

Hormones Disrupted



TOXIC PHTHALATES IN MAINE PEOPLE

Alliance for a Clean and Healthy Maine | March 2014

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Sponsored by the Alliance for a Clean and Healthy Maine

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Executive Summary



The bodies of Maine people are polluted with phthalates (pronounced THAL-ates), a group of hormone disrupting chemicals that are widely used in many consumer products. Every one of the 25 men and women who voluntarily participated in a new biomonitoring study by the Alliance for a Clean and Healthy Maine were exposed to at least five of the seven phthalates tested. Some Mainers were exposed at much higher levels than other Americans. Eight Maine people were in the top 5% of phthalate exposure nationally, and another four were in the top 10% in the U.S.

Scientists have shown that phthalates reduce testosterone levels and thyroid hormones critical to healthy development. Dozens of human health studies now link phthalate exposure to serious health effects, including birth defects of male sex organs, learning and behavior problems in children, and increased rates of asthma and allergies. Phthalates harm reproductive health through reduced fertility, premature birth, early puberty in girls, breast growth in boys, and increased risk of prostate and testicular cancer. The phthalates are also “obesogens” that interfere with fat-related hormones linked to obesity and metabolic disorder.

Pregnant women and children are more vulnerable to the adverse effects of phthalates and also face higher exposures. Phthalates especially threaten early childhood development, but also teen and adult health. There is likely no safe level of exposure to hormone disrupting chemicals.

Phthalates are added to soften vinyl plastic widely used in many products including lunch boxes, kids’ backpacks,

school supplies, rain coats and boots, shower curtains, tablecloths, floor tiles and wall covering. They are also a common ingredient of “fragrance” found in many cosmetics, lotions and other personal care products. Safe alternatives to phthalates are widely available.

All seven of the phthalates tested have been prioritized for action by various state, federal and European agencies, and by some business leaders. Yet in the last decade, U.S. exposure has only partially declined for four phthalates and has significantly increased for three others.

The continued widespread exposure to phthalates demonstrates that our chemical safety system is badly broken. The governing federal law, the Toxic Substances Control Act (TSCA) has never been updated in nearly forty years, but meaningful TSCA reform remains elusive. In Maine, the Kid Safe Products Act of 2008 provides powerful authority to protect public health from priority chemicals in everyday products, but has been used too sparingly, so far.

In order to protect the health of Maine families, the Alliance recommends that:

- The Maine Department of Environmental Protection should use its authority under the Kid Safe Products Act to designate phthalates as priority chemicals and require manufacturers to publicly report on which of their products contain phthalates, to help close the information gap.
- Consumers should demand that all phthalates be phased out in favor of safer alternatives.

Introduction

Pollution isn't just something that happens to our rivers and air - it happens to us. Pollution in people can be measured through biomonitoring, in which samples of urine, blood or tissue are collected from people and analyzed for the presence of specific industrial chemical compounds. A growing body of credible scientific evidence links human exposure to toxic chemicals with chronic diseases and disabilities. Scientists are especially alarmed by chemicals that disrupt the endocrine or hormone system, which is critical to healthy development during pregnancy, early childhood and puberty, and to good health throughout life.

This report documents the presence of a group of widely used hormone-disrupting chemicals known as phthalates (pronounced THAL-ates) in 25 Maine people who volunteered for a biomonitoring project conducted by the Alliance for a Clean and Healthy Maine. The Alliance, a statewide public health coalition, works to prevent harm to our children and future generations by promoting safer alternatives to unnecessary dangerous chemicals in everyday products.

This is the second time that the Alliance has tested Maine people for toxic chemicals. In a 2007 biomonitoring study, we found 46 industrial chemicals (of 71 tested) in the bodies of 13 Maine people, including high levels of phthalates, mercury, lead, arsenic, BPA and flame retardants. These findings helped spur action in 2008 by the Maine Legislature to enact the Kid Safe Products Act.

The Kid Safe Products Act establishes a science-based process for protecting the health of children by reducing exposure to harmful chemicals through safer substitutes. Under the law, Maine identified nearly 1,400 "Chemicals of Concern" based on their inherent hazards and in 2012, after accounting for exposure potential, named 49 "Chemicals of High Concern". So far, two "Priority Chemicals" have been formally designated through rulemaking, the hormone



disrupting chemicals known as bisphenol A (BPA) and nonylphenol ethoxylates (NPEs).

Once Maine names a Priority Chemical, the state can require product manufacturers to: (1) publicly report which consumer products they sell in Maine contain the chemical, (2) assess whether safer alternatives are available, and (3) phase out use of the chemical, if children and pregnant women are exposed and safer alternatives are available and affordable. So far, this authority has been used to require safer alternatives to BPA in baby bottles, sippy cups and baby food packaging, and to identify uses for the first time of NPEs in paints and cleaners.

Phthalates are obvious candidates for priority action under the Kid Safe Products Act. Seven of the phthalates have sat idly on the list of "Chemicals of High Concern" for nearly four years. There's strong scientific evidence linking phthalates to serious health effects. Maine people are exposed while manufacturers continue to hide their use of phthalates from consumers. This biomonitoring study and report should lead to swift action by policymakers to name phthalates as Priority Chemicals and to use the authority of the Kid Safe Products Act to protect Maine children and future generations from exposure to these hormone-disrupting chemicals.

Phthalates: The Health Hazards

A subtle but profound health tragedy is unfolding due to the widespread use of hormone disrupting phthalates. As endocrine disrupting chemicals, phthalates interfere with expression of testosterone, the male sex hormone essential for the normal development of baby boys. These chemicals also harm thyroid hormones critical to healthy brain development in the fetus, and metabolic hormones related to fat processing and obesity.

A growing number of human health studies, animal research and biochemical experiments lead to the same conclusion – phthalates are toxic to multiple organ systems. Pregnant women exposed to the highest levels of phthalates more often give birth prematurely.¹ Higher *prenatal exposure to phthalates* produces more serious health problems in children, such as the following:

- **Abnormal development of male sex organs**, including birth defects of the penis known as hypospadias;²

smaller penis size and shorter anogenital distance, a sign of feminization,^{3,4} which is associated with reduced semen quality in young men,⁵ increased risk of prostate cancer;⁶ and undescended testes,⁷ which increases the risk of testicular cancer.

