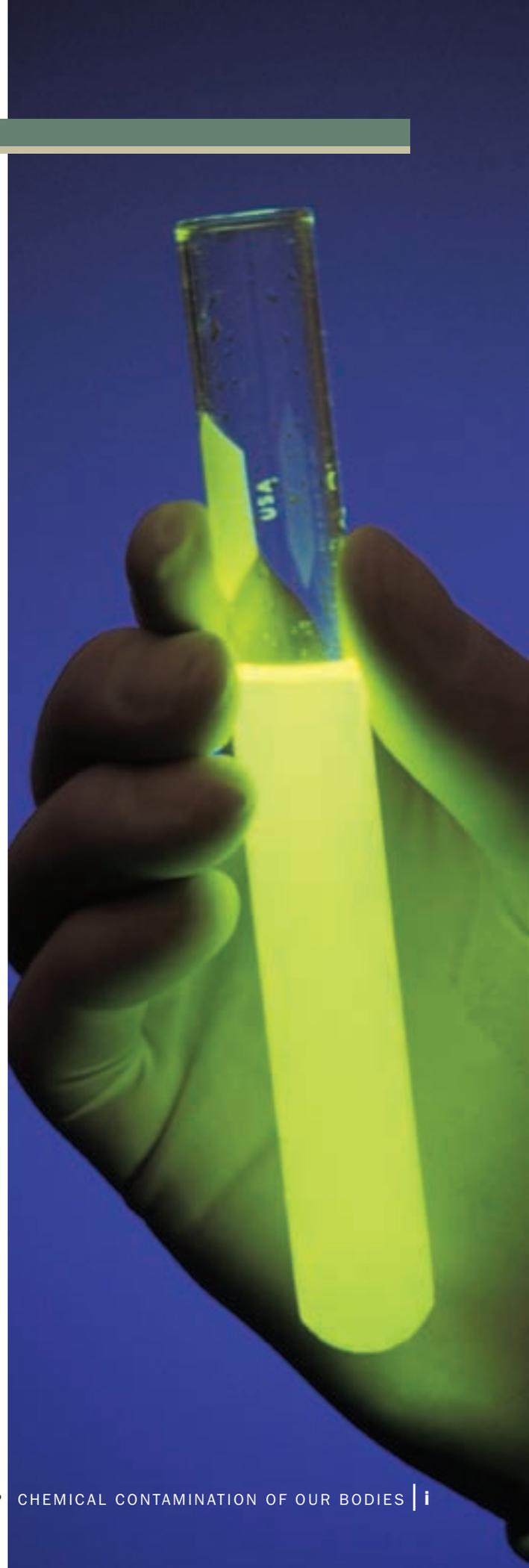
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By Project Participant **Cathy Rexford**

I am by no means a scientific expert. I am your next-door neighbor, your co-worker, the gal you bump into at the grocery store. I am the one who waits in line behind you at the post office or the bookstore. I am the woman who sits next to you on a plane. And I am a person who carries around toxic chemicals in her body.

When I was invited by a good friend to volunteer for this project, I was immediately interested. Who wouldn't want to know more about themselves? She warned me that it could be a bit overwhelming to know exactly what industrial chemicals are in our bodies. Because then, as if some magical scientific wand were waved, it becomes real. And if it's real, then we have to face it. For myself, it's not so much what we know that is so interesting, as what we do with the knowledge we are given.

Several months later, I received my results. This very neat row of numbers compared my levels of toxic chemicals to others who had also been tested. I admit, at first, it was normal for me to compare myself to the others. I thought, *"Well, if I'm not the worst, then I must be ok."*

But, then the thought occurred to me, what if our perception of *normal exposure* to these chemicals has been skewed? What if, instead of asking myself, *"Are my levels normal?"* What I should really be asking myself is, *"Are ANY levels of exposure normal?"* Is any level of chemical in my body that is associated with birth defects, learning disabilities, breast cancer, reproductive problems, and other health impacts, is this what I consider *"normal"*?

The reality of our situation is this: Sometimes it's easier not to know. It's easier to go about your day and not ask questions. Because sometimes, we just can't face the truth. But by asking ourselves questions about our own health and well-being, we gain knowledge. We gain awareness, and with that knowledge comes responsibility.

Once we are made aware, we have a choice either to look the other way or to act on it. The reality is, all of us have toxic chemicals in our bodies. It's the world we live in today. But we can act together: Now that we are aware, we can act to reduce our exposure, and can help urge changes in the system that allows toxic chemicals into our communities.

We can begin by asking ourselves where this contamination comes from. In the case of the chemicals we were tested for, they come from ordinary products like perfume, plastics, personal computers, tin cans, plastic water bottles and hundreds of other household items that all of us use every day.

Toxic chemicals don't belong in the human body. Safer alternatives to most toxic chemicals are available. So why aren't we offered these alternatives? Why aren't product makers required to replace toxic chemicals with safer ingredients? This is just common sense, isn't it?

What follows in this report are the data of thirty-five people from the seven states of Alaska, Connecticut, Illinois, Massachusetts, Michigan, Minnesota and New York who volunteered to be tested for industrial chemicals in our blood and urine. The hazardous chemicals for which we tested bisphenol A, phthalates, and brominated flame-retardants.

This report sheds some light on the reality of toxic chemical exposure and may help all of us to live well and live free of unnecessary chemicals.

Executive Summary

This report documents the results of a national bio-monitoring project that tested 35 diverse people from seven states for contamination with three types of toxic, industrial chemicals. The project found these industrial chemicals in every person tested. Human and other animal studies have linked these detected chemicals to birth defects, cancer, learning disabilities, infertility, asthma and other harmful health conditions. People's exposures to toxic chemicals from the products they use every day—shower curtains, tin cans baby bottles, water bottles, shampoo, hair-spray, couch cushions, computers, and other products—indicates the failure of our nation's chemical policies, which have not prevented our bodies from becoming polluted with toxic chemical substances. The presence of toxic chemicals in products we use daily is legal. Our chemical safety policies have failed. But we can protect public health with better, common sense chemical policies, and many are already being advanced at both the state and federal level.

Introduction

As Americans, we know something about pollution. In the 1970's, we learned from Woodsy the Owl to "Give a Hoot, Don't Pollute." We learned about pollution from cars and trucks, runoff from pesticide applications, and acid rain from power plants. This year, high profile recalls of lead contaminated dolls, backpacks, bibs, toys, jewelry, cub scout badges and other supposedly benign objects made parents realize that a simple trip to the toy store was instead a deadly serious game of Russian roulette. People expanded their notion of pollution to include industrial chemicals used to make consumer products. This summer's scare about lead in toys is not surprising, considering there are now over 80,000 chemicals registered for use in the American marketplace, with approximately 2,000 more being introduced each year.¹ Should people have to worry and wonder every time they go to the grocery store, the furniture store or the toy store?

We know that rates of some diseases are increasing—for example, obesity, asthma, learning disabilities,

autism, attention deficit/hyperactivity disorder, childhood cancer and certain birth defects. Could these increasing rates of chronic diseases be linked to increasing pervasive human exposure to dangerous chemicals in the environment? For the vast majority, their toxicity hasn't been studied and their health impacts are unknown. But we do know the chemicals we tested for, phthalates, bisphenol A and brominated flame-retardants are linked to an array of diseases in human and laboratory studies. We do know that thousands of chemicals contaminate our air, water, land, and food, as well as our homes, communities, schools and workplaces. With pollution all around us, even in the products we use every day, the question became clear: *Is it in us?*

About the Project

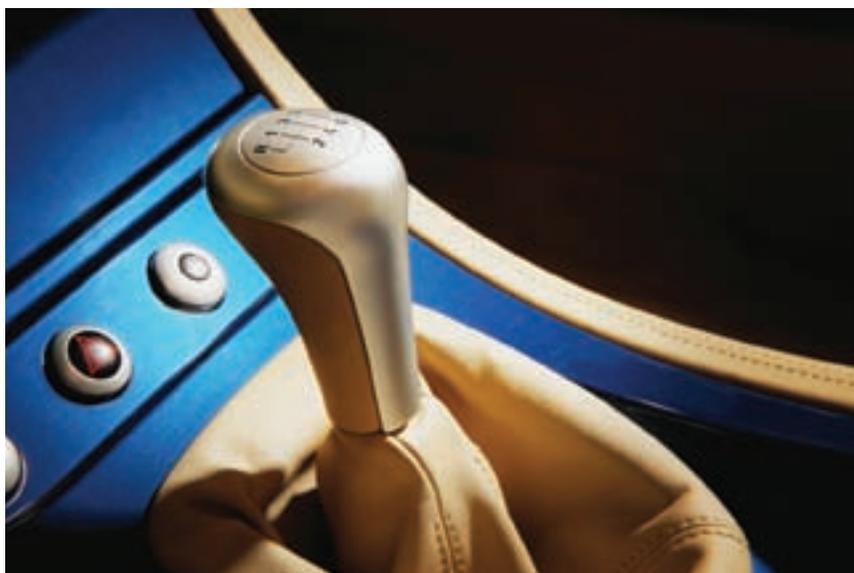
Thirty-five individuals from seven states set out to find the answer to that question and to make a difference in the lives of people like us. In the spring of 2007, women and men from Alaska, Connecticut, Illinois, Massachusetts, Michigan, Minnesota and New York



volunteered to donate samples of their blood and urine, which were sent to laboratories where scientists perform biomonitoring, a public health tool that can measure the presence of chemicals in body tissues and fluids. The samples were tested for three types of toxic chemicals that are in tens of thousands of consumer products. These volunteers have stepped forward to share their stories. Their in-

sphenol A at the same time. An important part of our report is the presentation of solutions to the problem of pollution in people. Through a unique collaboration among expert organizations, our report presents the results of biomonitoring and offers various personal, municipal, state, federal and market solutions.

The hazardous chemicals that are the subject of this project, bisphenol



attention is that by talking frankly about their concerns, their fears, and their hopes for a world safe from toxic chemicals, they will motivate others to ask questions about the chemicals that surround us. Are they safe? Are they in us?

This project is the broadest non-governmental effort of its kind in the United States and the first U.S. multi-state, multi-organizational effort to document toxic chemicals in the bodies of average Americans. Our volunteers are in the vanguard of this effort to use new analytical tools that detect chemicals in small quantities; fewer than approximately 250 people have been so biomonitoring and told of their results. It is the only project that tested participant's blood and urine for bi-

A (BPA), phthalates, and polybrominated diphenyl ethers (PBDEs), are ubiquitous in the products we use every day. They are in plastic containers, shower curtains, sofa cushions, wall-paper, toys, furniture, fabric, cars, televisions and stereos, soda cans, infant car seats, raincoats, tuna fish cans, beer cans, infant formula can linings, water bottles, medical equipment, baby bottles, shampoo, hairspray, nail polish, perfume, air fresheners and the list goes on and on. Exposure to these chemicals is associated in laboratory and, in some cases, human studies with birth defects, learning disabilities, breast and prostate cancer, reproductive problems, liver damage, and other conditions.

Results: Toxic chemicals contaminate our bodies

We tested for seven metabolites of five different phthalates. Presence of the metabolite(s) indicates exposure to the parent compound(s). We detected levels of twelve **polybrominated diphenyl ethers** in our participants. We tested for the presence of **bisphenol A** in urine and blood serum. Altogether we have results for a total of 20 chemicals. **We found all three types of toxic chemicals in every person tested:**

- Of 35 participants, all had in their bodies at least 7 of the 20 chemicals for which we tested.
- The person with the most chemicals tested positive for 17 of the 20 chemicals.
- We found diethyl phthalate, dibutyl phthalate and di (2-ethylhexyl) phthalate (DEHP) in all 33 participants who provided urine samples. Thirty-two tested positive for butylbenzyl phthalate.
- We found six types of PBDEs in all 35 participants, and decabDE in all but one participant.
- All 33 participants who provided urine samples had bisphenol A in their urine.

Although these 35 people cannot be considered representative of the general population, the test results strongly support the conclusion that people are routinely exposed to phthalates, BPA, and PBDEs, regardless of geographic location, whether in a rural or urban setting, and despite differences in age, occupation, gender, race, and lifestyle. The results for our 35 volunteers could be your results. They are your neighbors, your friends, your teachers, faith leaders, first responders, legislators, mothers, fathers, sons and daughters. In a sense, they represent the face of America. Without

CHEMICALS OF CONCERN



Bisphenol A (BPA)

More than six billion pounds of bisphenol A are produced each year² and 95% of Americans tested by the Centers for Disease Control now excrete it in their urine.³ In laboratory studies, bisphenol A alters egg development in exposed fetuses and increases the risk of genetic damage in the next generation, thus providing evidence for multigenerational effects.⁴ In laboratory animals, exposure to bisphenol A profoundly affects the male reproductive system, with adverse changes to the testes, testosterone and sperm production.⁵ It increases prostate and breast cancer risk, alters brain development, and causes earlier puberty and obesity. Researchers found that women with a history of recurrent miscarriage had higher blood serum levels of bisphenol A than women with successful pregnancies.⁶ All of our participants who submitted urine samples had bisphenol A in their urine, and more than half had it in their blood. The levels of bisphenol A in the blood and urine of our participants are within the range shown to cause effects in laboratory animal studies, including impacts on cell function.⁷

Phthalates

Globally, more than 18 billion pounds of phthalates are produced each year. They are primarily used as plasticizers in flexible polyvinyl chloride (PVC) products, such as vinyl shower curtains, flooring, and medical devices, among many others.⁸ Phthalates are also used in a wide range of other products, such as fragrances and pill coatings, and are found in Americans of all ages, sizes, and races. Evidence has been building in recent years that links phthalates to adverse health effects such as reproductive and developmental problems, respiratory impairment and other harmful effects on organs in humans and in laboratory animals.^{9,10,11,12,13} Four of the five participants in whom we found measurable levels of dimethyl phthalate had levels above the U.S. Centers for Disease Control's (CDC) population-wide 95th percentile—meaning that in CDC's study, 95% of the participants had lower levels.¹⁴



Polybrominated diphenyl ethers (PBDEs)

Global market demand for PBDEs in 2001 was over 67,000 metric tons.¹⁵ PBDEs, used for decades as flame-retardants in products such as televisions and couches, have been shown to build up in our bodies. Laboratory animal data show that PBDEs may harm the developing brain, impair sperm development, and impair thyroid function.^{16,17,18} PBDEs are associated with undescended testicles of newborn baby boys in one study.¹⁹ All of our participants had PBDEs in their bodies, including penta- and deca-BDE.

Despite both proven and suspected dangers to our health, the chemical industry is allowed to manufacture, sell and add toxic chemicals to the products we use without first being required to evaluate their safety. Product makers are not required to put safer alternatives in place, even when the existence of safer chemicals or processes is known, available, effective, and affordable.



“For me as a pediatrician, the most worrisome thing about the presence of scores of chemicals in people’s bloodstreams is the concern about what these chemicals might be doing to children. Children’s developing organ systems—their brains, their immune systems, their lungs, their reproductive systems—are extremely sensitive, and the development is easily disrupted, especially in the earliest years of life. The situation in which we find ourselves, in which these industrial chemicals are in children’s bodies with insufficient knowledge of their toxicity, is potentially perilous.”

Philip Landrigan, Chairman of the Department of Community and Preventive Medicine, Mount Sinai School of Medicine

our knowledge or consent, these dangerous, unnecessary chemicals are coursing through our blood into our organs, into our brains, and into pregnant women’s developing babies. They move through the placental barrier to the developing fetus, and may be transferred through breast milk to the nursing infant. Although breast milk is the best food for babies, the presence of toxic chemicals in breast milk is unacceptable.

Previous biomonitoring studies have found pollutants such as pesticides, lead, mercury and PCBs in people, even when deliberate efforts were made to reduce exposure. This is true for our participants as well. Some of our most careful shoppers, those who prefer organic or natural products, have some of the highest individual results of the industrial chemicals which they were tested.

And while we cannot generalize from our laboratory results to postulate about levels in all Americans, our results are similar to the results of biomonitoring studies across the country. Our sense is that these levels may well reflect the chemical body burden of many Americans. And other biomonitoring studies indicate that we may well be carrying hundreds of other industrial chemicals that leach from con-

sumer products used in daily life. The sum total of industrial chemicals that contaminate us comprise our “chemical body burdens.” All Americans carry such “chemical body burdens.” These may have the potential to cause serious harm.

Good health depends on interconnections among many different factors such as genetic inheritance, nutrition, economic status, gender, stress levels, and access to adequate health care, as well as exposure to toxic chemicals. In general, personal chemical body burden is not necessarily predictive of individual health problems. But given the established and suspected linkages of hundreds of diseases to toxic chemical exposures, avoidance of exposures will give us all a better chance at enjoying a healthier life.

Heather Loukmas, mother of a five-year-old daughter and eight-month-old son and Executive Director of the Learning Disabilities Association of New York State, was born and raised in Michigan. Heather showed the highest levels of BDE-154, a particular polybrominated diphenyl ether. Upon consultation with Dr. Ted Schettler (our physician of record for this project), Heather discovered that her result was likely due to exposure to polybrominated biphenyl (PBB-153), also used

as a flame retardant and accidentally added to grain in the 1970s in Michigan, when Heather was just a toddler. Although somewhat different, the two chemicals look alike in the chemical analysis. Follow-up studies of Michigan women who were exposed to PBB-153 in their food found that their daughters were likely to start their periods sooner. Will Heather’s daughter be affected? Only time will tell.

Our national chemical safety system has failed

Although chemicals in products and our homes were not intended to end up in our bodies, we now know they do. The Toxics Substances Control Act, America’s federal chemical management rule, was passed more than thirty years ago, before personal computers, cell phones, and the Internet; and before biomonitoring studies such as ours. This federal safety system designed to protect us from toxic chemicals has failed. Premises upon which the outdated system was based grow increasingly obsolete, as studies continue to emerge about the health effects these chemicals may have. We lack even basic safety data for the vast majority of chemicals in common use, because such information was not required when many chemicals were

registered for use. And current science tells us that our methods for evaluating toxicity of industrial chemicals are inadequate. For example, we know very little about how combinations of chemicals might interact, simply because very few studies have explored how multiple toxic chemical exposures might combine to cause harm. We also do not fully understand how timing of exposure may be critically important, especially to the developing fetus, which is exquisitely sensitive during key stages of development to those chemicals to which the mother is exposed. Finally, we do not understand enough how toxic chemicals might interact with a multitude of other factors, such as stress, exposure to viruses, poor nutrition, or genetic inheritance, all of which might exacerbate the effects of industrial chemicals on human health.

Lacking chemical toxicity data, people cannot choose or express their preference for safer products. In the absence of informed consumer demand, corporations have little incentive to switch to available safer alternatives or develop new ones. Current policy inhibits the implementation of green chemistry, a process for developing and screening new chemical substances for their potential harm to humans and the ecosystem before these substances are placed on the market. In the United States, chemicals are “innocent until proven guilty.” The time has come for new laws to ensure that

products in stores are safe for workers, communities, and our families.

We can protect public health by adopting common sense chemical policies.

This report details current state and federal initiatives already being advanced that would implement these policies. Policy advocates have united to work toward enactment of the following reforms:

- Phase-out harmful chemicals and switch to safer alternatives.
- Require that all chemicals are screened for safety and that safety data and product ingredients be made publicly available.
- Promote, not stifle, safer alternatives and green technologies.
- Protect workers and communities.



Conclusion

Toxic chemicals do not belong in the human body. But as long as industries keep putting them in products, we will continue to be exposed. Most people assume that if a product is being sold that the government has screened it for safety. This is simply not the case. Although there are steps we can take to reduce our exposure, **we cannot shop, eat or exercise our way out of the problem of toxic chemicals in commerce, in our homes, and in us. Government and industry action to phase out these chemicals in favor of safer alternatives is needed now.**

We are a nation that cares about environmental health and the well-being of its people. It is both possible and necessary for people to make a change, to step up and demand more of our state and federal government to end contamination of our children, our homes, and the earth. So, in conjunction with asking ourselves the questions, “Is it in us?” and “Are we contaminated?,” we also ask governments and businesses to ask themselves: Is it in us, all of us? Can we as individuals, government, and corporate America come together to stem the tide of toxic pollution and the increasing incidence of illnesses linked to toxic chemical exposures? Can we jointly create a chemical safety policy that is truly protective of human and ecosystem health?

The Participants

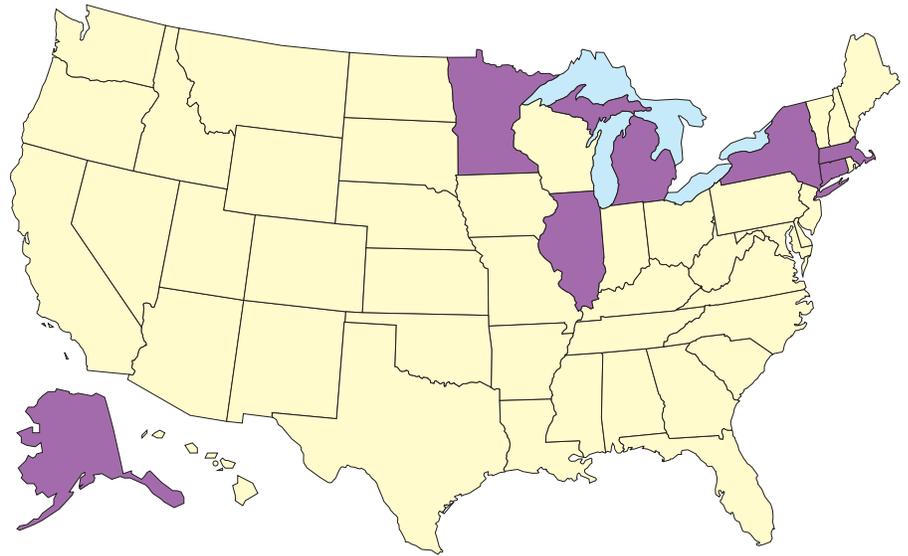
ALASKA

Diane Benson, 52, is a lifelong Alaska resident. She is engaged in film/video production, research and public outreach activities, addressing issues concerning violence and recovery, race-relations, and veterans and families. Ms. Benson won the Alaska Democratic Party Primary for the U.S. House in 2006 and is currently campaigning for U.S. Congress. She is active with the Anchorage Chamber of Commerce's Military Appreciation Committee, Healing Racism Steering Committee, Alaska Native Sisterhood, and National Organization of Women. She has a Masters of Fine Arts in Creative Writing and is working on her Masters in Public Policy. We found four of the five phthalates and nine of the twelve PBDEs in Diane's body. She also had bisphenol A in both her blood and urine. She is one of the few participants to have some of the larger PBDEs in her body (we found BDE 197 and 207).

"The troubling factor is that we and all other life forms now have these chemicals in us. No matter how miniscule the amount, the fact is that they are present. What other contaminants might be in our systems that we don't know about? We have a right to be informed."

Ethan Berkowitz, 45, is a small business owner and past Democratic House Leader for the Alaska legislature.

He is currently running for the U.S. House of Representatives. He owns Alaskan Alternative Energy, and serves on the Board of Directors for the Boys & Girls Clubs of South Central Alaska. He is engaged in the Anchorage Youth



Court and Institute of the North. Mr. Berkowitz is fond of fishing, traveling, hockey, and has a great interest in polar policies and programs. He also enjoys reading to his two children. We found four phthalates and ten PBDEs in Ethan's body. Bisphenol A was detected in both his blood and urine. Ethan had some of the higher levels of PBDEs that indicate exposure to penta-BDE.

"This reminds us that these chemicals are everywhere. It doesn't matter where you are on the food chain—whether you are a saint or a politician, they touch everybody. What this highlights is how hard it is to be safe from invisible toxic chemicals."

Timothy June, 54, is a boat builder and commercial fisherman who has lived in Haines, Alaska with his high school sweetheart for 31 years. Tim's teenage experience with cancer in southern California destined him to a life of environmental, social and political activism to advocate for cancer prevention. He co-founded Alaska Clean Water Alliance, has served on numerous statewide advisory and

environmental boards, and was policy advisor to the Governor on oceans, watersheds and subsistence foods. He is presently chairman of the Alaskans for Clean Elections seeking campaign reform. We found four phthalates and eight PBDEs in Tim's body. Bisphenol A was detected in his urine. He was one of five participants that had quantifiable levels of deca-BDE in their blood.

"Tom Brokaw's 'Greatest Generation' failed to protect my generation from the ravages of carcinogens. It is now the responsibility of my generation to protect future generations from the ravages of hormone and endocrine disruptors. Our success or failure will be our legacy."

Cathy Tagnak Rexford, 29, is Inupiaq/English/French/German of Kaktovik, Alaska and is currently the Alaska Director of Native Movement. She has worked extensively in Native education and language efforts, contemporary Indigenous theatre and film projects. She has focused her writing and work on translating the worldview of the Indigenous peoples of Northern

Alaska into creative mediums. She holds a BA from the Evergreen State College in Native American Studies and a BFA from the Institute of American Indian Arts in Creative Writing. We found four phthalates and ten PBDEs in Cathy's body, and detected bisphenol A in both her blood and urine. She was one of five participants to have BDE-183.

"No individual, corporation or organization has the right to knowingly violate my ability to live in a healthy way. Maybe what these test results show won't shock you, but they are real, undeniable and they are a reflection of what we are doing to our planet, and to ourselves."

Lori Townsend, 48, has worked in journalism for more than 15 years. She is a reporter and host of Alaska News Nightly on Alaska Public Radio Network. She helped co-found the Alaska non-profit broadcast company Native Voice Communications. NVC created the award-winning Independent Native News and many other documentaries and productions. Ms. Townsend has produced news and feature stories nationally and internationally. She is an avid gardener and counts water skiing, training horses, diving and a welding certification among her interests. We found four phthalates and eight PBDEs in her body, and detected bisphenol A in both her blood and urine.

At her request, this participant was not quoted in the report, because she is preparing a story concerning the project for public radio.

CONNECTICUT

Laura Anderson, 45, is a mother, artist and certified school psychologist. She lives in the suburbs in Wethersfield, Connecticut with her husband and two daughters, ages 12 and 7. Through her work as a school psychologist she became interested in the rising prevalence of young students suffering from behavioral disorders, and she hopes to learn more about the linkages between toxins and mental and physical health. We found four phthalates and nine PBDEs in Laura's body, and bisphenol A in her urine.

"As hard as I try to eat right and maintain a healthy lifestyle, these results show that there is just no way to avoid being exposed to toxic chemicals. I feel honored to participate in this project and make a contribution to this effort to protect the human race."

Stacy Carney, 36, is a healthy living enthusiast, activist, wife, mother, massage therapist and occasional organic market gardener. She has been using natural body care products for over 10 years and hopes that ALL consumer products will be safe someday. Stacy lives in Sandy Hook, Connecticut with

her family. We found all five phthalates and nine PBDEs in Stacy's body, and bisphenol A in her urine. She had the highest levels of BPA in her urine, exceeding CDC's 95th percentile.

"I was pleased to find my levels were relatively low, but also surprised to find that I had levels of some of these chemicals at all considering my healthy lifestyle."

Toni N. Harp, 60, Connecticut State Senator and Deputy President Pro Tempore, has prioritized many initiatives important to her constituents, including reducing exposure to pollution and providing better access to quality health care. Senator Harp has lived in New Haven for more than 25 years and is currently employed as the Homeless Service Director at the Hill Health Center. She is married to Wendell Harp, an architect, and she is the proud mother of three children—Djana, Jamil, and Matthew. We found nine PBDEs in Toni's body. She had detectable, but not quantifiable levels of bisphenol A in her blood. Toni did not contribute a urine sample; therefore we did not gather data on phthalates.

"As a health professional and a legislator, this is empowering information for me and I hope it galvanizes change."



Karen Owen, 57, the oldest of nine children, grew up on the seashore in New Jersey. She received her Masters of Science in Nursing from the University of Hartford, Connecticut in 2004, the same year her son graduated from high school. Currently she is a school nurse at an upper middle school in Connecticut, where she also coaches intramural tennis. She still lives near the water on Long Island Sound and is concerned about environmental issues that affect us all. We found four phthalates and ten PBDEs in Karen's body, and bisphenol A in her blood and urine. She had the highest number chemicals (17 of 20) in our project.

"The body burden project provides a special opportunity for me to become more aware of environmental exposure to chemicals we take for granted are NOT there."

Nancy Simcox, 42, was raised in rural upstate New York where she gained a deep appreciation for the natural environment. She has worked as a research scientist in occupational and environmental health for the past fifteen years. She is also a mother who has become more active in promoting a better future for our children. She currently serves on the board of the Connecticut Council on Occupational Safety and Health, and she resides with her family in Durham, CT. We found four phthalates and eight PBDEs in Nancy's body, as well as bisphenol A in her urine. She is one of six people for whom we found BDE-183.

"Some of my levels were greater than I expected, even greater than the average levels of the general population, and this just makes me wonder what body burden a worker with even more exposures might have."

ILLINOIS

Dorian Breuer, 35, is a community organizer living in Chicago's Pilsen neighborhood, where he has fought to clean up the neighborhood's industrial polluters. He has run for the Illinois State Senate. He commutes by bicycle to his new job, where he provides technical support for a Chicago nonprofit. In September 2007, he married his fiancée, Morgan. We found four phthalates and seven PBDEs in Dorian, as well as bisphenol A in his urine.

"This project has highlighted for me the pervasiveness of industrial chemical exposure in the modern world. How can the chemical makers oppose basic safety screening for chemicals? It seems like the same situation as the big-three automakers opposing seatbelts."

Anonymous woman with two children. We found four phthalates and seven PBDEs in this participant, as well as bisphenol A in her blood and urine and the second-highest level of the phthalate DEHP. The sum of her metabolites for DEHP was nearly twice the 95th percentile in the CDC's third biomonitoring study.

At her request, this participant was not quoted.

Stephanie Felten, 27, served for eight years in the U.S. Navy, including five years aboard a ship overseas. A California native, she moved to Aurora Illinois with her husband Chad in 2005. Now a full time student at North Central College and stay-at-home mother, Stephanie's interest in toxics stemmed from possible environmental exposures to her son, Derek, which led her to found the advocacy group Illinois MOMs (Making our Milk Safe). We

found all five phthalates and eight PBDEs in Stephanie, as well as bisphenol A in her urine.

"People have a trust that products manufactured and sold in the United States are safe. This report proves otherwise. Manufacturers need to be held to a standard of using alternatives that are proven safe. The practice of using chemicals until they are found to harm human health is violating basic human rights. The project results are particularly troubling to me as a nursing mother."

Mattie Hunter, 53, has been a Democratic State Senator from Chicago since 2003 and has sponsored successful bills to reduce toxic mercury in products and fund breast cancer research. Her interest in toxics stems, in part, from high lead-contamination levels discovered in her district. She is also a certified alcohol and drug counselor. We found four phthalates and seven PBDEs in Mattie, as well as bisphenol A in her urine. Mattie had the project's highest levels of diethyl phthalate, above the CDC's 75th percentile.

"I was surprised to learn these chemicals were in my body, but in some ways, I'm surprised it wasn't worse given some of the polluted places I've lived. It is not okay for industrial chemicals to be in people's bodies. This kind of pollution shouldn't be allowed."

Elaine Nekritz, 49, is the third term Democratic state representative of tree-lined Northbrook, where she lives, and five other suburbs Northwest of Chicago. Among her legislative priorities—healthcare, education, and local flooding and transportation issues—are implementing a state bio-

monitoring program and phasing out dangerous toxics. She is an avid cyclist and lives with her husband, Barry. We found four phthalates and seven PBDEs in Elaine, as well as bisphenol A in her blood and urine.

"Biomonitoring projects such as this one are critical to establishing the need for a comprehensive chemicals policy in the United States. While it is disturbing to know the level of these unwanted chemicals in my body, I believe it is important to have this information and use it to demand change."

MASSACHUSETTS

The Reverend Dr. Jim Antal, 57, serves the Massachusetts Conference of the United Church of Christ as Minister and President. Jim has led churches of all sizes in Massachusetts and Ohio. He also led the Fellowship of Reconciliation and founded a national high school peace organization. He was a chaplain and/or teacher at Northfield Mount Hermon School, Andover, Yale and Yale Divinity School. The Alban Institute published Jim's book on the search process and all of his life he has contributed to interfaith, ecumenical and peace and justice activities. An avid cyclist, you may see him on the road with his "God is Still Speaking" jersey. Jim and his wife, Cindy, live in Framingham, Massachusetts and have two sons. We found four phthalates

and eight PBDEs, including quantifiable levels of deca-BDE, in Jim, as well as bisphenol A in his urine. Jim had the highest level of DEHP—more than twice as much as the participant with the second highest level—and nearly four times the CDC's 95th percentile.

"I expected that because I'm a vegetarian and have a healthy lifestyle that the levels in my body would be lower. Now that I see my results, I'm wondering if the water bottle on my bike, or other things I thought were safe, are actually causing harm."

Iris Chen, 28, works for a non-profit agency in Quincy, primarily with youth from ages 6–16. We found four phthalates and eight PBDEs in Iris' body, as well as bisphenol A in her urine.

"I work with school age children; therefore I am very concerned that the products we use aren't safe enough for children. In order to protect the children and our health, the government should set regulations to replace toxic chemicals with safer alternatives."

Jerry Fishbein, 47, is a Vice President of 1199 SEIU, United Healthcare Workers East, a regional labor union made up of 270,000 health care workers in New York, Massachusetts, Maryland and D.C.—part of the Service Employees International Union. As an officer in the Massachusetts Division of 1199 he is involved with union organizing and negotiations. Jerry lives in Dart-

mouth, Massachusetts in the southeastern part of the state and enjoys kayaking, hiking, and growing heirloom tomatoes. He is married and has two children ages 14 and 7. We found four phthalates and seven PBDEs in Jerry, as well as bisphenol A in his blood and urine.

"I guess I'm not surprised that toxins found in everyday products have found their way into my body. Lots of people seem to assume it's happening, they just aren't aware to what extent. With this kind of research and data I'm hopeful that we can raise awareness of the fact that current policies and or "restrictions" really aren't good enough. These so called "protections" leave us (all of us) with poisons inside."