- **Harm to the brain, causing learning and behavior problems**, including decreased alertness in baby girls,⁸ poorer reflexes⁹ and adverse behavior¹⁰ in baby boys, more feminized play behavior in boys;¹¹ and in both sexes: lower cognitive scores and withdrawn behavior at age three,¹² poorer social behavior at ages seven to nine,¹³ and poor attention and impulsive behavior.^{14,15}
- **Sensitization of the immune system, increasing asthma and allergies**, as measured by increased inflammatory response.¹⁶

Childhood exposure to phthalates interferes with normal sexual development and produces adverse effects similar to

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prenatal exposure on behavior, intellectual function and immune health. Human health studies have linked higher phthalate exposure to early puberty in girls,¹⁷ breast growth in boys¹⁸ and lowered intelligence.¹⁹ Phthalates are also *obesogens*, with childhood exposure linked to increased body mass index and waist circumference.^{20,21}

Although effects on the developing fetus and young children have received the most attention, *adult exposure to phthalates* also leads to adverse health outcomes, including low testosterone levels in males,²² poor sperm quality,²³ increased endometriosis,²⁴ low thyroid levels in men²⁵ and pregnant women,²⁶ increased waist size and insulin resistance in men,²⁷ and immune problems such as allergies,²⁸ rhinitis and eczema.²⁹

Major Health Hazards of Phthalates

- Premature birth
- Birth defects of male sex organs
- Reduced fertility
- Prostate and testicular cancer
- Learning disabilities
- Behavior problems
- Asthma and allergies
- Early puberty in girls
- Breast growth in boys
- Obesity and diabetes

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Phthalates in Commerce and Human Exposure

Phthalates are Widely Used but Safer Alternatives are Available and Affordable

Phthalates are routinely added to hundreds of everyday products and building materials found in the home. This large class of industrial petrochemicals all share a similar chemical structure as esters of phthalic acid. ExxonMobil Chemical Company, BASF Corporation and Eastman Chemical Company are among the largest manufacturers of phthalates.

About 90 percent of phthalates are added to polyvinyl chloride (PVC) as plasticizers to make the plastic soft and flexible. Vinyl plastic is widely used in everyday products. Phthalates are also added to plastisols used to make shiny colored prints on children's clothing and to other plastics, adhesives, caulking, coatings and many other common materials. Diethyl phthalate (DEP) is a common ingredient in the chemical soup called "fragrance" on the labels of many cosmetics and personal care products.

Phthalates can be found in the following products around the home:

 Clothing - raincoats, printed shirts, diaper covers, skirts
 Footwear - rain boots, sandals, sneakers
 Accessories - backpacks, handbags, packaging
 Building products - floor tiles, wall covering, wiring
 Household - shower curtains, tablecloths, toys
 Personal care - shampoo, deodorant, lotion, nail polish
 School supplies - lunch boxes, notebooks, binders
 Outdoors - swimming pools, inflatables, garden hoses
 Automotive - car seats, upholstery, dashboards

Safer alternatives to phthalates, and to vinyl products in general, are widely available. See the "Additional Resources" section on **page 15** of this report for documentation on safer substitutes.

The Most Vulnerable Among Us Face the Highest Phthalate Exposure

Widespread use of phthalates exposes virtually everyone, but children, women, people of color, low-income people and workers face the highest levels of exposure. Children have higher levels of phthalates in their bodies than adults, and women are exposed more than men, according to ten years of biomonitoring results from the U.S. Centers for Disease Control and Prevention (CDC).

Phthalates readily escape from products into household dust and the air in our homes, schools, child-care centers, offices and cars. Phthalates enter our bodies through breathing, eating and skin contact, including from frequent hand-to-mouth activity and teething by toddlers. Contamination of the food supply may be a major source of phthalate exposure.³⁰ Phthalates have been measured in breast milk, umbilical cord blood, amniotic fluid, blood and urine, as well as in household dust and indoor air. Phthalates in a pregnant woman cross the placenta and expose the developing fetus. Because of their small size, children are exposed to higher concentrations of phthalates pound for pound than adults.

The CDC cautions that the measurement of detectable levels of phthalates in human bodies does not imply that they cause an adverse health effect. However, dozens of human health studies now show increasing rates of serious disability and disease as phthalate exposure increases. Many scientists say *there's no safe level of exposure to phthalates* because the body responds to extremely tiny doses of hormones and people vary widely in susceptibility.³¹

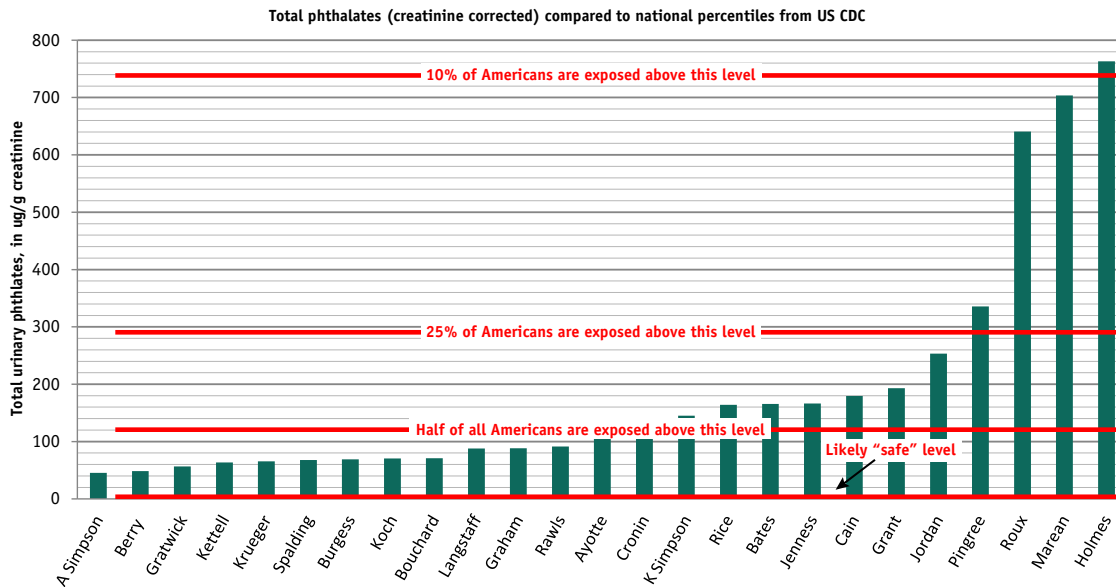
30 Schechter A, Lorber M, Guo Y, Wu Q, Yun SH, Kannan K, Hommel M, Imran N, Hynan LS, Cheng D, Colacino SA, Birnbaum LS. 2013. Phthalate Concentrations and Dietary Exposure from Food Purchased in New York. *Environ Health Perspect* 121:473-479. <<http://dx.doi.org/10.1289/ehp.1206367>>.