Keeana Serene Saxon, 30 of Roslindale, MA is an attorney admitted in both Connecticut and Massachusetts. Currently seeking an attorney position in Massachusetts, she also has experience on Beacon Hill as she worked for a state senator. Satisfying her interest in performing arts, she is certified to teach music. Though born in Washington D.C., she was raised in Newton, MA, coming to live in Roslindale at the age of 17 years. We found four phthalates and seven PBDEs in Keeana, as well as bisphenol A in her blood and urine. She had the highest levels of bisphenol A in her blood—more than twice as much as any other participant.



"I'm dismayed that I have any toxins in my body. I just didn't grow up thinking that anything was wrong with my environment or with the products I used. Now that I armed with knowledge of what my body is carrying, I am acutely more aware of the air I breathe and the products I touch."

Ellen Story, 66, is a Democratic State Representative for Amherst and Granby Massachusetts. Ellen was the first woman to represent this district, and has been in the legislature since April 1992. She grew up in Texas, and has lived in both the Netherlands and in Cape Town South Africa, where she picketed for integration and started her career in politics. Ellen enjoyed camping in the Rocky Mountains with her family while growing up, and now lives in Amherst, Massachusetts. She serves on the Joint Committee on Economic Development and Emerging Technologies and is Vice-Chairperson of the Joint Committee on Tourism, Arts and Cultural Development. We found four phthalates and eight PBDEs in Ellen's body, as well as bisphenol A in both her blood and urine.

"I was surprised that I showed elevated levels, since I am not exposed to some sources that most people are (for example, I don't have a television), and I consider myself very healthy. I guess this test shows that these chemical pollutants are impossible to avoid."

MICHIGAN

Bryan Brown, 12, is an honors student in 7th grade in Pigeon, Michigan and the youngest of three siblings. He enjoys science class, reading, computer and video games, as well as team sports, boating, and swimming. Bryan's school stands out for having three large wind turbines that have already saved the school thousands of dollars. We found four phthalates and nine PBDEs in Bryan's body, as well as bisphenol A in his urine. Bryan and his father, Terry, are the only two participants in whom we found BDEs 85 and 138, indicating a common source of exposure.

"I feel lucky that I was able to participate in an important project like this. Most kids my age don't get to do something that could help so many people."

Terry Brown, 48, was elected State Representative from Michigan's 84th District in 2006. His prior work includes serving as principal/supervisor of a school for children with significant cognitive, emotional and/or behavioral issues. Rep. Brown also worked for many years as a school social worker. He helped promote Michigan's use of renewable energy. He enjoys hockey, hunting, fishing, and scuba diving, and has served on the Huron Sheriff Department's rescue team. He lives in Pigeon with his wife Carol, their son Bryan Brown, and two older children. We found four phthalates and nine PBDEs in Terry's body, as well as bisphenol A in his urine. Given his high BDE-154 reading (which can indicate either BDE-154 or polybrominated biphenyl (PBB) 153), Terry is one of two

project participants likely to have been exposed through eating food contaminated with PBB-153 added to feed grain in the early 1970s. (See also Heather Loukmas from New York)

"Showing the prevalence of potential toxins in our bodies illustrates the importance of conducting high-quality research on chemicals before releasing them into our environment. Research and regulations need to work hand in hand to ensure that chemicals are used safely and effectively."

Laura Varon Brown, 46, developed and edits "Twist", a Sunday newsmagazine of the Detroit Free Press for and about women. Her prior work for the Free Press—where she has worked since 1990—includes serving as Metro Editor. She has a certificate in Journalism Law from the Detroit College of Law. Above all, she believes that what matters most is motherhood. Ms. Varon Brown—of no relation to Rep. or Bryan Brown—lives in Bloomfield Township with her husband and three children. We found four phthalates and seven PBDEs in Laura's body, as well as bisphenol A in her urine.

"I came into the project a bit of a skeptic about toxic chemicals and the role they play in our every day products and environment. I am really hoping that the awareness this report brings will lead to better disclosure of what's in our containers, furniture and the goods we use every day. Environmental concerns span much deeper than recycling and the gas mileage. That was the biggest eye-opener for me."

Donele Wilkins, 48, is co-founder and Executive Director of Detroiters Working for Environmental Justice (DWEJ), a non-profit organization that addresses urban environmental issues in Detroit. Ms. Wilkins is a public speaker on topics including environmental justice and community-driven sustainable development. She is a mom of two (including Payton, below), which motivates her to change conditions in her community. She was instrumental to DWEJ's success in shutting down Henry Ford Hospital's Incinerator. We found four phthalates and seven PBDEs in Donele's body, as well as bisphenol A in her urine.

"Industrial chemicals have no place in our bodies. Moreover, there are far too many people—too often people of color and poor people—who suffer disproportionately from environmental pollution. Now we know we're getting it from inside our homes as well as outside. We refuse to be guinea pigs in a massive, uncontrolled experiment, especially when a few people are making a lot of money off selling products that have these toxics in them."

Payton Wilkins, 18, is a senior at Consortium College Preparatory Academy in Detroit, and his favorite subjects are literature and gym. He enjoys painting, and was a member of the youth team that painted the mural at the new Boll Family YMCA in downtown Detroit. Payton coordinates Youth on Patrol

Against Pollution under Detroiters Working for Environmental Justice (run by his mother, above). He aspires to become an entrepreneur and to develop and expand his artistic interests, which include acting. We found four phthalates and seven PBDEs in Payton's body, as well as bisphenol A in his urine.

"I just turned 18 and it's simply not fair that my body has already built up toxic chemicals. I want to live a healthy long life. I've got things to do and places to go. But what are my chances when I've got these chemicals that are known to be toxic in my body? It pisses me off even more to think that I've been soaking up chemicals from the incinerator all my life. What is all this going to do to me?"

MINNESOTA

Dallas Goldtooth, 24, is Mdewakanton Dakota and Diñe from the Lower Sioux Indian Community in Morton, Minnesota. He received his B.A. from the University of California, Berkeley studying Ethnic Studies and Education. He currently works for Dakota Wicohan, a Dakota Language Immersion non-profit organization. He is a cultural teacher and community health organizer for the Dakota Indian communities of Minnesota. We found four phthalates and nine PBDEs in Dallas, as well as bisphenol A in his urine.

"To find that these chemicals are in the human body, even at low levels is both surprising and disturbing. We don't fully understand the effects of these chemicals, but no good can come from having flame-retardants in your body."

Sara Grochowski, 31, recently relocated to Minneapolis after living in Amsterdam for three years. She is currently redefining her life as a stay-at-home mother while continuing to teach yoga, write, get involved in the community, and simply enjoy the myriad of life changes. With her family, she is also an active reader and researcher of all information to enable her to make choices and live a healthy and sustainable lifestyle. We found four phthalates and seven PBDEs in Sara's body, and bisphenol A in her urine.

"The U.S. is a society that feels it's appropriate to sell first and test later and given our history with other substances such as lead paint, asbestos, and pesticides one would think corporations would learn. Considering what is in my body, I feel a sense of duty to inform others as much as possible, protect my own child from possible contaminants and always research before using/buying."

Shelley Madore, 45, is a Minnesota state legislator serving the suburban areas of Apple Valley and Burnsville, where she has a long history of community activism with the City of Apple



Valley and with Early Childhood Family Education and Special Education programs. She has been a powerful advocate for children with developmental disabilities through her service with ARC and the Autism Society of Minnesota. She has authored several bills addressing services for people with disabilities, as well as a bill to require preference for mercury free vaccines. Shelley is the mother of two children. We found four phthalates and seven PBDEs in Shelley, as well as bisphenol A in her blood and urine. Shelley had the highest levels of two kinds of flame-retardants. Her BDE 153 levels were significantly higher than is generally found.

“With my results showing a high level of one of the flame-retardants, I wonder where I was exposed and whether my children are still being exposed. These PBDE flame-retardants are developmental toxins and I have two children with neurological disabilities—could there be a connection? With rising numbers of children with developmental and neurological problems, we simply shouldn’t continue to allow chemicals that are toxic to the brain to be used in products.”

Gretchen Musicant, BS, MPH, 55, is the Minneapolis Health Commissioner, and oversees the Department of Health and Family Support. She was Minneapolis Director for Public Health Initiatives, is past Vice President of Community Health for the MN Hospital Association and was a Government Affairs Specialist for the MN Nurses Association. She chaired the

Universal Coverage Committee of the MN Health Care Commission, The Social Conditions and Health Action Team of the MN Department of Health, and the Healthier MN Community Clinic Fund. Gretchen has a 24-year-old son. We found four phthalates and seven PBDEs in her body, as well as bisphenol A in her urine.

“Participating in this project brought home the reality of chemical contamination of human beings and made it very personal for me. These chemicals are in me and probably in all of us. We know some of the health impacts of the chemicals that were measured in this project. We clearly need to learn more about the extent of our collective exposure and the impact it is having on the public’s health.”

Christopher Williams, MD, 44, is a father of an 11-year-old son and an avid athlete. He is a pediatrician practicing in Minneapolis and received his medical degree from the University of Minnesota Medical School. He serves on the board of directors of Environmental Justice Advocates of Minnesota. We found seven PBDEs in Chris. He did not provide a urine sample; therefore we have no data on Chris’s phthalate or bisphenol A levels in urine.

“Becoming aware of chemicals in my own body made me think about the thousands of chemicals in the products that we use every day and that make our lives better. But these chemicals have to go somewhere. We should be taking that into account when we make these products.”

NEW YORK

David Koon, 60, has served as State Assemblyman from the 135th district in Rochester since 1996. He is the Chair of the Legislative Commission on Toxic Substances and Hazardous Waste. His prior work includes working as an Industrial Engineer for Bauch and Lomb. His longstanding commitment to his community includes promoting violence prevention and serving on the board of the National Center for Missing and Exploited Children. He and his wife, Suzanne, created the Jennifer Patterson Koon Peacemaking Foundation in honor of their daughter. In addition to Jennifer (deceased), they have a son and two grandchildren. We found four phthalates and seven PBDEs in David, as well as bisphenol A in his urine.

“The results of my individual evaluation certainly raised my awareness of the personal impact of manmade chemicals. The report created a new perspective for me regarding the need for action—if not by the federal government, then by the State.”

Heather Loukmas, 36, has been Executive Director of the Learning Disabilities Association of New York State (LDANYS) for four years and was Associate Director for five years prior. She is responsible for the organization’s action on state policies, regulations and laws that impact children and adults with learning disabilities, serves on state-level panels and committees, and raises public awareness about the link between learning disabilities and

toxic chemicals. Heather lives in Clifton Park with her husband Jeff and two children, 5 years and 8 months. As an Executive Director and mother of two young children, Heather is professionally and personally committed to protecting children's environmental health. We found four phthalates and seven PBDEs in Heather's body, as well as bisphenol A in her blood and urine. Heather had the highest levels of one brominated flame retardant (BDE-154/PBB-153), likely due to accidental grain contamination, which made its way into dairy products, meat, and eggs, in the early 1970's when Heather was a toddler in Michigan. (See also Terry Brown from Michigan.)

"This project started as an academic exercise for me. But finding out that I carry a chemical linked to early menarche in daughters of exposed women made it clear to me that it's not just about the products we can control, but a much bigger picture. This isn't a problem we could shop our way out of."

John Sferazo, 52, is President and co-founder of the non-profit Unsung Heroes Helping Heroes, which advocates for and assists workers from the World Trade Center and other disasters to secure medical and psychological treatment, rehabilitation and monetary benefits. A union structural ironworker, John began working at Ground Zero before sunrise on September

12th, 2001 and continued there for more than 30 days. His breathing and lung capacity have decreased due to exposure to 9/11 pollutants, leaving him unable to work since August 2004. We found all five phthalates and seven PBDEs in John's body, as well as bisphenol A in his urine. John had the third highest DEHP levels and the highest dimethyl phthalate (more than 3.5 times higher than CDC's 95th percentile) and BDE-99 levels. The tubing for his sleep apnea machine (needed for his health ailments post-9/11) may be a significant source of the phthalates.

"As someone whose life has already been dramatically changed because of environmental exposures, who has taken medications to purge toxic chemicals from my bodies, I was shocked to find these chemicals. It's clear action is needed to protect all of us."

Edith Williams, PhD, MS, 27, was finishing her PhD and working as a Research Associate at the State University of New York's Department of Family Medicine when her samples were collected. She worked closely with the Toxic Waste Lupus Coalition in Buffalo, and researched the different availability of fresh, healthy food in white communities versus communities of color. She has since moved to the University of South Carolina, where she is a Research Assistant Professor with a focus on disproportionate impacts on the

health of African-American women. She lives in Columbia, South Carolina with her two children. We found three phthalates and seven PBDEs in Edith's body, as well as bisphenol A in her urine.

"I am glad to see work like this being done, work that recognizes women don't exist in bubbles and our health is directly affected by what we encounter every day in our environments."

Black/Latina woman, 27, One of our participants, an environmental advocate in New York City, wished to not make public her identity as linked to her personal test results. We found all five phthalates and six PBDEs in her body, as well as bisphenol A in her urine. None of her levels were in the upper range of our participants, although all participants in whom we detected diethyl phthalate had levels above CDC's 95th percentile.

"Insurance companies may take things like this into consideration to determine their coverage premiums, though it may be illegal for them to do so. There's so much uncertainty as to what our chemical body burden may mean that, as a young woman of color, I am not confident that this information won't be used in the future to limit my access to health care."



Introduction

Pollution in our air, water, and land has been documented for decades, prompting laws intended to protect public health and the environment. Yet these policies have proven ineffective in keeping dangerous, unnecessary chemicals out of products, workplaces, communities, homes and our bodies. Scientists are now finding pollution in people, much of which comes from the unnecessary use of toxic chemicals in common products. It's time for this scientific evidence to motivate government to implement policies that truly protect public health.

Through a cooperative effort with the Commonwealth Biomonitoring Resource Center and the Body Burden Work Group, thirty-five men and women from the states of Alaska, Connecticut, Illinois, Massachusetts, Michigan, Minnesota and New York volunteered to be tested for industrial chemicals encountered in their everyday lives. They embarked with us on an unusual

journey: to submit their blood and urine for toxic chemicals testing. We and our participants sought to uncover the chemical secrets in their bodies, and to consider whether the computers, cars, cosmetics and other products they use might be the source of hidden dangers.

Industrial chemicals are all around us—in the air we breathe, the water we drink, the food we eat, and the products that fill our homes, schools and workplaces. While some of these substances may be harmless, few of them have been tested for their safety, especially for children. The effects of most chemicals in commerce are largely unknown because, with the exceptions of pharmaceuticals and pesticides, the chemical industry is not required to test their products for health and safety threats before marketing them in consumer products. Pesticide safety tests are also often incomplete. Medical research is revealing that some common chemicals can disrupt the normal functioning of our

cells and organs and damage our health. Some chemicals also accumulate over time, building up inside our bodies.

Together, the industrial chemicals inside of a living being add up to a total “body burden” of contamination. Each of us carries a chemical burden; for some, this burden can be more risky than for others, depending on several factors that contribute to disease, such as our genetic makeup, age, health status, and socio-economic background as well as the level of exposure. Some populations such as babies in the womb are especially vulnerable.

These thirty-five people join others across the United States, Canada and Europe who have volunteered for previous testing so that we may all begin to understand our relationship with the chemicals in the world around us. The results represent the first-ever report of toxic pollutants found in people from this combination of states. By releasing these findings, we



seek to elevate the public discussion about pollution in people and promote action to fix our broken safety system that allows exposure to hazardous chemicals, some of which can build up in our bodies. Using this information, we can track likely sources of exposure to toxic chemicals, and develop methods to reduce exposures while we work together to change government policy and business practices that will promote safer alternatives.

This project focused on three groups of industrial chemicals that have been linked to harmful health effects in laboratory studies or in humans:

- **Phthalates**--chemicals added to nail polish and many other beauty products, adhesives, air fresheners, toys, and to PVC plastic (vinyl) to make it more flexible for shower curtains, flooring, medical products and other flexible plastics;
- **Polybrominated diphenyl ethers (PBDEs)**—toxic flame retardants added to the plastic cases of televisions and other electronics, and the fibers in draperies, foam cushions, furniture and other textiles;
- **Bisphenol A (BPA)**—a chemical used to make reusable polycarbonate plastic water bottles and baby bottles, some food containers, the linings in metal food and beverage cans and dental sealants.

We chose these particular industrial chemicals because they are found in products we use every day. They have come under increasing scrutiny as potential threats to human health, especially that of the developing fetus, infants and children.

The federal government requires that states maintain Toxic Release Inventories (TRI), which are compilations

DO LOW DOSES POSE A DANGER?



levels used by EPA to calculate “safe” doses for humans. In some cases, these effects are not seen at higher levels of exposure.

Logically, we have always assumed that the “dose makes the poison,” and it’s difficult to understand how tiny amounts might have any effect. However, we can understand more about how industrial chemicals at low levels can be biologically active when we consider chemicals used for medical purposes. Many prescription drugs aimed at addressing a host of medical conditions can cause the intended biological effects at doses similar to the low levels found for the chemical pollutants in this project.