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Major Findings

Maine people are polluted with phthalates. All 25 people tested in our study had detectable levels of phthalates in their bodies, with total phthalate exposure ranging from 46 parts per billion (ppb) to 763 ppb. We measured nine metabolites (or breakdown products) in urine that represent recent exposure to seven phthalates. At least six of nine metabolites were measured in every person, while eight Mainers had all nine phthalate metabolites in their bodies and another 13 were exposed to eight of the nine chemicals. For the methods used, see Appendix A. For the full results, see Appendix B.

Figure 1. Mainers Face Cumulative Exposure to Phthalates



Cumulative exposure to multiple phthalates has an additive effect on the risk to human health. That's why it's important to consider total phthalate exposure, as in Figure 1. Each bar on the graph represents recent exposure to the phthalates tested for in the person named. The Maine results are comparable to exposures for all Americans measured by the CDC's national biomonitoring program. The red lines mark the percentile exposure for the U.S. population, age 20 and older, in 2010. For example, 10% of Americans were exposed to phthalates at a level greater than 744 parts per billion (top red line, 90th percentile). Two other red lines show American exposure at the 75th percentile (at 287 ppb) and 50th percentile (123 ppb).

Figure 2. Some Mainers are More Highly Exposed to Phthalates than Other Americans

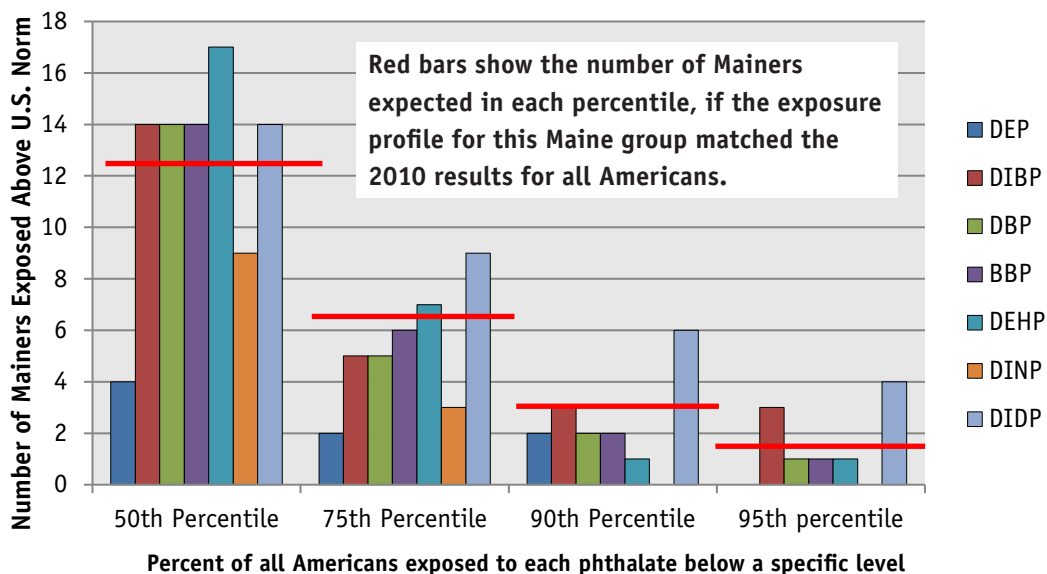


Figure 2 shows the number of Mainers that were exposed to specific phthalates above the national norm. The Maine group was exposed to higher levels of three phthalates (DIDP, DIBP, DEHP) than all other Americans, and to lower levels of two others (DEP, DINP). Eight Mainers were in the top 5% of U.S. exposures for five phthalates, including two people for two phthalates each. The exposure levels for another four people tested were in the top 10% for all Americans.

The DIDP exposure levels in Mainers were much higher than for other Americans for every percentile. A “percentile” represents the proportion of people exposed above and below a specific exposure level. For example, 5% of all Americans are exposed to more than the chemical concentration representing the 95th percentile, while 95% of the U.S.

population is exposed less than that. Similarly, the 50th percentile represents the midway point in the exposure range, with half of Americans exposed at a higher level and half exposed lower. If the phthalate exposure pattern for the 25 Mainers matched the national profile, we would expect the number of people exposed to be close to the red bars in Figure 2 for each percentile.

The higher levels of DIDP in Mainers might reflect increased use of that phthalate as a DEHP replacement since the U.S. data were obtained by the CDC in 2010, rather than real disproportionate exposure. A continued downward trend might also explain the lower DEP test results, although it is possible that this Maine group also avoids synthetic fragrances containing DEP more often.

Figure 3. The Phthalates and Their Metabolites in the Maine Biomonitoring Survey

Parent Phthalate to which People were Exposed			Phthalate Metabolite Measured in Urine	
Acronym	Common Name	CAS Number	Acronym	Common Name
DEP	Diethyl phthalate	84-66-2	MEP	Mono-ethyl phthalate
DIBP	Diisobutyl phthalate	84-69-5	MIBP	Mono-isobutyl phthalate
DBP	Dibutyl phthalate	84-74-2	MBP	Mono-n-butyl phthalate
BBP	Butyl benzyl phthalate	85-68-7	MBzP	Mono-benzyl phthalate
		84-74-2	MBP	Mono-n-butyl phthalate
DEHP	Di(2-ethylhexyl) phthalate	117-81-7	MEHHP	Mono-(2-ethyl-5-hydroxyhexyl) phthalate
			MEHP	Mono-2-ethylhexyl phthalate
			MEOHP	Mono-(2-ethyl-5-oxohexyl) phthalate
DINP	Diisononyl phthalate	28553-12-0	MCOP	Mono-(carboxyoctyl) phthalate
DIDP	Diisodecyl phthalate	26761-40-0	MCNP	Mono-(carboxynonyl) phthalate

- A fourth DEHP metabolite was measured but not reported: MECPP, Mono-(2-ethyl-5-carboxypentyl) phthalate
- A second DINP metabolite was not measured by the laboratory: MINP, Mono-isononyl phthalate
- The Chemical Abstract Service (CAS) Registration Number uniquely identifies chemical compounds regardless of name

Figure 4. These Maine People were Exposed to Higher Levels of Phthalates than Most Americans

Mainers were exposed to these "parent" phthalates	We measured these phthalate "metabolites" in urine samples	Top 5% of US phthalates exposure	Top 10% of US phthalates exposure	Top 25% of US phthalates exposure	Top 50% of US phthalates exposure
DEP	MEP	Holmes Roux	Grant Jordan	Grant Jordan	Grant Jordan
DIBP	MIBP	Cain Jenness Rice	Cain Jenness Rice	Ayotte Kettell	Bates Cronin Graham Grant Holmes Jordan Pingree Rawls K Simpson
DBP	MBP	Bates Jordan	Jordan	Cronin Graham Berry Bouchard	Cronin Graham Berry Bouchard Cain Graham Grant Holmes Cronin Langstaff Kettell Langstaff Marean Pingree Rawls Roux
BBP	MBzP MBP	Jordan	Graham	K Simpson Jenness Rice Kettell	Bates Cronin Graham Berry Bouchard Cain Graham Grant Holmes Cronin Langstaff Marean Pingree
DEHP	MEHP MEHHP MEOHP	Marean	Ayotte Cronin K Simpson Spalding	Ayotte Cronin K Simpson Spalding	Bates Cronin Graham Berry Bouchard Cain Graham Grant Holmes Cronin Langstaff Marean Pingree Rawls Roux Krueger Langstaff
DINP	MCOP		Cain Jordan Rawls	Cain Jordan Rawls	Ayotte Bates Gratwick Jenness Koch Strang Burgess
DIDP	MCNP	Ayotte Jenness Jordan Pingree	Graham Cain Langstaff	Graham Cain Langstaff Spalding	Bates Cronin Graham Berry Bouchard Cain Graham Grant Holmes Cronin Langstaff Marean Pingree Rawls Roux K Simpson
Total of Seven Phthalates	Total of Nine Metabolites	Holmes	Marean Pingree Roux	Marean Pingree Roux	Bates Cronin Grant Jenness Jordan Rice K Simpson

Exposure Notes: Urinary levels of metabolites reflect recent exposure to the parent phthalate compound. The percentiles of top US phthalate exposures are for adults 20 years and older from the 2010 CDC national biomonitoring survey. Actual BBP levels were somewhat higher than reported, and the DBP levels were somewhat lower. That's because they share a common metabolite, MBP, all of which was assigned to DBP in the absence of data on how the MMP metabolite actually fractionates from the two parents. DEHP was also under-reported, because the results for a fourth DEHP metabolite known as MECPP were not reported because the laboratory "was not able to verify with a 3rd party confirmation." Similar levels of exposure to different metabolites may not represent the same level exposure to the parent phthalates, because each compound is metabolized at different rates and in varied proportions.

The Participants



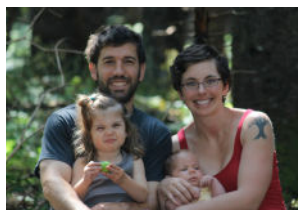
Meredith Strang Burgess, 57, is a former Republican state legislator from Cumberland. As a breast cancer survivor has lost many friends to cancer (including 2 childhood friends who grew up on the same street as she did in Camden), Meredith has often wondered what environmental factors might contribute to Maine's high rates of cancer. **Meredith's body contained 7 out of 9 phthalates tested;** her levels of DIDP and DINP were higher than most Americans, and her level of DIDP was 4th highest for that phthalate in the group.



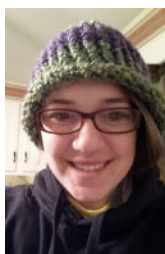
Anna Langstaff, 31, lives in Yarmouth and is due to give birth to a baby boy (Henry) in April 2014. In her 10 years as an early childhood educator, Anna has observed a striking increase in asthma and allergies among her students and wonders about the role of exposure to toxic chemicals. Anna has worked hard to create a toxic-free environment for the new baby but worries about exposure to the art supplies her husband uses as a painter. **Our study found all 9 phthalate compounds in Anna's body**, with a level of DIDP that is higher than 90% of all Americans.



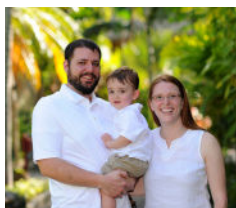
Don Marean, 72, is a Republican state representative from Hollis who has owned small businesses for 40 years. **Don had a surprisingly high level of DEHP**, 4 times higher than levels found in 95% of all Americans. Don's high level of DEHP made his overall levels of phthalates second highest in the group. He is surprised to learn his results and says we need more research and information to find out the sources of exposure.



Zach Bouchard and Katie Mae Simpson, both 33, are married and live in Portland with two young children, Maple and Asher. Both are extremely careful about the products they buy. **Katie Mae's body contained was twice as high as Zach's**, with 5 phthalates at levels higher than 75% of all Americans and the 4th highest DEHP level in the group. **Zach had all but 1 type of phthalate.** Both parents are concerned. As Katie Mae said: "I am a nursing mom. These results show that I have levels of chemicals in my body that no person should have, which is unacceptable."



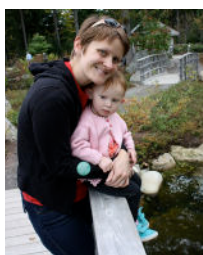
Elise Roux, 24, is a USM student from Windham. Elise was diagnosed with melanoma at age 9, which her mother had at age 21. **Elise's body contained the second highest level of the phthalate DEP** in the group, at an amount that is higher than 90% of all Americans. Elise participated in the Alliance's biomonitoring study in 2006 and also had a high concentration of DEP in her body back then, although her level in our 2013 study is 3 times higher than in 2006. DEP is primarily used in cosmetics and personal care products, and Elise wonders which ones are contributing to her high exposure.



Leah Koch, 38, is a consultant and stay-at-home-mom in Portland who is pregnant with her second child. **Leah's body had all phthalates tested**, including a DBP level that is higher than 75% of Americans. She has consciously tried to rule out unsafe products in her home, and is frustrated that is difficult to make choices without enough information. Leah says its time for policy makers to require better safety testing of chemicals.