Hormones have the capacity to act at extremely low levels to regulate development, reproduction, immune function and many other biological systems at parts per million or parts per billion as well. It is not surprising that industrial chemicals also have this capacity.

of periodic reports from industries concerning the quantities of certain toxic chemicals released in emissions. Production facilities are required to report the amount of neurotoxins, carcinogens or reproductive or developmental toxins they are releasing as emissions into the air, water, or land. In a recent study, Massachusetts and New Jersey reported that for every pound of these toxic chemicals released as emissions, these states are also producing and shipping around the country 42 pounds of the same chemicals, either as ingredients in products that might be used daily in or around the home or as the chemicals themselves, to be used in manufacturing elsewhere. This analysis means that over 97% of these toxic

chemicals are in products, rather than emissions. Based on this report, much of our exposure to these chemicals may not be from the food we eat, water we drink, air we breathe, but from products we have assumed to be safe for use.²⁰

Exposure to these chemicals is ubiquitous and continuous. In general, scientists believe that all industrial chemicals with these exposure patterns are of concern. Scientists as well as health policy advocates are troubled by the fact that these chemicals have become essentially a constant part of our environment, a part that has been internalized. No one knows the long term effects of this internal reservoir of toxic chemicals inside our bodies. But we do know that

exposures early on are linked to health problems that may not appear until decades after exposure. PBDEs are among those industrial chemicals that are very long-lived in the environment (or persistent) and that build up in the food chain (or bioaccumulate). Phthalates and bisphenol A do not persist, but are problematic due to frequent, recurrent exposures.

These chemicals were also selected because of their linkages to health effects at a wide range of exposures. Recent laboratory studies increasingly indicate that these industrial chemicals are likely to have adverse health effects at the low levels to which we are most likely exposed, in some cases at levels below what was previously considered safe, especially during critical periods of human growth and development. We know that low-level exposures to lead and mercury harm the developing brain, causing lowered intelligence and permanent learning and behavior problems, and so it is not surprising to find that other chemicals, such as those we tested for, have similar capacities for harm.

As improved laboratory technology allows for the detection of lower and lower concentrations of chemicals, we can identify those that were previously nondetectable. While these levels might seem miniscule, emerging science raises concerns about the risks associated with these low-level exposures. For example, more than 100 bisphenol A studies have demonstrated adverse health effects at low doses.²¹ In fact, in the case of bisphenol A, some health effects seen at lower doses are not apparent at higher doses, and this may be true for other industrial chemicals as well. The adage, “the dose makes the poison,” is no longer the best or most accurate way to pre-



dict or describe toxicity (see sidebar).

Industrial chemicals that interrupt the intricate processes of developing life may at low levels cause subtle but important changes in development that may surface later in childhood as, for example, learning or behavioral problems, or in adulthood, perhaps as infertility, certain kinds of cancers, or deteriorating brain function. Researchers are only just beginning to understand these connections. Although we know from animal studies that these chemicals can be harmful, our understanding is incomplete about the combined effects of these chemical exposures on human health, especially on fetuses, children, and others who are more sensitive to toxic effects. Given this rapidly advancing body of knowledge, it is important to remember that the absence of conclusive evidence in humans that a chemical causes some effect does not mean it is harmless.

In this project, human exposure levels for some of these chemicals exceed levels shown to cause adverse effects in other animals.

The results of this project cannot be used to predict how a participant's health will be affected by his or her chemical body burden. When moving from the sources of industrial chemicals, to the industrial chemicals inside us, and to the effects that they might have on any given individual's health, it can be difficult to find incontrovertible answers. Many factors influence whether or not exposure to toxic substances will result in a health problem, including:

- the type and nature of the chemical;
- the exposures to other chemicals that may act in concert with the chemical of concern;
- when in his or her lifetime a person was exposed;
- how often a person was exposed, and for how long;

- the amount of the chemical exposure;
- the individual's genetic makeup and physical condition;
- the person's health and nutrition, and their access to quality health care; and
- the person's socio-economic status.

All of these factors are important determinants of the effects of toxic chemicals on human and ecosystem health. Given the complexity of toxicity assessment, we should not assume that lack of knowledge is proof of safety. This is particularly true when no one has even looked for health effects of the chemical in people who are exposed or when animal studies are non-existent or incomplete. The results presented in this report compel us to act with caution, for our health and the sake of our children's future. The history of permanent, widespread harm caused by toxic substances like lead, PCBs, and mercury demonstrates the need to act on early warnings. And when controlled laboratory experiments reveal a connection between exposure to these chemicals and brain damage, infertility, premature puberty, or chronic diseases, our concern only increases. When there are plausible concerns about threats to public health, even in the face of scientific uncertainty about precise cause-and-effect relationships, precautionary action should be taken to prevent exposures and possible harm.

Only in the last decade have scientists and doctors discovered that some chemicals, like those in our project—brominated flame-retardants, phthalates and bisphenol A—can leach from the products containing them into the

environment and into humans and wildlife. Sources of potential exposure vary with our individual day-to-day routine activities. In this survey, information gathered from interviews with participants was used to develop possible routes of chemical exposure. Because of the multitude of products we use every day and the variety of food we ingest, such exposure pathways are difficult to establish, but participants were provided with information about possible sources such as food consumption and product use.

Continued biomonitoring, the testing of human tissues and fluids for the presence of industrial chemicals, can help set priorities for policy, substitution with safer alternatives, and further research. We can use this data to help us make safer personal choices, when possible, in the products we use daily and equally important, help us become engaged in state or national campaigns that will create truly health-protective chemical policies. This report lists information the volunteers are finding useful about making safer choices and provides information about some of the current campaigns

that are relevant for the industrial chemicals the volunteers have most concerns about.

Thirty-five people stepped forward to engage in this biomonitoring project, recognizing that it was not designed to be a research study. Because of the small sample size, the project results cannot be used to draw conclusions about levels of chemical exposures for various population sectors or the public as a whole. The data from this project only provide a snapshot of the accumulation of and exposure to three types of toxic chemicals in those people who volunteered to be in this project.

However, we can place our results in the context of other national and regional biomonitoring studies and surveys, particularly the U.S. Centers for Disease Control and Prevention's Third National Report on Human Exposure to Environmental Chemicals, in similar small studies in Washington, California, and Canada, and in six studies in the U.S. conducted by the Environmental Working Group, an early groundbreaker in the use of biomonitoring. Although it is important to note that participants in this project are not necessarily representative of the general population, our results are comparable to those from other projects and studies. The only compilation of nationwide measurements representative of the U.S. population is the National Health and Nutrition Examination Survey (NHANES), conducted by the U.S. Centers for Disease Control and Prevention (CDC), and the data from our project are similar to levels of these chemicals found in average Americans as measured by the CDC.



The Results: Toxic Chemicals Are in Our Bodies

Our laboratory results confirm what other national and state-level biomonitoring projects have found: we are all contaminated with hazardous, unnecessary chemicals.



We found all three types of toxic chemicals in every person tested:

- Of the 35 participants, all had at least 7 of the 20 specific chemicals for which we tested in their bodies. The 33 participants who provided blood and urine samples had at least 13 chemicals (including at least one of each type of chemical for which we tested). One participant had 17 of the 20 chemicals.
- Participants contributing both blood and urine had an average of 15 chemicals in their bodies.
- We found evidence of diethyl phthalate, dibutyl phthalate and DEHP, in all 33 participants who provided urine samples. 32 had

evidence of butylbenzyl phthalate.

- We found six kinds of PBDEs in all 35 participants, and detected decaBDE in all but one participant.
- Sixteen participants tested positive for bisphenol A in their blood.
- All 33 participants who provided

urine samples had bisphenol A in their urine, and 25 were above the CDC median level.

- See Table 1 for details on which chemicals were found in our participants. See the appendix for details on levels.

Researchers typically carry out chemical toxicity testing in laboratory animals to estimate exposure levels considered safe for humans. But because animals and people can vary significantly in their response to toxic chemicals, regulatory agencies typically apply safety factors when using data from laboratory animals to set regulatory limits. The U.S. Environmental Protection Agency typically applies a safety factor of ten to account for dif-

ferences between animals and humans, and an additional factor of ten for differences among people, since individuals may differ in their ability to detoxify harmful chemicals in the body. The agency may also apply a safety factor of up to ten to account for other uncertainties. It's questionable whether this safety factor is adequate, given all the elements that must be considered, such as combination of chemicals, timing of exposure, duration of exposure, and other elements that clearly affect health, such as socio-economic status, gender, genetic inheritance, physical well-being, nutrition, and level of stress.

For both people and other animals, periods of rapid growth and development—before birth and in early childhood—are most susceptible to impacts of chemical exposures, often at levels that have no discernable effects in adults. In this report, we compared our participants' results to the lowest levels in human or animal studies where health effects have been seen. In some cases, these are levels that result in harm to the offspring when the mother is exposed during pregnancy. None of our participants were pregnant at the time of sampling. To protect public health, however, it is necessary to prevent exposures, and establish standards that are protective of developing fetuses and children. But until we understand all the factors that make a specific industrial chemical toxic to humans, setting standards is problematic, though extremely important, and should be done on the basis of precaution. We do know that human exposure levels for some of these chemicals exceed levels shown to cause adverse effects in animals.

Table 1. Chemicals Found in Participants, by Type of Chemical and Participant's State

		Phthalates						Polybrominated diphenyl ethers									Bisphenol A		Total Chemicals							
		mMeP	mEtP	mBuP	mBzP	mEHP	mEOHP	mEHHP	BDE-28	BDE-47	BDE-100	BDE-99	BDE-85	BDE-154	BDE-153	BDE-138	BDE-183	BDE-197		BDE-207	BDE-209	Blood	Urine			
Alaska	Benson	n/t																						16		
	Berkowitz																								17	
	June																								15	
	Rexford	n/t																							17	
	Townsend																									15
Connecticut	Anderson																								16	
	Carney																									16
	Harp	No sample collected																					n/s		10	
	Owen																									17
	Simcox																									15
Illinois	Anon.																									14
	Breuer																									14
	Felton																									16
	Hunter																									14
	Nekritz	n/t																								14
Massachusetts	Antal																									15
	Chen																									15
	Fishebein																									14
	Saxon																									14
	Story																									14
Michigan	Brown, B	n/t																								16
	Brown, T	n/t																								17
	Brown, L																									14
	Wilkins, D	n/t																								14
	Wilkins, P	n/t																								14
Minnesota	Goldtooth																									16
	Grochowski																									14
	Musicant																									14
	Madore																									14
	Williams	No sample collected																					n/t	n/s	7	
New York	Anon.																							n		14
	Koon																									14
	Loukmas																									14
	Sferazo																									15
	Williams	n/t																								13
Total participants:		5	33	33	32	31	33	33	35	35	35	35	2	35	35	2	6	9	11	34	16	33				

 Yes, chemicals detected
 No, chemicals not detected

Note: For PBDEs and bisphenol A, participants with levels below the level of quantification, yet above the level of detection, were placed in the 'yes' category. 'N/s' indicates when no sample was collected. 'N/t' indicates that for technical reasons, no test was conducted. The bisphenol A result for both blood and urine is considered one chemical for the total count. For detailed information about specific chemicals and individual results, please see the appendix.

The Chemicals

Phthalates

Phthalates add flexibility and resilience to many consumer products. Of particular concern are di-2-ethylhexyl (DEHP), butylbenzyl phthalate (BBzP), dibutyl phthalate (DBP), and diethyl phthalate (DEP). DEHP and BzBP are primarily used to soften polyvinyl chloride (PVC) and other flexible plastics, and found in tablecloths, furniture, vinyl flooring and wallpaper, shower curtains, garden hoses, inflatable swimming pools, plastic clothing such as raincoats, children’s toys, automobile upholstery and convertible tops, medical tubing and IV bags.²² DEP and DBP are used in non-plastic consumer items such 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.

^{23,24,25,26}

What We Found: Phthalates in Our Bodies

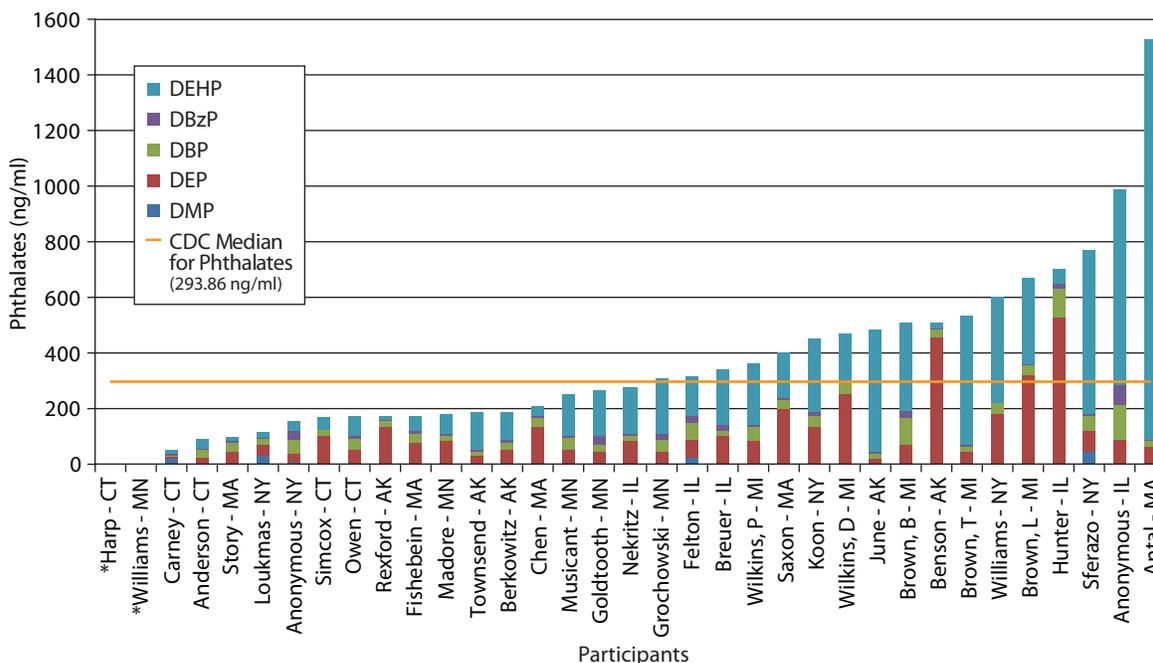
We tested for seven “metabolites” (chemicals left after the body after has metabolized—or digested—them), which can indicate the presence of five different phthalates. Two of our participants did not provide urine samples, and so were not evaluated for phthalates. All remaining 33 participants had phthalates in their bodies, and all had evidence of DEHP (di-2-ethyl hexyl) phthalate), DEP (diethyl

phthalate and DBP (dibutyl phthalate). For five of the seven chemicals for which we tested, our minimum value was above the U.S. Center for Disease Control’s median (meaning half of their more than 2,000 participants have values below and above those levels). Thirty-two had evidence of butylbenzyl phthalate. In four cases, (dimethyl phthalate and all three indicators of DEHP), more than one of our participants had levels that exceed CDC’s 95th percentile.

For the five participants who had reportable levels of dimethyl phthalate (DMP) metabolites, four of them were above the CDC’s 95th percentile for DMP (as much as 3 and a half times the 95th percentile.

Jim Antal, in whom we found the

Phthalates in Participants' Urine



* Participants did not provide urine samples.

Note: Data is presented here as the phthalates found in products, not the monoesters dewatered in samples.

DEHP levels are a sum of the three monoesters for which this project tested that indicate its presence in bodies.

most DEHP and the participant in whom we found the second most DEHP, exceeded CDC's 95th percentile by nearly four times and nearly double, respectively. For the purposes of this report, we have summed the levels for the three metabolites that indicate the presence of DEHP, as discussed here and presented in the chart above.

See the appendix for detailed data for each participant.

Health effects—Evidence that ties phthalates to adverse health effects, especially in baby boys, has been building over recent years. Phthalates have been linked to the following health concerns:

Reproductive and Developmental Problems: One study indicates that phthalates can be found in the womb and are associated with shorter pregnancy duration.²⁷ The only study that has looked for effects of prenatal phthalate exposure in humans found altered male reproductive development, including shortened anogenital distance, an increased likelihood of testicular maldescent, small and indistinct scrotum, and smaller penile size, in the group most highly exposed to some of the phthalates.²⁸ Baby boys drinking some phthalates in their mother's breast milk can have altered sex hormone levels.²⁹ Phthalates have also been linked to lower sperm counts, reduced sperm motility, and damaged sperm in men.³⁰ In animal studies, phthalates are also linked to hypospadias, or abnormal urinary openings on the penis.³¹ EPA classifies the phthalate DEHP as a probable human carcinogen.