Paige Holmes, 34, lives in Lisbon with 2 young sons, 2 year old Owen and 6 year old Mason and works part time as the development director of a theater. Paige is careful to use glass containers instead of plastic and switched out her vinyl shower curtain for cloth to avoid phthalates. Still, **Paige had the highest overall level of phthalates in the group**, due to her levels of DEP and DEHP, both higher than 90% of all Americans. Paige was shocked by her results and worries about the safety of her children.



Helen Ayotte, 31, works as the engineering manager of a natural gas company and lives in Hallowell with her husband and 2-year-old daughter. Helen makes many of her own products and has consciously reduced her use of plastic to reduce exposure to harmful household chemicals. **Helen's level of DEHP was higher than 75% of all Americans**, and her body contained 8 out of 9 phthalates tested.



Katie Rawls, 32, lives in Portland and is pregnant with her first child, a girl. She travels all over the world from Canada to China as a marketing manager with a company that is a material supplier to factories making synthetic leather used in automobiles and furniture. While she works to reduce chemical exposures at home, Katie wondered how she might be exposed to phthalates in her job and travels. **Katie's body contained 6 out of 9 phthalates tested**, including the group's 2nd highest level of the phthalate DINP.



Bettie Kettell, 67, is a retired operating room nurse in Durham and has two young grandchildren. Bettie participated in the Alliance's 2006 study when she was still working at a hospital, and suspects that routine exposure to plastic medical equipment and vinyl flooring caused her high levels back then. **We found every type of phthalate in Bettie's body, but at much lower levels than in 2006.** Bettie is a breast cancer survivor who was also diagnosed with adult-onset asthma at age 50, and seeing her drop in exposure post-retirement strengthens her concerns that hospital workers are overly exposed to dangerous chemicals.



Geoff Gratwick, 70, is a Democratic state senator from Bangor and physician who is also a prostate cancer survivor with no family history of the disease. As a physician he has observed increasing frequency of allergies and autoimmune diseases and worries about the role of chemical exposure. **Geoff's body contained 8 out of 9 phthalate chemicals tested**, including two different compounds at levels higher than most Americans. He believes strongly that our state and national government should be doing more to evaluate product safety.



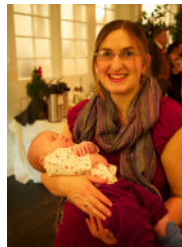
Don Berry, 61, is the president of the Maine AFL-CIO and an electrician who lives in Sumner. Don is no stranger to cancer: his mother died of cervical cancer while his brother died at age 37 of lung cancer, which Don suspects was related to his job refinishing floors without much safety protection. He wonders what chemicals might be in his own body from 14 years doing construction in Maine paper mills. **Our study found 7 out of 9 phthalates in Don's body** and low levels of phthalates overall compared with the group.



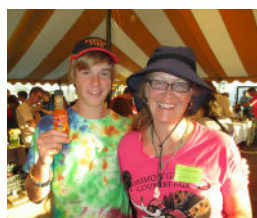
Emily Cain, 33, is a Democratic state senator from Orono who was diagnosed with asthma as an adult. **Emily's body had the group's second highest level of DiBP** which is used in nail polish and lacquers. She also had all 9 phthalates, and 3 at levels higher than 90% of all Americans. Emily finds the lack of information on phthalate exposure frustrating, and strongly believes that everyone will be better off if they have the ability to make healthier choices.



Jessica Graham, 31, lives in Waterville with her 5 year-old son and 4 year-old daughter. She is worried for the future: as an educator she sees major increases in early puberty in girls and autism among school groups. Jessica has spoken at public hearings and press conferences to demand stronger protections from toxic chemicals, and makes many of her own products to reduce her family's exposure. **Jessica had the group's second highest level of BBP in her body**, and she was frustrated to learn that BBP is used in too many product categories to guess the source of exposure. She hopes this study inspires long overdue action.



Tracy Krueger, 31, lives in Bowdoinham and works as an environmental scientist. She is a new mom – her baby was 8 weeks old at the time of the study. **Tracy's body contained all 9 phthalates tested**, although she was relieved to find low levels relative to national data. Tracy tries to reduce her exposure by eliminating plastic containers and processed foods, but she wants greater transparency to make healthier choices as a consumer.



Heather Spalding, 49, lives in Palermo with her husband, her 15 year-old son and her 12 year-old daughter, and is the deputy director of the Maine Organic Farmers and Gardeners Association. Heather has long been aware of the devastating effects of hormone-disrupting chemicals. Her sister is a "DES daughter," who has struggled with health problems linked to the synthetic pregnancy hormone diethylstilbestrol (DES) - commonly given to women of her mother's generation to prevent pregnancy complications. DES is now known to cause a variety of adverse health effects for those exposed to the chemical in utero. **Heather had 8 out of 9 phthalates tested in her body.**



Megan Rice, 38, is a mom in Belgrade with 2 young girls, ages 4 and 7. She has volunteered countless hours advocating for safer products, testifying before the Legislature, meeting with members of Congress, and raising awareness. At home she avoids toxic chemicals where she can, even making her own cleaning products and deodorant. **Megan's body contained the second highest level of DEHP and 3 other phthalates at levels higher than 75% of all Americans.** She is frustrated by the results and wants real action to ensure that products are safe before they are sold.



Nancy Intrieri Cronin, 43, is the Executive Director of the Maine Developmental Disabilities Council and lives in Fayette with her 4 year-old son. She is keenly aware of how much autism and developmental disabilities have increased over the past decade, and worries about her own son's exposures to toxic chemicals. **Nancy had the third highest level of DEHP in the group**, and a total of 8 of the 9 phthalates tested. For Nancy, these results mean "we are playing dice with the human race."



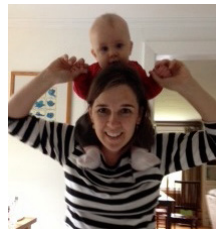
Maria Jenness, 28, works at Maine Island Trail Association and lives in Boothbay Harbor with her 15 month-old son, Roy. As a longtime outdoor guide, Maria feels she no longer depends on most personal care products or cosmetics, and has put even more effort into avoiding them as a new mom. **Maria's levels of DIBP and DIDP were both at levels higher than 95% of all Americans.** Both these chemicals are found in a wide range of products including building supplies, and as a careful shopper Maria worries that her high exposure is out of her control.



Alison Bates, 34, is a nurse practitioner at Planned Parenthood who lives in South Portland with 2 sons, ages 4 and 7 months. She especially worries about links between endocrine disrupting chemicals and increasing cases of infertility among her patients. **Alison's level of DBP was two times higher than 95% of all Americans and the highest in the group.** She suspects routine exposure to plastic medical equipment caused her high levels, which means her exposure could be beyond her own control. Alison wants policies that lead to toxic-free products for health care workers and their patients.



Hannah Pingree, 37, of North Haven formerly served as the Democratic Speaker of the Maine House of Representatives and led effort to pass Maine's Kid Safe Products Act. She is also a mom of 2 young children, 3-year-old Elsie and 1-year-old Oscar. **Hannah had the greatest exposure to DIDP, 15 times higher than 95% of Americans**, and her body also contained 8 out of the 9 phthalates tested. Hannah also participated in our 2006 body burden test and is once again shocked to find extremely high levels of certain chemicals in her body despite being very careful of what she buys. She says "it is clear we cannot ask parents and consumers to just shop their way out of this problem."



Stephanie Jordan, 39, lives in Falmouth and is the mother of a 4-year-old daughter and 1-year-old son. Her family's health has led Stephanie to worry more about chemical exposures: her father-in-law passed away 2 years ago from a rare form of cancer linked to Agent Orange exposure, and one of her husband's sisters has multiple sclerosis while the other has a kidney disorder. **Stephanie's body contained 2 different phthalates at levels higher than 95% of all Americans including the group's highest level of BBP.** She is frustrated that there is not more information available to help her reduce her exposure.



Amy Simpson, 32, has a 6 week old son and is a social worker living in Portland. Like her sister Katie Mae Simpson, she works hard to avoid toxic chemicals in her home; she doesn't buy plastic products and researches her personal care products before she buys them. **Amy's body contained all 9 phthalate compounds tested and the lowest levels of phthalates of the group.** For Amy, knowing that she is still exposed despite her best efforts to avoid phthalates means that policymakers must do more to protect people from harmful chemicals.



Gay Grant, 53, is a state representative from Gardiner who has 2 adult children. She wonders about the role that chemical exposures could have played in her son's asthma and her own allergies. **Gay's body contained 8 out of 9 phthalates tested, with 3 at levels higher than most Americans.** Gay first learned about phthalates as a legislator, but strongly feels that "people shouldn't have to be in elected office to learn about toxic chemicals."

Phthalates: Still Overused and Under-Regulated

Our Chemical Safety System Fails to Protect Public Health from Phthalates

A broken chemical safety system has allowed the use of phthalates to rise for decades, even as scientific concerns about safety have steadily mounted. First introduced in the 1920's, phthalates were "grandfathered in" when the Toxic Substances Control Act (TSCA) was passed nearly forty years ago. That means their use could continue and grow without any safety assessment or mandatory testing for health hazards. Congress has never updated the law and meaningful, health-protective TSCA reform remains a necessary but elusive goal.

Beginning in Europe, over the last 15 years a consensus emerged among independent scientists and government regulators that phthalates pose serious risks to public health. All seven of the phthalates we tested in Maine people have been prioritized by various state, federal and European government agencies due to scientific concern about hazards and exposures:

- Six are named in a Phthalates Action Plan by the U.S. Environmental Protection Agency
- Six are Chemicals of High Concern to Children in the State of Washington
- Five are banned in toys and childcare items by the U.S. Consumer Product Safety Commission
- Five are known to cause cancer and/or developmental toxicity by the State of California
- Four are banned as Substances of Very High Concern by the European Chemicals Agency, and
- Four are designated as Chemicals of High Concern by the State of Maine.

Business leaders have also begun to act. Several cosmetic companies have ended their use of DBP in nail polish. Procter & Gamble and Johnson & Johnson have pledged to eliminate their use of DEP. Target and Walmart require disclosure of phthalates use by many of their suppliers.

Despite these growing concerns, reductions in the use of phthalates has been slow to materialize. Between 2000 and 2010, U.S. exposure to the four phthalates that have come under the greatest market and regulatory pressure



(DEP, DEHP, BBP, DBP) declined by only 42%, 37%, 32%, 17%, respectively. But over the same decade, American exposure actually *increased* for four other phthalates (DIBP by 206%, DINP by 149%, DnOP by 25%, DIDP by 15%). In a classic case of regrettable substitution, the declining phthalates are being replaced in part by the increasing phthalates, which pose similar health threats but are less studied.

Under the new European chemical policy known as REACH, four phthalates (DEHP, BBP, DBP, DIBP) will be phased out there by February 2015 as Substances of Very High Concern, unless exemptions are granted for specific uses due to a lack of safer alternatives or exceptional socio-economic impacts. Once banned in Europe, these phthalates can still be used in most products sold in the U.S., creating a double standard of unequal protection for Americans.

In the absence of timely and meaningful TSCA reform by Congress, state policymakers and market leaders must continue to step up their actions to require disclosure of the use of phthalates in products and to spur the switch to safer substitutes as soon as practicable.

Conclusions and Recommendations

For many participants, this study raises more questions than answers.

Katie Mae Simpson wonders why the phthalate levels in her body are twice as high as her husband **Zach Bouchard**, even though the couple routinely avoids PVC plastic and personal care products with fragrance. State Representative **Don Marean** wants to know why his exposure to DEHP was more than 30 times higher than the typical American.

Here's what we can safely conclude:

- **Mainers are widely exposed to phthalates.** These chemicals were found in the bodies of all 25 Maine people tested. These results are consistent with national biomonitoring studies that have found phthalates in the bodies of virtually every American.
- **Phthalates cause serious health problems.** A growing body of credible scientific evidence, including dozens of human health studies, have linked phthalate exposure to serious harm to reproductive health, the developing brain and immune system.
- **You can't shop your way out of phthalate exposure.** Our Maine participants read labels and shop carefully, yet they are still exposed to phthalates. The widespread use of phthalates and the lack of information on their presence in specific products mean that consumers can't easily avoid phthalates on their own.
- **Our chemical safety system fails to protect pregnant women and children.** Continued exposure to phthalates demonstrates that our federal chemical safety system is badly broken. Maine has identified several phthalates as Chemicals of High Concern, but state leaders have failed to prioritize phthalates for actions that will reduce our exposure.

These findings support a clear call to action. The Alliance strongly recommends that:

- **The State of Maine should act now to close the information gap.** The Maine Department of Environmental Protection should use its existing authority under the Kid Safe Products Act to designate phthalates as Priority Chemicals and require manufacturers to publicly report which of their products contain specific phthalates.
- **The use of phthalates should be phased out in favor of safer alternatives.** *Consumers* should demand phthalate-free products where they shop and from manufacturers. *Business* leaders should meet consumer demand for safer, affordable alternatives. *Regulators* should take action to phase out the use of all phthalates.