Respiratory Impairment: Concentrations of phthalates in house dust are associated with asthma and rhinitis in children.³² Phthalates in PVC

flooring have also been linked to increased bronchial obstruction during the first two years.³³ For adults, certain phthalates have been linked to reduced lung capacity at magnitudes similar to those observed with tobacco smoke.³⁴

Effects on other Organs: In laboratory animals, depending on the exposure level, phthalates also affect the pituitary, thyroid, thymus, ovaries, liver, and blood.³⁵

Exposure pathways—Phthalates can get inside our bodies a number of dif-



ferent ways, including chewing on phthalate-containing products, as a child might do with a toy, breathing contaminated dust, eating contaminated food (from food packaging or general environmental contamination getting into the food supply), through the skin, and directly through transfusions and other medical devices and procedures.^{36,37,38,39,40,41} Phthalates are present in breast milk and can cross the placenta to enter a growing fetus.^{42,43} Medical devices containing di-(2-ethylhexyl) phthalate are a source of significant exposure in susceptible premature newborn babies.^{44,45,46}

Different phthalates from different sources:

- The largest source of DEHP for most people is their diet, followed by breathing contaminated indoor air.⁴⁷ DEHP accumulates in foods from general environmental contamination, and from processing, packaging, or storing.⁴⁸ The single largest use of DEHP is as a plasticizer for polyvinyl chloride (PVC), from which it can leach, causing direct exposure.^{49,50,51}
- DEP mainly comes from products containing fragrances and personal care products such as shampoos, scents, soap, lotions, and cosmetics, and from breathing air containing these chemicals.^{52,53} DEP is also found in products such as toothbrushes, tools, food packaging, insecticides, and aspirin. It is released easily from plastics, as it is not a part of the polymer chain that forms the plastic.⁵⁴
- DBP is primarily found in cosmetics, mainly nail polish, but DBP is also found in pharmaceutical coatings, insecticides, and some printing inks.^{55,56,57}
- BBzP is an industrial solvent used in adhesives, vinyl flooring,

sealants, car-care products, and some personal care products such as hair spray.^{58,59,60}

Phthalates do not accumulate in our bodies, but they are often found there: we are continuously exposed to phthalates throughout our lifetime, beginning in the womb, because they are so widely and frequently used. Importantly, because of constant exposure through toys, food, or other products the most highly exposed children can take in up to twenty times the amount of some phthalates now considered “tolerable”.⁶¹

How to Reduce Phthalates in Your Body

While market trends and personal purchasing actions are not likely to dramatically reduce phthalate exposure without coordinated policy action by state and federal governments,

there are ways you can reduce your family’s exposure. Addressing just two types of products containing phthalates—PVC and cosmetics—would have a major impact in reducing exposure:

Go PVC-Free. Avoid PVC in all building material applications (www.healthybuilding.net). Purchase shower curtains made of natural fiber, polyester, or nylon instead of vinyl. Avoid plastics marked with the #3 symbol; these are made of PVC. Read the labels on belt, shoe, raincoat, purse and other apparel for PVC or vinyl (<http://www.besafenet.com/pvc/>). Ask toy manufacturers if they have stopped using PVC. Use polyethylene plastic wrap and bags or glass containers to store food. You can find information about phthalates in adhesives, caulk, grout, and sealants at National Institute of Health’s household products

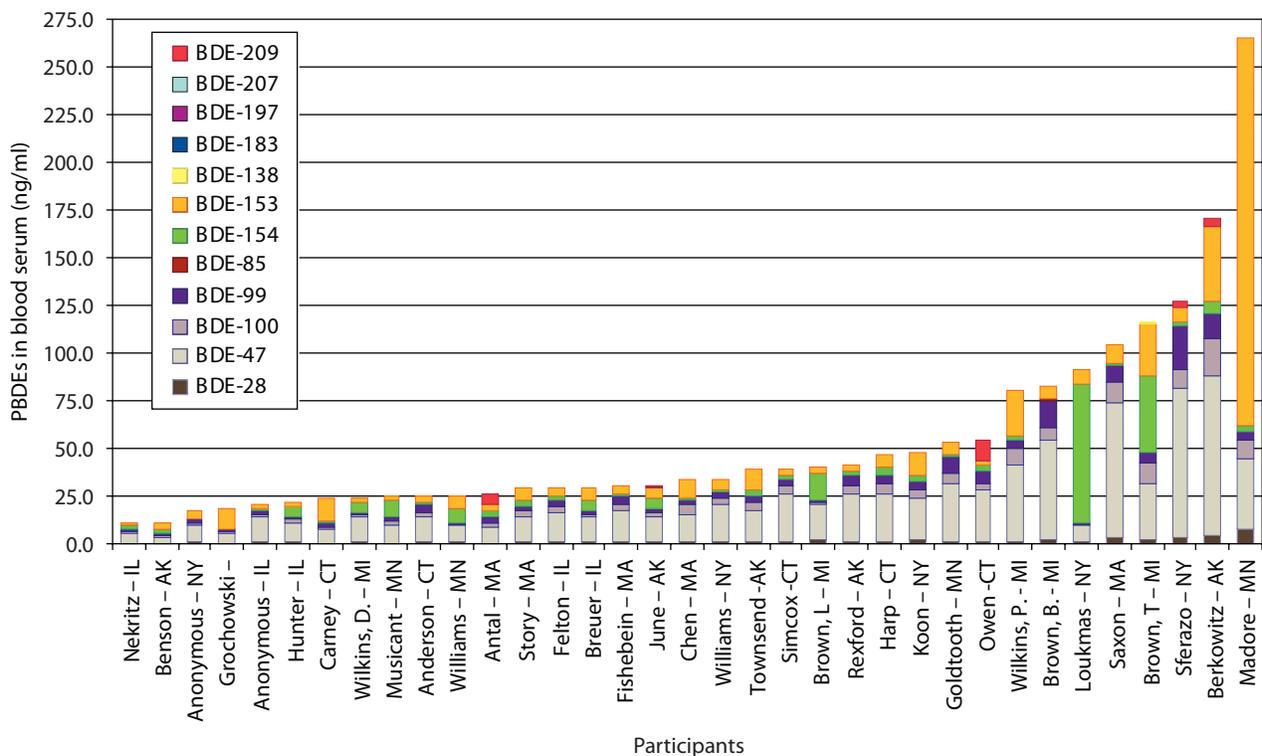
database (www.householdproducts.nlm.nih.gov/).

Purchase phthalate-free personal care products. Look at ingredient lists and avoid products listing “fragrance” or phthalates. Choose products from Compact for Safe Cosmetics signers (www.safecosmetics.org). You can find out more about your personal care products beyond what is on the ingredient label at www.cosmeticsdatabase.com.

Policy action:

The Federal Government should require that phthalates be replaced with safer alternatives. In the absence of federal policy, each state and local government should ban the use of phthalates in every application for which there is a safer substitute. The California legislature has passed a “toxic toys” bill, which

PBDEs in Participants



Governor Schwarzenegger signed in October 2007. AB 1108 (Ma) bans the use of six phthalates in children's products and toys, modeled after the European Union's current ban. Several other states have pending policies addressing phthalates, including Maryland, Minnesota and New York. In Massachusetts, the Safer Alternatives bill would replace toxic chemicals like brominated flame retardants and phthalates found in common household and workplace products with safer alternatives where feasible.

Toxic Flame Retardants— PBDEs

Polybrominated diphenyl ethers (PBDEs) are added to many products in homes, offices, automobiles and airplanes.⁶² Three mixtures used widely—penta-BDE, octa-BDE, and deca-BDE—made up 14%, 6%, and 80% of the 1999 worldwide production, respectively.⁶³ In 2004, manufacturers voluntarily ended U.S. production of penta and octa, commonly found in furniture foams, textiles, kitchen appliances and electronics, after high levels were found in breast milk. Penta and octa pose known health threats (see below). Deca, however, is still being produced and used primarily in plastic electronics, such as television and computer casings, and furniture and mattresses.⁶⁴ Deca breaks down when exposed to sunlight into more persistent, harmful lower brominated congeners (forms) that readily bioaccumulate in the environment.⁶⁵ Deca can also cause health effects similar to penta and octa⁶⁶ (see below).

PBDEs are members of a broad chemical class of halogenated compounds that includes other highly toxic chemicals such as PCBs and di-



oxins.⁶⁷ PBDEs are intrinsically hazardous because: (1) they persist in the environment and do not break down easily; (2) they accumulate in fatty tissues of living things; and (3) they have a number of toxic properties, including the ability to disrupt hormone signals.⁶⁸ They bio-magnify and bio-accumulate, meaning that they build up in the bodies of animals and humans through the food chain. There are numerous ways that humans are exposed to PBDEs, including consumption of contaminated foods and through inhalation or ingestion of household dust. Because of the chemical characteristics of PBDEs, they do not fully bind to the products in which they are used. Deca, in particular, breaks down when exposed to sunlight.⁶⁹ PBDEs are released from furniture, electronics and other products when exposed to UV light, causing them to be present in the air we breathe and in dust. A main source of exposure is fatty foods,⁷⁰ as PBDEs are fat-seeking and can take up residence (bio-accumulate) in the fatty tissue and fluids of animals, bio-magnifying as they move up through the food web consumed by wildlife and humans. People living in North America have levels of PBDEs that are approximately 10 to 40 times higher than individu-

als living in Europe or Japan, probably because of more widespread use of higher concentrations of PBDEs in consumer products in the US.⁷¹

What We Found: PBDEs in Our Bodies

PBDEs were found in all of the participants. We detected levels of 12 PBDEs in our participants. We found six congeners (specific chemical forms of within the class), in every person tested. Thirty-four participants had detectable levels of BDE-209, which corresponds with deca-BDE. Five participants had levels of BDE-209 high enough to be quantifiable. Previously thought not to be able to enter our bodies because the chemical was too large, our results indicate that this chemical is in fact in many people. BDEs 28, 47, 99, 100, 153—all of which were in every participant—are all commonly found following exposure to penta-BDE commercial mixtures (which are rarely just one congener but rather a mixture). One participant, Shelley Madore, had an unusually high level of BDE-153.

Two participants had high levels of BDE-154. The analytical process does not distinguish between BDE-154 and brominated biphenyl (BB)-153, both of which were used as fire retardants. Both participants who had high levels of BDE-154/BB-153 lived in Michigan during the early 1970s, when animal feed grain was accidentally contaminated with BB-153 and distributed throughout the state. Daughters of women who were exposed to this compound have been found to get their periods earlier. Heather Loukmas, 35, was just a toddler when she was likely exposed. She now has a daughter who is five years old. How Heather's body burden will affect her daughter is uncertain.

How PBDEs Can Affect Our Health

Developmental Disorders: In laboratory animals exposed during pregnancy or soon after birth, PBDEs can harm the developing brain of fetuses or newborns. In these studies, neonatal exposure to PBDEs permanently affects learning and memory functions, impairs motor activity, and is linked to aberrations in spontaneous behavior and hyperactivity that seem to be permanent.^{72,73}

Reproductive Problems: PBDEs have been associated with cryptorchidism, or undescended testes, in humans,⁷⁴ and can permanently impair sperm development in animals.⁷⁵ They have been associated with the delay of puberty in both male and female rodents and alterations in sexual development and sexually dimorphic behavior (differences in behavior

between sexes).⁷⁶ In other laboratory studies, depending on the level of exposure, PBDEs are linked to birth defects, reduced weight gain during pregnancy, changes in ovary cells, and reduced sperm count.⁷⁷

Cancer Incidence: PBDE concentrations in the womb have been associated with an increased risk of testicular cancer in men.⁷⁸ The Agency for Toxic Substances and Disease Registry (ATSDR) lists deca-BDE as a possible human carcinogen.⁷⁹

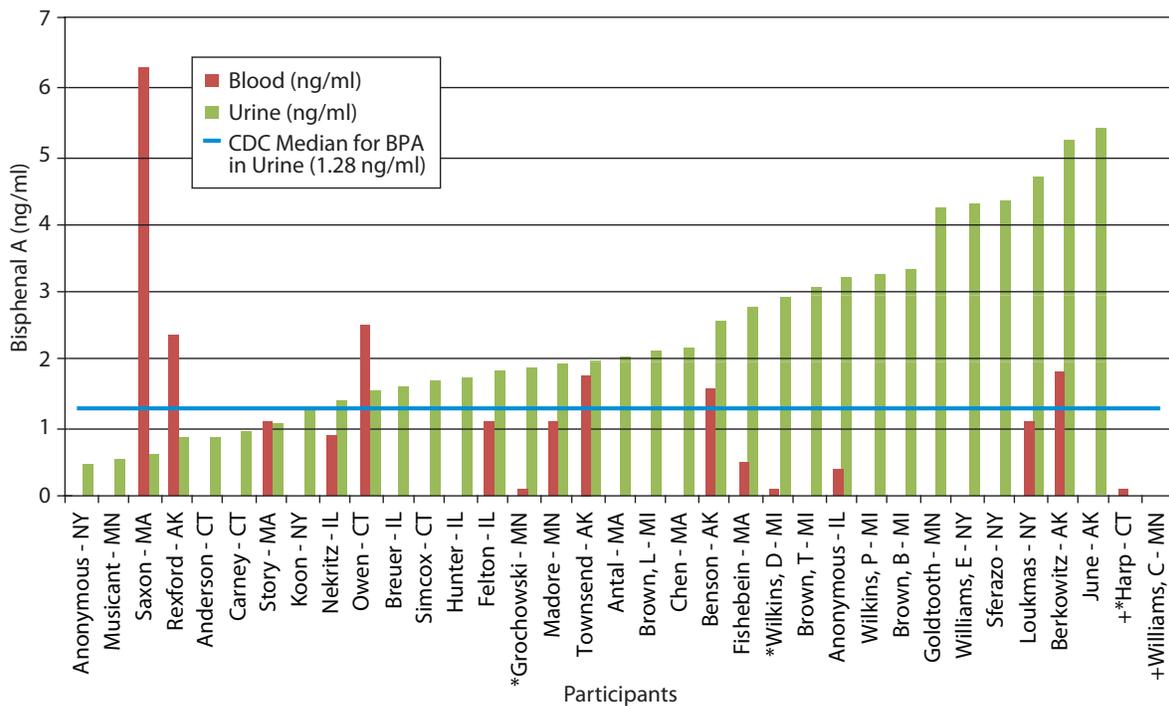
Thyroid Impairment: Recent studies link PBDEs to decreased circulating concentrations of thyroid hormone in animals and to a decrease in thyroid weight in their adult offspring.⁸⁰ Thyroid disruption may explain the impacts of PBDEs on the developing brain.

How to Reduce PBDEs in Your Body

While market trends and personal purchasing actions are not likely to dramatically reduce PBDE exposure without coordinated policy action by state and federal governments, there are ways you can reduce your family's exposure.

PBDE-free Furniture and Electronics: Some companies offer furniture that does not contain PBDEs in its foam and upholstery. Find out which ones at www.safer-products.org or www.thegreenguide.com, or contact the company directly. Many companies, such as Canon, Dell, HP, Intel, Erickson, Apple, and Sony are beginning to make electronics with alternatives to PBDEs. More information is available at www.safer-products.org.

Bisphenol A in Participants Blood and Urine



* Indicates participants's blood had detectable, but not quantifiable, levels of BPA.

+ Indicates participants did not contribute urine samples and therefore have no BPA urine results.

PBDE-reduced Food: You can reduce your fat intake by: choosing lean meat and poultry cuts, cutting off visible fat before you cook meat, and choose cooking methods that remove excess fat such as broiling, grilling, and roasting; Choosing wild-caught fish and avoiding farmed fish can also reduce exposures, since PBDE levels have been found to be higher in farmed fish who are fed a diet of fat-rich pellets.

Policy Action

U.S. production of penta- and octa-BDE was suspended under a voluntary agreement between USEPA and Great Lakes Chemical Company. But deca-BDE, which constitutes over 80% of PBDE production, is still widely used. Deca-BDE can break down into penta- and octa-BDE, which is much more easily taken up into peoples' bodies. Therefore, **federal action is required to ban the use of all PBDEs in every application for which there is a safer substitute. In the absence of federal policy, each state government should enact policies to phase out PBDEs.**

Some states have already taken action, and action is pending in several others. California, Hawaii, Illinois, Maine, Maryland, Michigan, Minnesota, New York, Oregon, Rhode Island and Washington have reinforced the voluntary EPA agreement by enacting penta- and octa-phase-outs. Many of these bills include a requirement to study the availability of safer alternatives to deca and report back to the legislature. Hawaii, Maine and Washington have required safer substitutes for deca-BDE in certain applications. Some companies have agreed to eliminate their use of deca-BDE by a date certain. This state- and market-level momentum should continue and ac-

celerate in 2008–2009, in order to fuel broader chemical policy reform in these states, and create demand for federal chemicals policy reform.

Bisphenol A

Bisphenol A (BPA) is a high-production volume chemical (>6 billion lbs./yr.) used in epoxy resin and polycarbonate plastic products, including water bottles, baby bottles, and food storage and heating containers. It is also used to line metal food and beverage cans and in dental sealants, and is added to certain plastics used in children's toys. Of the plastics categorized as numbers 1 through 7, BPA falls into the catchall category number 7, or 'other'. The chemical was first developed as a synthetic estrogen and was later used as the building block to produce polycarbonate.⁸¹ Bisphenol A is an "endocrine disruptor," a chemical that interferes with the hormonal system in animals and humans and contributes to adverse health effects.⁸²

How We are Exposed to Bisphenol A

Humans are exposed to bisphenol A through daily consumption of food and beverages contaminated with BPA, as well as through environmental contamination. Leaching of BPA occurs from the resin lining of metal cans and from plastic food and beverage containers under conditions of normal use.⁸³ Additionally, bisphenol A is now pervasive in the environment and commonly found in dust particles, surface water and drinking water, as production of BPA releases approximately two hundred thousand pounds of the chemical into the atmosphere annually.⁸⁴

A recent study by scientists from the U.S. Centers for Disease Control and Prevention found that 95% of Americans tested now carry bisphenol A in their urine at an average level of 1.33 µg/L.⁸⁵ Although the United States Environmental Protection Agency considers exposure to 50 µg/kg/day of bisphenol A 'acceptable,' this standard was set in 1993 based on studies from



the 1980s. A recent consensus of over 30 expert scientists states that adverse health effects occur at levels in animals within the exposure range typical for people in developed countries.⁸⁶ Also, a review of scientific literature demonstrates a wide range of health effects resulting from bisphenol A at significantly lower levels than considered “safe” (as low as 2 parts per billion in some studies).⁸⁷

Health Effects

Although we have little human data because studies are practically nonexistent, there is general agreement among scientists that animal studies are relevant for humans. More than 100 studies have examined the low dose adverse effects of bisphenol A.⁸⁸

Endocrine disruption: As early as 1936, bisphenol A was shown to be an environmental estrogen. Exposure to bisphenol A is associated with alterations in hormone synthesis, hormone metabolism, hormone concentrations in blood, changes in tissue enzymes and hormone receptors, as well as interacting with other hormone-response systems in laboratory animals.⁸⁹

Recurrent miscarriage: Researchers found that women with a history of recurrent miscarriage had average blood serum levels of bisphenol A at 2.59 ng/ml, more than three times higher than women with successful pregnancies; a finding predicted by previous animal studies.⁹⁰

Impaired cell division: 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.⁹¹ Without doubt there are other causes of aneuploidy, but if BPA can cause aneuploidy in humans as well as laboratory



animals, it is clearly a preventable contributor.

Altered mammary gland development: In a laboratory study, mammary gland development was significantly altered in mice exposed in utero and neonatally to 25- 250 ng BPA/kg (bw)-d of bisphenol A, the lowest dose thus far shown to disrupt animal development and 2000 times lower than the EPA standard. Scientists suggest that this study’s implications for human health include increased susceptibility to breast cancer after perinatal (five months before birth and one month after) exposure to bisphenol A.⁹²

Early Puberty: Low-dose exposure to BPA can affect the timing of the onset of puberty. Laboratory studies reveal the early onset of sexual maturation in female offspring occurring at maternal doses between 2.4 and 50 ppb per day during pregnancy.⁹³

Cancer: Research using cell cultures showed that a concentration of bisphenol A of 1 nM made human prostate cancer cell cultures less responsive to the hormone treatment used to control prostate cancer.⁹⁴ This concentration is lower than the aver-

age level of bisphenol A found in Americans.⁹⁵ There is evidence that at very low doses, BPA may increase susceptibility to cancer in animals. The impacts of BPA on mammary gland and prostate gland development in rodents are the kinds of changes that would likely make the animal more likely to develop cancer in those organs.⁹⁶

Altered brain development and behavior: Scientists found that bisphenol A exposure in the womb modifies sexual differentiation of the brain and behavior in rats at only 30 µg/kg/day,⁹⁷ lower than the dose considered safe by the EPA.⁹⁸ For some behaviors tested, results suggest that bisphenol A exposure was linked to both demasculinization of males and defeminization of females.

Insulin resistance: A recent study in adult mice provided evidence of an association between bisphenol A exposure and increased insulin resistance. In humans, this would increase the risk of type II diabetes.⁹⁹ Doses used in their experiments were 5 times lower than the dose considered ‘safe’ by the EPA.¹⁰⁰

Developmental origins of adult health and disease: The 2007 “Chapel Hill Bisphenol A Expert Panel Consensus Statement: Integration of Mechanisms, Effects in Animals and Potential to Impact Human Health at Current Levels of Exposure” states that enough evidence exists to suggest that adverse health outcomes may not become apparent until after exposure during critical developmental periods. Especially of concern is that “these developmental effects are irreversible and can occur due to low-dose exposure during brief sensitive periods in development, even though no BPA may be detected when the damage or disease is expressed.”¹⁰¹

Bisphenol A in Our Bodies

All 33 participants who provided urine samples had bisphenol A in their urine. Twenty five (or more than 75%) of these participants had levels above the CDC median. Sixteen of our 35 participants had bisphenol A detected in their blood, and thirteen of them had quantifiable levels. Interestingly, 14 of the 16 people who had bisphenol A in their blood were women. The levels of bisphenol A in the blood and urine of some of our participants are within the range shown to cause effects in laboratory studies and impacts on cell function.¹⁰² See the text box on “Do low doses matter?” for more discussion about why it’s not as simple as “the dose makes the poison.”

While market trends and personal purchasing actions are not likely to

drastically reduce bisphenol A exposure without coordinated policy action by state and federal governments, there are ways you can reduce your family’s exposure.

tures.¹⁰³ Use glass or ceramic containers instead. Cut back on consumption of canned foods to reduce exposure to bisphenol A contamination from the interior coating of the container. Also, avoid canned foods with higher fat content, which may have higher levels of bisphenol A.¹⁰⁴ Before getting dental sealants, check with your dentist about the ingredients in the products they use, as some formulations may leach bisphenol A.

Policy Action

Federal action is required to ban the use of Bisphenol A and replace it with safer substitutes. In the absence of federal policy, each state government should enact policies to phase out BPA. Several states, including Maryland, Minnesota and New

York, have pending bills that address BPA in toys and children’s articles.

vide a way of assessing chemical hazards or regulating those industrial chemicals of greatest concern. The law does not require chemical corporations to generate or disclose information about the health and environmental safety of the more than 2,000 chemicals that enter the market each year—there are approximately 81,600 chemicals registered currently for commerce in the United States.¹⁰⁵ The Environmental Protection Agency (EPA) has little power under TSCA to require safety data on most industrial chemicals. In those cases where the EPA can evaluate information necessary to ban a toxic chemical, they must also prove that a chemical presents an “unreasonable risk,” must balance costs and benefits, consider alternatives, and choose the “least burdensome” option. As a result, TSCA has been unable to control the vast majority of chemicals.

In a 2006 report produced by the University of California Policy Research Center, the authors noted: “For the great majority of chemicals in commercial circulation, TSCA has provided insufficient authority to require the generation of information on chemical toxicity and ecotoxicity and the distribution of that information to state governments, businesses, industry, and the public. In 1979, at the time TSCA was implemented, there were about 62,000 chemicals in commercial circulation in the U.S.—often described as ‘1979 existing chemicals.’ These chemicals were ‘grandfathered’ under TSCA; chemical producers were not required to disclose information on their toxic and ecotoxic properties, and they were generally considered to be “safe.”¹⁰⁶ EPA has used its authority to test fewer than 200 of the 62,000 chemicals that were in commerce when TSCA was implemented in 1979.

“Every day, Americans use household products that contain hundreds of chemicals. Most people assume that those chemicals have been proven safe for their families and children. Unfortunately, that assumption is wrong.”

Senator Frank Lautenberg, D-NJ

How to Reduce Bisphenol A in Your Body

You can minimize exposure to bisphenol A: Use glass, stainless steel, or polyethylene bottles (polypropylene and PET as well) instead of polycarbonate (hard, shiny, clear plastic) bottles. Avoid heating foods in polycarbonate containers, as bisphenol A tends to leach faster with higher tempera-

Market and Policy Recommendations

Problem Summary: The Toxic Substances Control Act (TSCA) of 1976 is the federal law intended to regulate toxic chemicals to prevent them from harming our health or the environment. TSCA has failed to meet the intended goals. Reviews of TSCA conducted by the National Academy of Sciences, the U.S. Government Accountability Office, and others have determined that TSCA does not pro-

"Since Congress enacted TSCA in 1976, EPA has issued regulations to ban or limit the production of only five existing chemicals or groups of chemicals."¹⁰⁷ These statistics confirm that the federal system of chemicals management is in dire need of reform.

"It is time to hold the chemicals in our consumer goods and household products to a higher standard, and fully understand their effect on our bodies."

Former Senator James Jeffords, VT

While the U.S. chemical regulatory system still labors under the weak TSCA authority, the European Union has enacted an array of protective policies that require data on inherent hazards of chemicals in commerce, promote safer substitutes for toxic chemicals in products, provide for consumer right to know, and have the capacity to ban the chemicals of very high concern. Foremost of these policies is the new **REACH (Registration, Evaluation and Authorization of Chemicals)** program. REACH, described in more detail below, is a comprehensive approach to control the manufacture, import, and use of industrial chemicals in the European Union.

Internationally, the **Stockholm Convention**, otherwise known as the POPs (Persistent Organic Pollutants) Treaty, is a global treaty to protect human health and the environment from a short list of the worst persistent organic pollutants. The United States has not yet ratified this important international agreement.

While it's hard to deny the benefits of modern chemistry in creating an array of useful consumer products, few understand that hazardous chemicals are not an essential part of chemistry.

Green Chemistry is an approach to the design, manufacture and use of chemical products to intentionally reduce or eliminate hazards.¹⁰⁸ Many companies are already putting green chemistry into practice, but we need strong policies that encourage green

chemistry as a tool for moving from a toxic to a healthy economy.

20,000+ New Chemicals Added Since 1979

The U.S. government should adopt sensible chemical policies that protect our health in our homes and workplaces. In the absence of comprehensive federal policy, states should continue to exercise their constitutional right to protect their citizens by enacting policies to prevent the use and dissemination of toxic chemicals. By designing new, safer chemicals, products and production systems we can protect people's health and create healthy, sustainable jobs. Some leading companies and governments are already on this path. But shifting markets to safe chemicals and products will require policy change.

Framework for Chemical Policy Reform

The U.S. can contribute to a safe and healthy global environment through major reform of our nation's chemicals policy. In 2004, a meeting of groups and individuals met in Louisville, Kentucky to create a document intended to guide chemical policy re-

form. Participants named the Charter after this city to honor it and all the communities across the country and around the world committed to ending toxic chemical contamination. Louisville, Kentucky, USA is home to "Rubbertown," with eleven facilities releasing millions of pounds per year of toxic emissions.

As articulated in the Louisville Charter,¹⁰⁹ any reform must:

- **Require Safer Substitutes and Solutions**—Seek to eliminate hazardous chemical use and emissions by altering production processes, substituting safer chemicals, redesigning products and systems, and rewarding innovation. Safer substitution includes an opportunity and obligation on the part of the public and private sectors to invest in research and development for sustainable chemicals, products, materials and processes.
- **Phase-Out PBT Chemicals**—Prioritize for elimination chemicals that are slow to degrade, accumulate in our bodies or living organisms, or are highly hazardous to humans or the environment. Ensure that chemicals eliminated in the United States are not exported to other countries.
- **Give the Public, Workers the Full Right-to-Know**—Provide meaningful involvement for the public and workers in decisions on chemicals. Label products that contain chemicals, list quantities of chemicals produced, used, released, and exported, and provide public/worker access to chemical hazard data and government decisions.
- **Act with Foresight**—Prevent harm when credible evidence exists that harm is occurring or is likely

- to occur, even when some uncertainty remains regarding the exact nature and magnitude of the harm.
- **Require Comprehensive Safety Data for All Chemicals**—For a chemical to remain on or be placed on the market manufacturers must provide publicly available safety information about that chemical. The information must be sufficient to permit a reasonable evaluation of the safety of the chemical for human health and the environment, including hazard, use and exposure information. This is the principle of “No Data, No Market.”
 - **Take Immediate Action to Protect Communities, Workers**—When communities and workers are exposed to chemicals known to pose a health hazard, immediate action is necessary to eliminate these exposures.

Solutions Summary

1. **Reform of the Toxics Substance Control Act:** Guided by the framework outlined above, TSCA should be amended to require the phase out of the worst chemicals and require safety data on all chemicals. The Kid Safe Chemicals Act, below, is one such attempt at reform
2. **State Level Chemical Policy Reform:** In the absence of comprehensive federal policy and guided by the framework outlined above, states should enact policies to protect their citizens by preventing the use and dissemination of toxic chemicals.
3. **Ratification of the POPs Treaty:** The U.S. Congress should take immediate action to ratify the Stockholm Convention and to support expansion of the treaty’s list of problem chemicals (see below) .

4. **Support for Green Chemistry:** Federal and state policies are needed to create economic incentives for companies to adopt safer practices, safer production methods and safer alternatives, as well as increased investment in green chemistry programs, within Universities, state and federal agencies and business environments. The information below describes solutions in greater detail.

United States Congress

In 2004, Senators Frank Lautenberg (D-NJ), Jim Jeffords (I-VT) and Patrick Leahy (D-VT) as well as Representative Henry Waxman (D-CA) requested an investigation by the Government Accountability Office (GAO) into the performance of the **Toxic Substances Control Act (TSCA)**. The GAO found that little had changed since its 1994 investigation, which concluded TSCA was fundamentally failing in its stated purpose of ensuring that chemicals used in United States commerce were safe. The 2005 GAO report reiterated that EPA lacks the basic data needed to evaluate the risks of industrial chemicals. Even with information on toxicity and exposure, GAO concluded, EPA lacks effective mechanisms to manage the risks to human health and the environment.

Based in part on the GAO’s findings, Senators Lautenberg and Jeffords proposed a bold overhaul of TSCA in the summer of 2005, called the “**Kid-Safe Chemicals Act (KSCA)**.” Congressman Henry Waxman (D-CA) later introduced a companion bill in the House of Representatives. KSCA responded to many of the GAO’s findings. It proposed giving the EPA clear authority to demand data on health effects from the chemical industry and ensure that the chemicals would be safe for chil-

dren. It flipped the “burden of proof” for proving a chemical’s safety from the government to industry. It also proposed money for investment into “green chemistry”—research into and development of chemicals with fewer or no ill effects on the environment and human health.

KSCA did not move in the 109th Congress. Both Representative Waxman and Senator Lautenberg have indicated that they plan to reintroduce KSCA in the 110th Congress with refinements based on feedback from the earlier bill. Components of a new national chemical reform bill should require complete health and safety data on industrial chemicals and make them publicly available; phase out dangerous chemicals; expand the public right-to-know on toxic chemicals; and promote innovation for safer alternatives.

POPs Treaty

The **Stockholm Convention on Persistent Organic Pollutants**, better known as the POPs Treaty, is an international treaty containing provisions to protect human health and the environment on a global scale from a small number of persistent organic pollutants. The treaty defines POPs as “chemical substances that persist in the environment, bio-accumulate through the food web, and pose a risk of causing adverse effects to human health and the environment.” The treaty created a list of the 12 worst offenders, known as the **Dirty Dozen**. This list includes eight organochlorine pesticides: aldrin, chlordane, DDT, dieldrin, endrin, heptachlor, mirex and toxaphene; two industrial chemicals: hexachlorobenzene (HCB) and the polychlorinated biphenyl (PCB) group; and two groups of industrial by-products: polychlorinated dioxins and

furans. A key feature of the POPs treaty is the creation of an international scientific review process to consider adding other POPs chemicals to the dirty dozen. Currently ten other POPs are under review: hexachlorocyclohexane (alpha-, beta-HCH), chlordecone, endosulfan, hexabromobiphenyl (HBB), lindane, penta- and octa-bromodiphenyl ether, pentachlorobenzene (PeCB), perfluorooctane sulfate (PFOS), and short-chain chlorinated paraffins (SCCPs).

POPs in the U.S.: Although the United States signed the Stockholm Convention on POPs in 2001 under President George W. Bush, it has yet to formally ratify it under U.S. law. United States ratification of the POPs treaty requires minor changes in current federal regulation so that the US EPA would be authorized to take action on existing POPs (including the power to stop the export of banned pesticides), and to regulate new POPs if the United States chooses to. Congressional efforts to make the necessary legislative changes stalled in 2004 and 2006. U.S. failure to ratify this important treaty reflects policies that support the chemical industry at the expense of human health and the environment, while leaving the United States on the sidelines as the rest of the world takes action on these global pollutants.

European Union Regulations/Restrictions

The European Union has enacted an array of protective policies that require data on inherent hazards of chemicals in commerce, promote safer substitutes for toxic chemicals in products, provide for consumer right to know, and have the capacity to ban the chemicals of very high concern.

1. REACH (Registration, Evaluation and Authorization of Chemicals) legislation is a comprehensive approach

to control the manufacture, import, and use of chemicals. REACH went into effect on June 1st, 2007, and represents a paradigm shift in chemical legislation. The chemical makers and importers in the European Union are now obliged to provide basic health and safety information for all chemicals produced or marketed in quantities over one ton a year per importer or producer, before placing them on the market (“no data, no market” principle). This reverses the previous system, in which public authorities had first to prove a chemical was harmful before being able to regulate it. It sets up a system for better control of “substances of very high concern.” REACH will require some of these high priority chemicals to be substituted with safer alternatives, as they become available. Under new provisions for increased access to information, companies using chemicals but also downstream users, retailers, and consumers now have the right to obtain information about hazardous chemicals in products they buy.