Consumer Tips to Reduce Phthalate Exposure

1. Avoid flexible vinyl (PVC) plastic used in kids backpacks, school supplies, rain jackets, beach balls, air mattresses, shower curtains, floor tiles and other soft plastic products. (Vinyl products are sometimes labeled with the number 3 inside a triangle above the letters "V" or "PVC").
2. Avoid personal care products that list "fragrance" as an ingredient on the label.
3. Avoid T-shirts and other clothes that have shiny colored prints, unless they were screen printed with water-based inks or phthalate-free, PVC-free plastisol ink.
4. Look for product labels that say "phthalate-free" and "PVC-free."

Additional Resources

Additional Resources on Phthalates and Other Chemicals of High Concern

HUMAN EXPOSURE

- Schmitt C, Belliveau M, Donahue R, Sears A. 2007. Body of Evidence: A Study of Pollution in Maine People. Alliance for a Clean and Healthy Maine. <<http://www.cleanandhealthyme.org/BodyofEvidenceReport/tabid/55/Default.aspx>>
- U.S. Centers for Disease Control and Prevention. National Report on Human Exposure to Environmental Chemicals. <<http://www.cdc.gov/exposurereport/>>

PRODUCT USE

- Danish Environmental Protection Agency. Danish Surveys on Chemicals in Consumer Products (2001-2013). <http://www.mst.dk/English/Chemicals/consumers_consumer_products/danish_surveys_consumer_products/>
- HealthyStuff.org; Researching Toxic Chemicals in Everyday Products. Ecology Center. <<http://www.healthystuff.org>>
- State of Washington, Department of Ecology. Children's Safe Products Act Reports. <<http://www.ecy.wa.gov/programs/swfa/cspa/search.html>>

SAFER ALTERNATIVES

- Belliveau M, Lester S. 2004. Chapter 8: Don't Buy It, in PVC: Bad News Comes in Threes: The Poison Plastic, Health Hazards and the Looming Waste Crisis. Center for Health, Environment and Justice; Environmental Health Strategy Center. <http://chej.org/wp-content/uploads/Documents/PVC/bad_news_comes_in_threes.pdf>
- Center for Health, Environment and Justice. PVC-Free Products for your School and Home. <<http://chej.org/campaigns/pvc/resources/pvc-free-products/>>
- Healthy Building Network. PVC-Free Alternatives. <<http://www.healthybuilding.net/pvc/alternatives.html>>
- Lowell Center for Sustainable Production, University of Massachusetts Lowell. 2011. Phthalates and Their Alternatives: Health and Environmental Concerns. Technical Briefing. January. <<http://www.sustainableproduction.org/downloads/PhthalateAlternatives-January2011.pdf>>
- U.S. Environmental Protection Agency, Design for the Environment. Alternatives to Certain Phthalates Partnership. <<http://www.epa.gov/oppt/dfe/pubs/projects/phthalates/>>

CHEMICAL REGULATION

- European Chemicals Agency. Authorisation List. <<http://echa.europa.eu/addressing-chemicals-of-concern/authorisation/recommendation-for-inclusion-in-the-authorisation-list/authorisation-list>>
- State of California, Office of Environmental Health Hazard Assessment. Current Proposition 65 List. <http://oehha.ca.gov/prop65/prop65_list/Newlist.html>
- State of Maine, Department of Environmental Protection. Chemicals of High Concern. <<http://www.maine.gov/dep/safechem/highconcern/index.html>>
- State of Washington, Children's Safe Product Act: The Reporting List of Chemicals of High Concern to Children. <<http://www.ecy.wa.gov/programs/swfa/cspa/chcc.html>>
- United States Environmental Protection Agency. Phthalates Action Plan. <<http://www.epa.gov/oppt/existingchemicals/pubs/actionplans/phthalates.html>>
- United States Consumer Product Safety Commission. Phthalates. <<https://www.cpsc.gov/phthalates>>

APPENDIX A - Methodology

All project protocols were approved by the University of Southern Maine Institutional Review Board. John Krueger, MS, ChE, the project's Principal Investigator, provided oversight of the study methodology, data collection, laboratory testing and data analysis. The twenty-five participants in this project were selected for diversity in their towns and occupations. Fifteen of the participants were selected in part because they are either pregnant or have young children, representing two groups most vulnerable to phthalates exposure.

The Principal Investigator and two trained research assistants met with each participant in December 2013 to review project goals and methodologies, answer questions, obtain formal consent, and conduct a biographical and demographic survey. Each participant provided a urine sample using containers and procedures supplied by the Washington Environmental Biomonitoring Survey (WEBS), a project of the Washington State Department of Health. Samples were immediately frozen and then placed upright in an appropriate box with dry ice and shipped overnight to the laboratory. All samples were coded with two separate numbers to preserve anonymity of the participants. All samples collected were used solely for this project and were destroyed at its conclusion.

Through WEBS, the Washington State Public Health Laboratories measured levels of phthalates in the twenty-five urine samples using methods developed and approved by the U.S. Centers for Disease Control and Prevention. Each batch of samples was analyzed for Quality Control Standards before and after analysis, as part of the lab's Quality

Management Plan approved by the College of American Pathologists and Clinical Laboratory Improvement Act.

The parent compounds people are exposed to are phthalate diesters, which are metabolized in humans to their respective monoesters, which in turn may be glucuronidated. Therefore, urine samples were enzymatically hydrolyzed prior to extraction to convert any monoester glucuronides to their respective free monoesters. The test protocol uses addition of standards, spiking solutions, incubation, extraction by solid phase extraction (SPE) cartridges, elution, and analysis by high performance liquid chromatography - electrospray ionization tandem mass spectrometry (HPLC-ESI-MS/MS) - for the quantitative detection of the phthalate metabolites in urine.

The concentration of the individual analytes in each sample is calculated using the calibration curve derived from the known standard mixtures. The final urinary concentrations of phthalate metabolites are adjusted for creatinine, a urinary biomarker. Creatinine correction helps eliminate any dilution bias introduced as a result of some people being more hydrated than others at the time of sampling. The urinary concentrations of phthalate monoesters obtained using this analytical method provide an estimate of recent exposure to phthalates. However, the metabolism of each phthalate is unique and the proportion of monoester metabolite and oxidative metabolites is different for each phthalate. Therefore, similar metabolite concentrations from different phthalates may not reflect similar exposure levels to the parent phthalate compound.