REACH impacts on the U.S.: American organizations and individuals will be able to promote improvements in their own national legislation on chemicals by using the publicly accessible database of chemical hazards and properties generated under REACH. Since U.S. companies must comply with REACH in order to do business in the European Union, advocacy groups in the U.S. could expose double standards, where companies avoid the use of hazardous substances for export to the EU market but continue to use them here. Two examples of double standards are highlighted below in the electronics and cosmetics sections.

2. RoHS (Restriction of Hazardous Substances) Directive 2002/95/EC

restricts the use of certain hazardous substances in electrical and electronic equipment. To prevent generation of hazardous waste, the RoHS Directive requires substitution of six chemicals: various heavy metals (lead, mercury, cadmium, and hexavalent chromium) and brominated flame-retardants (polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE)) in new electrical and electronic equipment made or imported into the EU from July 1st 2006. China is implementing its own RoHS in 2007.

RoHS in the United States: California has enacted its own RoHS rule to take effect in 2007. The California RoHS applies to a group of products such as laptops, Cathode Ray Tubes and televisions.

3. Waste Electrical and Electronic Equipment Directive (WEEE) came into force in 2003, setting collection, recycling and recovery targets for all types of electrical products. Through WEEE, considerable obligations are placed on electronics manufacturers to take back their products at the end of their useful life. This concept of **Extended Producer Responsibility (EPR)** is incorporated into a number of corporate policies and state-level laws in the U.S.

4. The European Union has more stringent and protective laws for cosmetics than the U.S. The EU amended the Cosmetics Directive (76/768/EEC) in January 2003, which went into effect in September 2004, to ban the use of chemicals in personal care products that are known or strongly suspected of causing cancer, mutation or birth defects. The **EU Cosmetics Directive** in the US: Due to gaping loopholes in U.S. federal law, companies in America can put virtu-



ally any ingredient into personal care products. **Even worse, the government does not require pre-market safety tests for any of them. In fact, a mere 10 ingredients have been banned for use in personal care products in the U.S., compared to over 1,100 in the E.U.**

Market Reform Efforts in the United States

1. EPR of Electronics in the U.S.: With no federal e-waste solution on the horizon, states continue to move ahead with legislation to solve the e-waste problem. Twenty-three states plus New York City introduced e-waste legislation in 2007. Connecticut, Maine, Maryland, Minnesota, Oregon, North Carolina, Texas and Washington have passed laws requiring Extended Producer Responsibility of electronics. Arkansas, California, Connecticut, Maine, Massachusetts, Minnesota, New Hampshire, Oregon and Rhode Island have passed laws banning the disposal of electronic waste in landfills, and Connecticut, Massachusetts and New Hampshire have banned their disposal in incinerators.

2. The Computer TakeBack Campaign works to protect the health and well being of electronics users, work-

ers, and the communities where electronics are produced and discarded by requiring electronics manufacturers to take responsibility for the life cycle of their products, through policy requirements or enforceable agreements. A number of major electronics manufacturers have already adopted Extended Producer Responsibility, such as Dell, Hewlett Packard and Sony. **Companies who are fighting legislation in the U.S. that would require them to establish “Producer Takeback” recycling programs are touting their virtuous behavior for doing the same in Europe.**

3. Environmental Working Group has a grassroots campaign to urge congress to enact more protective standards for safe cosmetics. Their petition to Congress can be found at <http://www.cosmeticsdatabase.com/>. The **Campaign for Safe Cosmetics** urges cosmetics companies to endorse the Compact for Safe Cosmetics, a pledge to remove toxic chemicals and replace them with safer alternatives in every market they serve. The Campaign also works to reform chemical policies that allow toxic ingredients in consumer products in the first place.

State-Level Policy Efforts

The U.S. Centers for Disease Control and Prevention (CDC) has issued a series of reports on levels of exposures of average Americans to dozens of toxic chemicals (<http://www.cdc.gov/exposurereport/>) But the CDC reports do not break out data by state or region, so they give an incomplete picture of local exposures. Statewide biomonitoring is an important next step to understand who is being exposed to what, and where, to enable elected officials and other policy makers to make informed decisions about how to reduce harm based on actual levels measured in the bodies of people. What gets measured gets managed.

Environmental health advocacy coalitions in several states are strategizing about implementing state biomonitoring programs. In 2006, California became the first state in the country to do so. It will help guide the development of other state programs, and has two features other programs should include. First, the program does not restrict the chemicals that can enter the program. California could quickly biomonitor for an emerging chemical of concern like Bisphenol A even though it has not been fully characterized for risk or regulated elsewhere. Second, California’s program allows individual study contributors to receive their personal results. This right-to-know provision will speed public understanding of biomonitoring and its importance. Biomonitoring is here to stay, will continue to develop rapidly, and affords a great opportunity for organizing around the concept that “the trespass is the harm.” Public safety cannot wait for federal action. New State-level policy changes, referred to throughout this report, are building momentum for reform in other states and at the national level.

Conclusions

This small project corroborates findings from larger studies that industrial chemicals commonly found in everyday products make their way into our environment and into our bodies. The three kinds of chemicals for which we tested—brominated flame-retardants, phthalates and Bisphenol A—are commonly found in every home, creating unnecessary toxic exposures, which over time can adversely impact our health. Safer alternatives are available for many uses of all of these chemicals and should be required.

We are able to cite at least some toxicity data for these chemicals that lead to our concerns. Unfortunately, similar toxicity data are missing entirely for many other chemicals commonly used in consumer products and to which we are regularly exposed. With them, we are truly “flying blind.”

Toxic chemicals do not belong in the human body. Indeed, industrial chemicals do not belong in consumer products at all unless they have undergone safety testing. But as long as industries keep putting them in products, we will continue to be exposed. Although most people assume that if a product is being sold that the gov-

ernment has screened it to ensure safety, this is simply not the case. Not only do products contain chemicals about which we know very little, they also contain chemicals we know are harmful. Although there are steps we can take to reduce our exposure, we cannot shop, eat or exercise our way out of the problem of toxic chemicals

in commerce, in our homes, and in us. Government and industry action to phase out these chemicals in favor of safer alternatives is needed now.

Government and industry action is needed now to stop use of chemicals known or suspected to cause harm, to require safety testing, and to promote safer alternatives.



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Sampling and Testing Methods

Sampling Methods

All project protocols were approved by the Cook County Hospital Health Services Institutional Review Board (IRB). Dr. Ted Schettler, the project's Principal Investigator, provided medical oversight for the project. All collection and analytical procedures followed requisite quality control and assurance protocols.

The 35 participants in this pilot survey were selected for diversity in occupations, geography, age, race, ethnicity and gender. Regional Coordinators identified and communicated with potential subjects to review project goals and methodologies, answer questions, and complete project documents, including a biographical and demographic questionnaire to provide information about their residences, occupations, diet, and potential toxic exposures.

Samples were collected in March 2007 using containers and procedures supplied by the analytical laboratories. Phlebotomists in professional collection centers drew blood samples into vacutainers. Approximately 35–50 ml of blood was collected in five vacutainers from each participant following all necessary safety and sample collection protocols. After clotting, serum was obtained by centrifuging tubes and pouring off or pipetting serum into storage vials. Glass pipettes were provided by the laboratories to prevent contamination from plastic pipettes or inappropriate cleaners for glass pipettes.

Participants were provided with the necessary materials and protocols to collect urine over a twenty-four hour

period. Total volume was noted, samples were shaken, and amounts were poured off into containers as specified by laboratories.

Samples were processed as necessary, frozen, placed upright in appropriate containers with ice packs, and mailed via overnight courier to the analytical laboratories.

Data Analysis Methods

This project selected labs in Canada, Sweden, and the U.S. for sample analysis.

Urine Analysis: Phthalates and bisphenol A

Urine analysis was conducted by AXYS ANALYTICAL SERVICES LTD, 2045 Mills Road, Sidney BC CANADA V8L 5X2.

Analysis of Phthalate monoesters and Bisphenol A in urine samples was by Liquid Chromatography—Mass Spectrometry.

Deconjugation

1 mL urine samples are spiked with a suite of isotopically labelled surrogate standards and with 4-methylumbelliferyl glucuronide solution as an indicator for monitoring the deconjugation of glucuronidated forms of the analytes. The deconjugation is performed with β -glucuronidase enzyme at 37°C.

Extraction and Cleanup

The phthalate metabolites can be determined from a single sub-sample of urine; alternatively analysis of the phthalate metabolites and bisphenol A can be performed independently using separate sub-samples of urine. Extraction and cleanup is performed by SPE (solid phase extraction) on a

HLB (hydrophilic-lipophilic balance) sorbent cartridge. The analytes are eluted with methanol. If necessary, additional cleanup is performed using a MAX (mixed mode anion exchange) SPE cartridge and elution with methanol/formic acid/methyl tertiary butyl ether. The extract is spiked with recovery standards before proceeding to HPLC-MS/MS.

HPLC-MS/MS Analysis

Instrumental analysis of the sample extract is performed using a high performance liquid chromatograph (HPLC) coupled to a triple quadrupole mass spectrometer (MS). Separate instrumental runs are performed for the phthalate metabolites and bisphenol A. The reverse phase LC column contains 3.5 μ m C18 (octadecylsilica) particles and is eluted with gradient programs for mobile phases composed of acetonitrile and dilute aqueous acetic acid (phthalate metabolites) or acetonitrile and dilute aqueous ammonium hydroxide (bisphenol A). The mass spectrometer is operated at unit mass resolution in the MRM (Multiple Reaction Monitoring) mode.

Quality Assurance/ Quality Control (QA/QC)

Samples are analyzed in batches including a procedural blank, a spiked reference sample (SPM) sample and a sample duplicate (if sufficient amount of sample is available). A surrogate/authentic/recovery (SAR) solution is analyzed as an in-house QC measure prior to the analysis of samples. The batch is carried through the complete analytical process as a unit. For sample data to be reportable, the batch QC data must meet the established

acceptance criteria presented on the analysis reports.

**Target Analytes—
phthalates and bisphenol A**

- Monomethyl phthalate (mMP)
- Monoethyl phthalate (mEP)
- Mono-n-butyl phthalate (MBP)
- Monobenzyl phthalate (mBzP)
- Mono-2-ethylhexyl phthalate (mEHP)
- Mono-(2-ethyl-5-oxohexyl) phthalate (DEHP Metabolite VI) (mEOHP)
- Mono-(2-ethyl-5-hydroxyhexyl) phthalate (DEHP (Metabolite IX) (mEHHP)
- Bisphenol A

Polybrominated diphenyl ethers (PBDEs)

Blood samples analyzed by:
**Institutionen för miljö kemi/
 Department of Environmental Chemistry**
 Stockholm universitet/Stockholm University
 106 91 Stockholm/SE-10691
 Stockholm, Sweden

Blood serum samples were spiked with a suite of 13C12-labelled surrogate standards prior to extraction. The samples were extracted by shaking with a solution of ethanol, hexane and ammonium sulphate and then back-washed with reagent water to remove residual ethanol.

The final extracts were cleaned up on an automated (Fluid Management Systems, Inc'Power-Prep™) system using acidic silica, layered acid base silica, Florisil and alumina chromatographic clean up columns. The resulting extract was reduced in volume and spiked with labeled recovery (internal) standard prior to instrumental analysis.

Instrumental analysis was performed on a Micromass Ultima high

BDE Target Analytes

BDE Congener	BDE No.	BDE Congener	BDE No.
2,4,4'-TrBDE*	28	2,2',4,4',5,5'-HxBDE*	153
2,2',4,4'-TeBDE*	47	2,2',4,4',5,6'-HxBDE*	154
2,2',3,4,4'-PeBDE	85	2,2',3,4,4',5,6'-HpBDE*	183
2,2',4,4',5-PeBDE*	99	2,2',3,3',4,4',6,6'-OcBDE	197
2,2',4,4',6-PeBDE*	100	2,2',3,3',4,4',5,6,6'-NoBDE	207
2,2',3,4,4',5'-HxBDE	138	2,2',3,3',4,4',5,6,6'-DeBDE*	209

*BDE congeners of "Primary Interest" as defined by EPA Method 1614.

resolution Mass Spectrometer (MS) equipped with a Hewlett Packard 6890 Gas Chromatograph (GC) and a CTC autosampler. Chromatographic separation was achieved using a DB-5 HT (30 m, 0.25 mm I.D., 0.1 µm film); a split/splitless injection sequence was used. The MS was operated at a mass resolution of 5000 (static) in the electron impact mode using multiple ion detection, acquiring at least two ions for each target and surrogate compound.

Concentrations of target analytes are calculated using the isotope dilution (internal standard) method of quantification in accordance with EPA Method 1614B. Compounds are quantified by comparing the area of the quantification ion to that of the corresponding 13C-labelled standard and correcting for response factors.

Testing protocols are described more thoroughly in the following published articles:

Thuresson K, Bergman Å, Jakobsson K; Occupational exposure to commercial Decabromodiphenyl ether in workers manufacturing or handling flame-retarded rubber. Environmental Science and Technology 2005; 39(7): 1980–1986.

Fängström B, Hovander L, Bignert A, Athanassiadis I, Linderholm L,

Grandjean P, Weihe P, Bergman Å; Concentrations of polybrominated diphenyl ethers, polychlorinated biphenyls, and polychlorobiphenyl-ols in serum from pregnant Faroese women and their children 7 years later. Environmental Science and Technology 2005; 39(24): 9457-9463

Bisphenol A

Blood Samples analyzed by Xeno-Analytical, LLC, Columbia, MO

Preparation of Human Serum for Assay of BPA

Serum unconjugated BPA concentrations were measured in 2 ml aliquots. Serum proteins were precipitated and pelleted by centrifugation. The supernatant was applied to a pre-conditioned Waters C18 sep-pak-vac column, and eluted with methanol. Methanol extracts were dried and reconstituted in methanol. Recoveries of BPA in spiked samples are typically > 90%.

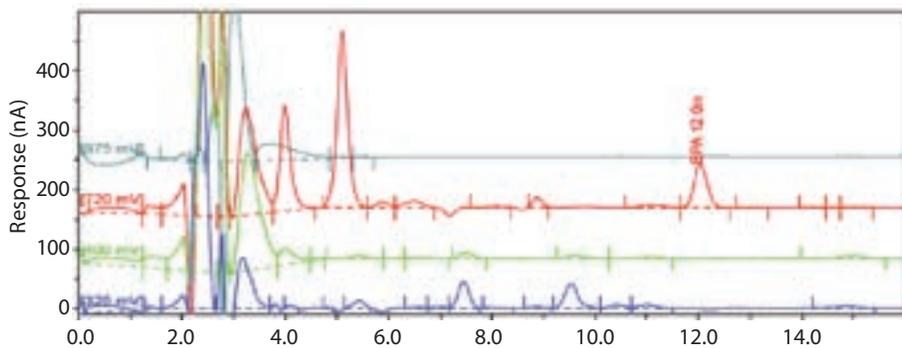
HPLC-CoulArray assay for BPA concentration measurements

Concentrations of BPA were determined in sample extracts by HPLC with an ESA CoulArray 5600 detector. The data were acquired and processed using the CoulArray software, and quantified using multiple point stan-

standard curves. The limit of detection for BPA extracted from serum was 0.3 ng/ml (ppb), and the average coefficient of variation is 5.3%. A chromatogram

from an assay for BPA extracted from human serum is shown in Figure 1 below.

Figure 1. HPLC-CoulArray Chromatogram of BPA in Human Serum



Chemicals Tested in this Study

Data presentation in the body of the report reflects amounts of bisphenol A and phthalates per volume of urine. Results in the Appendix are presented both per volume of urine and per gram of creatinine, as some biomonitoring reports have used this as a way to adjust for urine concentration.

Chemical Group Medium Tested Units of Measurement	Chemical Tested		Chemical Description
Phthalates Tested in Urine – 24 hour collection sample Results reported both as nanograms per milliliter (ng/ml) or parts per billion (ppb) total urine volume and micrograms per gram (ug/g) or parts per million creatine.	MMP	Mono-methyl phthalate	A metabolite of DMP (dimethyl phthalate)
	MEP	Mono-ethyl phthalate	A metabolite of DEP (diethyl phthalate)
	MBP	Mono-butyl phthalate	A metabolite of DBP (dibutyl phthalate)
	MBzP	Mono-benzyl phthalate	A metabolite of BzBP (benzylbutyl phthalate)
	MEHP	Mono-2-ethylhexyl phthalate	All three are metabolites of DEHP, which is di-(2-ethylhexyl) phthalate
	MEOHP	Mono-(2-ethyl-5-oxohexyl) phthalate	
	MEHHP	Mono-(2-ethyl-5-hydroxyhexyl) phthalate	
PBDEs Tested in blood Results reported as nanograms per gram (ng/g or ppb) of fat in serum.	Polybrominated diphenyl ethers 12 different PBDEs were measured of the 209 congeners that exist.		PBDE congeners are named from BDE-1 to BDE-209. They differ only by the location and number of the bromine atoms, which varies from 1 to 10. Congeners are chemical compounds that share the same basic structure. Congeners tested indicate common commercial formulations of penta- octa- and deca-BDE
Bisphenol A (BPA) Tested in blood and 24 hour urine sample. Results for blood are reported in in ng/ml or ppb. Urine results are reported both as nanograms BPA per milliliter (ng/ml or ppb) total urine volume and as micrograms BPA per gram (ug/g or ppm) of creatinine.	BPA	Bisphenol A	Used as lining for food and beverage cans and aseptic containers. Monomer for polycarbonate plastic.

Detailed Results

		MMP	MEP	MBP	mBzP	mEHP	mEOHP	mEHHP
Alaska	Benson	NQ	459	26.6	4.2	2.24	9.24	11
		NQ	820.892	47.572	7.511	4.006	16.525	19.673
	Berkowitz	< 14.0	54.5	25.9	9.85	10.1	39.2	50.6
		<LOD	65.423	31.091	11.824	12.124	47.057	60.742
	June	< 3.18	21.3	15.4	6.07	17.6	209	216
		<LOD	26.852	19.414	7.652	22.187	263.476	272.301
	Rexford	NQ	135	17.6	9.7	1.45	5.57	6.37
		NQ	180.297	23.505	12.955	1.937	7.439	8.507
	Townsend	< 3.32	30	15.7	7.81	20.6	51.7	62.8
		<LOD	79.177	41.436	20.612	54.368	136.449	165.745
Connecticut	Anderson	< 85.0	26.1	23.2	11.6	5.14	13.1	10.8
		<LOD	37.942	33.726	16.863	7.472	19.043	15.7
	Carney	17.2	10.2	7.21	3.35	2.62	5.64	6.85
		160.226	95.018	67.164	31.207	24.407	52.539	63.811
	Harp	NS	NS	NS	NS	NS	NS	NS
		NS	NS	NS	NS	NS	NS	NS
	Owen	< 4.72	53.3	37.1	13.7	8.92	30.5	30.5
		<LOD	50.057	34.843	12.866	8.377	28.644	28.644
	Simcox	< 28.0	101	19.8	4.61	1.74	19.9	18.1
		<LOD	223.716	43.857	10.211	3.854	44.079	40.092
Illinois	Anonymous	< 28.1	90.4	123	69.6	44.3	298	365
		<LOD	60.57	82.413	46.634	29.682	199.667	244.558
	Breuer	< 3.66	103	20.9	20.4	13.6	85.7	95.4
		<LOD	141.543	28.721	28.034	18.689	117.769	131.099
	Felton	26.6	60.8	58	27.1	7.32	64.8	71
		27.324	62.456	59.579	27.838	7.519	66.564	72.933
	Hunter	< 20.6	528	106	15.2	4.85	26.2	24.8
		<LOD	486.252	97.619	13.998	4.467	24.128	22.839
	Nekritz	NQ	85.6	16.6	6.75	14.6	77.2	79.7
		NQ	79.691	15.454	6.284	13.592	71.871	74.198

		MMP	MEP	MBP	mBzP	mEHP	mEOHP	mEHHP
Massachusetts	Antal	< 6.81	66.2	15.2	8.24	164	593	684
		<LOD	65.031	14.932	8.095	161.105	582.532	671.925
	Chen	< 2.53	136	34.1	3.02	4.02	13.6	12.7
		<LOD	286.391	71.808	6.36	8.465	28.639	26.744
	Fishbien	< 4.94	77	32.6	11.9	3.83	24.9	25.6
		<LOD	51.008	21.596	7.883	2.537	16.495	16.959
	Saxon	< 8.11	203	27.1	7.88	20.8	71.7	70.3
		<LOD	326.181	43.544	12.662	33.422	115.208	112.958
	Story	< 4.21	44.9	30.5	6.05	< 0.900	6.9	5.26
		<LOD	144.267	97.998	19.439	<LOD	22.17	16.901
Michigan	Brown, B	NQ	70.6	97.8	27.3	34.2	148	132
		NQ	50.277	69.647	19.441	24.355	105.396	94.002
	Brown, L	< 8.82	320	31.8	11.5	28.1	135	143
		<LOD	423.703	42.106	15.227	37.206	178.75	189.342
	Brown, T	NQ	44.5	20.5	7.43	77.2	182	203
		NQ	46.044	21.211	7.688	79.878	188.314	210.043
	Wilkins, D	NQ	252	45.6	7.26	14.7	78.2	71.2
		NQ	193.664	35.044	5.579	11.297	60.097	54.718
	Wilkins, P	NQ	85.2	48.1	9.56	40.1	91.5	88.9
		NQ	40.401	22.809	4.533	19.015	43.389	42.156
Minnesota	Goldtooth - MN	< 8.63	44	29.2	29.1	28.7	64.9	66.5
		<LOD	34.567	22.94	22.861	22.547	50.986	52.243
	Grochowski - MN	< 16.4	47.8	42.1	16.7	37.2	86.2	80.1
		<LOD	44.892	39.538	15.684	34.936	80.955	75.226
	Madore - MN	< 8.32	84.2	19.5	2.99	4.66	37.8	34.4
		<LOD	123.664	28.64	4.391	6.844	55.517	50.523
	Musicant - MN	< 9.79	53.6	44.5	3.26	5.61	62.9	79.5
		<LOD	128.018	106.283	7.786	13.399	150.23	189.877
	Williams - MN	NS	NS	NS	NS	NS	NS	NS
		NS	NS	NS	NS	NS	NS	NS

		MMP	MEP	MBP	mBzP	mEHP	mEOHP	mEHHP
New York	Anonymous - NY	9.26	31.1	49.4	32.4	5.95	15	14.5
		24.439	82.08	130.379	85.511	15.704	39.589	38.269
	Koon - NY	< 2.02	137	34.7	12.2	52.5	115	101
		<LOD	152.462	38.616	13.577	58.425	127.979	112.399
	Loukmas - NY	31.8	39.4	20.5	4.07	< 0.900	10.3	7.2
		39.051	48.385	25.175	4.998	<LOD	12.649	8.842
	Sferazo - NY	45.9	73.9	52.7	10.7	35.5	256	292
		32.851	52.891	37.718	7.658	25.408	183.223	208.989
	Williams - NY	NQ	183	36.1	< 39.9	90.5	152	139
		NQ	59.649	11.767	<LOD	29.499	49.545	45.307

Phthalates

Phthalate data is presented in the top row as nanograms per milliliter (ng/ml) or parts per billion (ppb) total urine volume and in the lower, grayed row as micrograms per gram (ug/g) or parts per million creatine.

NS means no urine sample was provided.

NQ means no data are available for that analyte. Due to severe matrix interferences affecting MEP in some samples the analyte was not quantifiable. In other samples this has resulted in elevated detection limits for the analyte.

Polybrominated Diphenyl Ethers

		BDE-28	BDE-47	BDE-100	BDE-99	BDE-85	BDE-154	BDE-153	BDE-138	BDE-183	BDE-197	BDE-207	BDE-209
Alaska	Benson	0.3	3.5	0.5	0.7	<LOD	3.1	3.0	<LOD	<LOD	<LOQ	<LOQ	<LOQ
	Berkowitz	4.3	83.7	19.1	13.8	<LOD	6.2	38.7	<LOD	0.4	<LOQ	<LOQ	3.8
	June	1.1	13.2	1.7	2.8	<LOD	5.7	4.7	<LOD	<LOD	<LOQ	<LOD	1.8
	Rexford	1.4	24.3	4.4	5.2	<LOD	2.8	3.5	<LOD	0.2	<LOQ	<LOQ	<LOQ
	Townsend	1.2	16.2	4.6	2.5	<LOD	4.3	9.8	<LOD	<LOD	<LOQ	<LOD	<LOQ

Connecticut	Anderson	0.6	13.3	2.6	4.1	<LOD	1.6	2.9	<LOD	<LOD	<LOQ	<LOQ	<LOQ
	Carney	0.5	7.5	1.2	1.5	<LOD	1.1	12.0	<LOD	<LOD	<LOD	<LOQ	<LOQ
	Harp	1.5	25.2	5.3	3.7	<LOD	4.8	5.9	<LOD	0.4	<LOQ	<LOD	<LOQ
	Owen	1.5	26.9	3.6	5.8	<LOD	3.1	2.8	<LOD	0.3	<LOQ	<LOQ	10.4
	Simcox	1.5	25.0	3.5	3.8	<LOD	2.3	3.0	<LOD	0.2	<LOD	<LOD	<LOQ

Illinois	Anonymous	0.9	13.1	1.2	2.5	<LOD	1.1	2.3	<LOD	<LOD	<LOD	<LOD	<LOQ
	Breuer	1.3	12.4	1.8	2.1	<LOD	4.8	7.5	<LOD	<LOD	<LOD	<LOD	<LOQ
	Felton	0.9	15.1	3.7	3.4	<LOD	1.7	4.5	<LOD	<LOD	<LOD	<LOQ	<LOQ
	Hunter	0.7	10.2	1.8	1.8	<LOD	4.7	2.4	<LOD	<LOD	<LOD	<LOD	<LOQ
	Nekritz	0.4	5.4	0.7	1.0	<LOD	2.7	0.6	<LOD	<LOD	<LOD	<LOD	<LOQ

Massachusetts	Antal	0.4	8.6	1.4	3.2	<LOD	4.2	3.0	<LOD	<LOD	<LOD	<LOQ	4.8
	Chen	1.1	14.7	4.8	2.8	<LOD	0.5	9.5	<LOD	<LOD	<LOD	<LOQ	<LOQ
	Fishebein	0.9	16.6	3.2	3.8	<LOD	1.9	3.6	<LOD	<LOD	<LOD	<LOD	<LOQ
	Saxon	3.5	70.5	11.2	8.3	<LOD	1.0	10.0	<LOD	<LOD	<LOD	<LOD	<LOQ
	Story	0.7	13.7	2.9	2.7	<LOD	3.2	6.0	<LOD	<LOD	<LOD	<LOQ	<LOQ

Michigan	Brown, B	1.7	52.7	6.5	13.8	0.8	0.7	5.8	0.1	<LOD	<LOD	<LOD	<LOQ
	Brown, T	1.9	29.5	10.7	5.4	0.5	39.7	27.7	0.8	0.2	<LOD	<LOD	<LOQ
	Brown, L	1.9	18.2	1.6	1.6	<LOD	13.6	3.7	<LOD	<LOD	<LOD	<LOD	<LOQ
	Wilkins, D	1.2	12.5	1.9	1.0	<LOD	5.5	2.0	<LOD	<LOD	<LOD	<LOD	<LOQ
	Wilkins, P	1.3	39.6	9.1	4.7	<LOD	1.6	24.6	<LOD	<LOD	<LOD	<LOD	<LOQ

		BDE-28	BDE-47	BDE-100	BDE-99	BDE-85	BDE-154	BDE-153	BDE-138	BDE-183	BDE-197	BDE-207	BDE-209
Minnesota	Goldtooth	1.2	30.2	5.7	8.1	<LOD	1.1	6.4	<LOD	<LOD	<LOQ	<LOQ	<LOQ
	Grochowski	0.4	5.0	1.2	0.7	<LOD	0.5	11.2	<LOD	<LOD	<LOD	<LOD	<LOQ
	Madore	8.2	36.2	10.0	4.0	<LOD	3.5	203	<LOD	<LOD	<LOD	<LOD	<LOQ
	Musicant	0.4	9.5	1.9	2.1	<LOD	8.4	2.7	<LOD	<LOD	<LOD	<LOD	<LOQ
	Williams	0.6	9.2	<LOQ	1.4	<LOD	7.8	6.4	<LOD	<LOD	<LOD	<LOD	<LOQ
New York	Koon	1.7	22.3	4.2	4.5	<LOD	3.1	12.0	<LOD	<LOD	<LOD	<LOD	<LOQ
	Loukmas	0.8	8.7	0.8	1.1	<LOD	72.6	7.4	<LOD	<LOD	<LOD	<LOD	<LOQ
	Sferazo	2.8	78.5	9.7	23.0	<LOD	2.2	7.8	<LOD	<LOD	<LOD	<LOD	3.3
	Williams	1.1	19.2	3.8	3.4	<LOD	0.8	5.8	<LOD	<LOD	<LOD	<LOD	<LOQ
	Anonymous	0.8	8.9	1.6	1.4	<LOD	0.3	4.3	<LOD	<LOD	<LOD	<LOD	NA

Polybrominated Diphenyl Ethers

Results reported as nanograms per gram (ng/g or ppb) of fat in serum.

<LOD means less than level of detection.

<LOQ means the chemical was detected but was below the level of quantification.

In the body of the text, participants who had <LOQ results were reported as having those chemicals in their bodies.

NA means that due to complications in analysis, the sample was not analyzed for the congener.

		ug BPA / L urine	ug BPA/ g creatinine	ng BPA/ ml blood
Alaska	Benson	2.58	4.61	1.6
	Berkowitz	5.24	6.29	1.83
	June	5.43	6.85	<LOD
	Rexford	0.866	1.16	2.38
	Townsend	1.97	5.2	1.77

Connecticut	Anderson	0.867	1.26	<LOD
	Carney	0.975	9.08	<LOD
	Harp	NS	NS	<LOQ
	Owen	1.56	1.47	2.52
	Simcox	1.7	3.77	<LOD

Illinois	Anonymous	3.24	2.17	0.41
	Breuer	1.59	2.18	<LOD
	Felton	1.86	1.91	1.11
	Hunter	1.72	1.58	<LOD
	Nekritz	1.38	1.28	0.91

Massachusetts	Antal	2.02	1.98	<LOD
	Chen	2.2	4.63	<LOD
	Fishebein	2.8	1.85	0.5
	Saxon	0.616	0.99	6.35
	Story	1.06	3.41	1.08

Michigan	Brown, B	3.34	2.38	<LOD
	Brown, T	2.15	2.85	<LOD
	Brown, L	3.06	3.17	<LOD
	Wilkins, D	2.92	2.24	<LOQ
	Wilkins, P	3.27	1.55	<LOD

		ug BPA / L urine	ug BPA/ g creatinine	ng BPA/ ml blood
Minnesota	Goldtooth	4.26	3.35	<LOD
	Grochowski	1.89	1.77	<LOQ
	Madore	1.93	2.83	1.12
	Musicant	0.546	1.3	<LOD
	Williams	NS	NS	NA

New York	Koon	0.471	1.24	<LOD
	Loukmas	1.27	1.41	<LOD
	Sferazo	4.73	5.81	1.09
	Williams	4.35	3.11	<LOD
	Anonymous	4.32	1.41	<LOD

Bisphenol A

Results for blood are reported in in ng/ml or ppb. Urine results are reported both as nanograms BPA per milliliter (ng/ml or ppb) total urine volume and as micrograms BPA per gram (ug/g or ppm) of creatinine.

<LOD means less than level of detection. <LOQ means the chemical was detected but was below the level of quantification. In the body of the text, participants who had <LOQ results were reported as having those chemicals in their bodies.

NS means no urine sample was provided. NA means that due to complications in analysis, the sample was not analyzed for the congener.

IS IT IN US?

CHEMICAL CONTAMINATION IN OUR BODIES

Our laboratory results confirm what other national and state-level biomonitoring projects have found: We are all contaminated with toxic chemicals.

- Of 35 participants, all had at least 7 of the 20 chemicals for which we tested in their bodies.
- The person with the most chemicals had 17 of the 20 for which we tested.
- We found diethyl phthalate, dibutyl phthalate and DEHP in all 33 participants who provided urine samples. Thirty-two had dibenzyl butyl phthalate.
- We found six types of PBDEs in all 35 participants, and deca-BDE in all but one participant.
- All 33 participants who provided urine samples had bisphenol A in their urine.

The chemicals our project detected in the bodies of participants are intentionally added to tens of thousands of everyday consumer products, including products made for children where they leach out and we become exposed.

Studies on laboratory animals find Bisphenol A, phthalates (THA-lates) and poly brominated diphenyl ethers (PBDEs) can cause birth defects, cancer and learning disabilities.

Why are toxic chemicals linked to health impacts included in consumer products and showing up in people's bodies? Because there's no federal law to prevent it.

The US Needs a New Policy on Chemicals

Congress should reform the Toxic Substances Control Act (TSCA) to:

Require Basic Data on Industrial Chemicals

Chemical companies must demonstrate the safety of their products, backed up with credible evidence. Chemicals that lack minimum data could not be legally manufactured in or imported into the United States.

Phase out Dangerous Chemicals in Newborn Babies

Persistent and bioaccumulative pollutants detected in human cord blood would be targeted for elimination.

Use New Scientific Evidence to Protect Health

EPA authorized to require additional testing as new science and new testing methods emerge including for health effects at low-doses and for nanomaterials. EPA must systematically review the safety of all industrial chemicals by 2020.

Establish National Program to Assess Human Exposure

The federal government's Center for Disease Control and Prevention (CDC) will expand existing analysis of pollutants in people to help identify chemicals that threaten the health of children, workers, or other vulnerable populations.

Expand the Public Right to Know on Toxic Chemicals

New, Internet-accessible public database on chemical hazards and uses will inform companies, communities, and consumers. The chemical industry excessive claims of confidentiality will be reined-in.

Promote Innovation for Safer Alternatives

EPA authorized to eliminate uses of dangerous chemicals where safer alternatives are available. Companies and the public can petition the government to consider the feasibility of better solutions.

Invest in Long-Term Solutions

New funding for applied research and technical assistance in "green chemistry" and for identifying and reducing exposure to historical contamination in partnership with affected communities.