APPENDIX B - Maine Biomonitoring Results

Urinary Phthalate Concentrations in parts per billion (creatinine corrected) expressed as ug/g of creatinine													
Parent phthalate people were exposed to: Phthalate metabolite measured in urine: Name	Residence	DEP	DIBP	DBP*	BBP*	DEHP			DINP	DIDP	Total		
		MEP	MIBP	MBP	MBzP	MEHHP	MEHP	MEOHP	MCOP	MCNP			
Name		* NOTE: DBP and BBP share a common metabolite, MBP. For simplicity and in the absence of other data, all MBP was assigned to DBP											
Paige Holmes	Lisbon	694.00	8.53	16.70	7.41	12.40	10.30	7.42	30.12	3.62	2.88	763.26	
Rep. Don Marean	Hollis	< LOQ	5.96	6.25	5.84	368.00	45.10	269.00	682.10	1.93	1.40	703.48	
Elise Roux	Windham	608.12	4.42	9.95	2.24	4.46	2.83	3.26	10.55	5.50	< LOQ	640.78	
Hon. Hannah Pingree	North Haven	14.80	11.40	18.80	9.46	13.10	17.10	7.85	38.05	< LOQ	243.00	335.51	
Stephanie Jordan	Falmouth	66.50	11.40	49.20	43.10	12.00	< LOQ	9.24	21.24	43.20	18.70	253.34	
Rep. Gay Grant	Gardiner	130.00	7.35	16.70	4.52	9.07	13.50	5.26	27.83	6.78	< LOQ	193.18	
Sen. Emily Cain	Orono	34.10	26.30	13.10	2.95	9.64	10.70	6.70	27.04	63.40	12.70	179.59	
Maria Jenness	Boothbay	8.97	30.20	17.10	15.00	6.41	14.00	4.44	24.85	23.20	47.10	166.42	
Alison Bates	South Portland	< LOQ	10.60	105.00	6.59	9.01	6.15	6.09	21.25	17.80	4.38	165.62	
Megan Rice	Belgrade	27.60	24.30	22.30	13.50	27.20	22.00	18.80	68.00	8.35	< LOQ	164.05	
Katie Mae Simpson	Portland	29.90	10.10	26.80	15.20	19.10	18.80	13.70	51.60	6.07	5.37	145.04	
Nancy Intrieri Cronin	Fayette	19.20	9.38	18.80	7.36	18.30	33.40	12.30	64.00	10.70	< LOQ	129.44	
Helen Aoyotte	Hallowell	< LOQ	16.60	12.40	5.57	17.00	18.40	12.20	47.60	12.20	18.20	112.57	
Katie Rawls	Portland	< LOQ	11.20	18.40	4.69	6.84	< LOQ	5.78	12.62	44.50	< LOQ	91.41	
Jessica Graham	Waterville	< LOQ	9.49	19.00	19.80	9.97	18.40	6.38	36.15	< LOQ	5.42	88.46	
Anna Langstaff	Yarmouth	10.60	6.37	17.60	6.21	10.80	13.30	9.42	33.52	3.70	9.85	87.85	
Zach Bouchard	Portland	< LOQ	6.84	11.80	8.08	14.60	11.60	8.18	34.38	6.97	2.75	70.82	
Leah Koch	Portland	5.63	6.79	23.50	4.42	2.49	1.96	2.31	6.76	21.20	2.09	70.39	
Hon. Meredith Strang Burgess	Cumberland	19.90	6.73	7.56	1.56	< LOQ	< LOQ	3.31	3.31	26.00	4.01	69.07	
Heather Spalding	Palermo	< LOQ	4.68	12.20	2.94	13.80	14.30	8.88	36.98	4.86	6.31	67.97	
Tracy Krueger	Bowdoinham	19.10	2.90	7.53	5.26	10.60	4.80	6.54	21.94	5.40	3.30	65.43	
Bettie Kettell	Durham	< LOQ	13.90	14.00	12.60	7.12	5.90	5.02	18.04	2.60	2.59	63.73	
Sen. Geoff Gratwick	Bangor	11.60	2.57	6.39	2.96	6.79	5.02	4.70	16.51	16.60	< LOQ	56.63	
Don Berry	Sumner	8.17	6.67	8.47	10.20	< LOQ	3.08	< LOQ	3.08	9.54	2.47	48.60	
Amy Simpson	Portland	7.38	6.24	9.50	3.70	6.34	4.93	3.56	14.83	1.78	2.15	45.58	
Limit of Quantitation (LOQ), ug/L (uncorrected):		0.10	0.10	0.10	0.50	0.25	0.10	0.50	-	0.10	0.10	-	
95 th percentile:		989	23.8	50.9	29.1	86.3	11.1	47.4	144.8	113	15.6	1,366.2	
90 th percentile:		523	17.7	34.5	19.2	40.6	6.24	24.3	71.14	69.5	9.68	744.72	
75 th percentile:		173	11.6	21.6	10.8	20.9	3.04	12.7	36.64	28.5	4.93	287.07	
50 th percentile:		62.5	7.24	13.5	5.67	11.5	1.51	7.19	20.2	10.9	2.72	122.73	

All percentile values represent U.S. population exposure, age 20 and older from US CDC, 2010



Hormones Disrupted

TOXIC PHTHALATES IN MAINE PEOPLE

March 2014

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Environment Maine Research and Policy Center

www.environmentmainecenter.org



ENVIRONMENTAL HEALTH STRATEGY CENTER

Environmental Health Strategy Center

www.preventharm.org



Learning Disabilities Association of Maine

www.ldame.org



Maine Conservation Alliance

www.protectmaine.org



Maine Labor Group on Health

www.mlgh.org



Maine Organic Farmers and Gardeners Association

www.mofga.org



Maine People's Resource Center

www.mainepeoplesalliance.org



Maine Women's Policy Center
THE VOICE OF MAINE WOMEN

Maine Women's Policy Center

mainewomenspolicycenter.org



Physicians for Social Responsibility/Maine Chapter

www.psr.org/chapters/maine



Planned Parenthood of Northern New England

www.plannedparenthood.org/ppnne



Toxics Action Center

www.toxicsaction.org