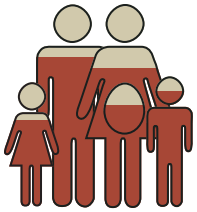
Taking It All In

Documenting Chemical Pollution in Californians Through Biomonitoring

A Project of the Commonweal
Biomonitoring Resource Center

ACKNOWLEDGEMENTS



Taking It All In—Documenting Chemical Pollution in Californians Through Biomonitoring was produced by the Commonweal Biomonitoring Resource Center (CBRC) in 2005. The report was written by Sharyle Patton and Davis Baltz, with input from Charlotte Brody, RN, Executive Director of Commonweal. Invaluable design and production help was provided by Cynthia Loebig of Commonweal.

CBRC seeks to democratize the public health tool of biomonitoring by:

- Providing information to the general public about current biomonitoring studies and their significance.
- Assisting groups in the design and implementation of biomonitoring projects.
- Collaborating with communities to ensure that biomonitoring studies address the needs of community members and respect community experience and wisdom.
- Facilitating scientific discussions about the significance of biomonitoring.

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The Commonweal Biomonitoring Resource Center is a program of Commonweal, a nonprofit health and environment research institute in Bolinas, California, founded in 1976. Commonweal's programs contribute to human and ecosystem health—to a safer world for people and for all life.

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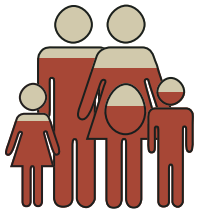
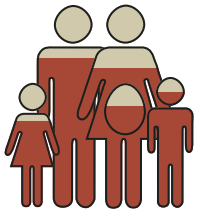


EXECUTIVE SUMMARY



Biomonitoring gives us important information about how much of the polluting chemicals that are in the air, the water, the food we eat and the products we use every day end up being taken into our bodies. **Taking It All In—Documenting Chemical Pollution in Californians Through Biomonitoring** is the first study of its kind that measures the chemical pollution in a cross-section of Californians, and gives them the opportunity to respond in their own words. The study participants are known for their integrity, wisdom, and commitment to community health and justice, and it is hoped that listening carefully to this group's responses will catalyze pubic discussion about how California can use biomonitoring as a public health tool.

The report measures the levels of over 25 varieties of 6 categories of chemicals: mercury, organochlorine pesticides (DDT), perfluorinated compounds (PFCs), polybrominated diphenyl ethers (PBDEs), Bisphenol A (BPA), and phthalates. All participants had detectable levels of at least one chemical in each of the six chemical categories.

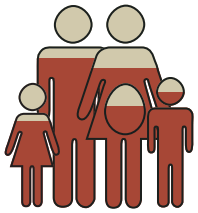
Scientists know we are living in the midst of an epidemic of chronic diseases and disabilities. A growing number of Americans suffer from asthma, cancer, learning disabilities, infertility, birth defects, Parkinson's Disease, autism and many other conditions. There is a growing body of scientific evidence that toxic chemicals in our bodies are a significant contributing factor in this epidemic of disease.

An explosion of new studies are showing that small amounts of toxic chemicals can have large effects on health, especially for babies in the womb and young children. New science is challenging the old notions that "the dose makes the poison" and that low doses are always safe. Instead, new science is teaching us that small amounts of chemicals, at critical times in development, can have lifelong health impacts.

Learning more is what biomonitoring is all about. Taking in all this new science will bring new insights and solutions to the health problems we face today. Biomonitoring is an essential scientific tool that will allow us to turn what we learn into enlightened corporate and government policies that better protect our health.

Without wider biomonitoring to establish patterns of exposures within California communities, including sources and pathways of exposure, we will be missing key information that can help us understand how chemical exposures may be linked to rising incidents of some diseases. Comprehensive, regular biomonitoring programs would enable us to establish baselines and track exposure trends. Until then, Californians will continue to be part of a vast chemistry experiment.

INTRODUCTION



When you hear the word "pollution," you think of polluted air, polluted water, polluted soil. In this study— **Taking It All In–Documenting Chemical Pollution in Californians Through Biomonitoring**—we measure the pollution in people. It is the first study of its kind that measures the chemical pollution in a cross-section of identified Californians.

This measurement of internal chemical levels is called biomonitoring. Biomonitoring gives us important information about how much of the polluting chemicals that are in the air, the water, the food we eat and the products we use every day end up being taken into our bodies.

Scientists know we are living in the midst of an epidemic of chronic diseases and disabilities. A growing number of Americans suffer from asthma, cancer, learning disabilities, infertility, birth defects, Parkinson's Disease, autism and many other conditions. There is a growing body of scientific evidence that toxic chemicals in our bodies—and especially in the bodies of pregnant women and small children—are a significant contributing factor in this epidemic of disease.

What is it like to know your own chemical body burden? **Taking It All In** reports on the internal pollution levels of eleven prominent Californians and gives them the opportunity to respond in their own words. Our study participants are part of a growing number of people who want to know more about the significance of synthetic chemicals found in the human body.

Philip R. Lee, M.D., is the former Chancellor of the University of California San Francisco (UCSF) School of Medicine and former U.S. Assistant Secretary of Health in the Carter and Clinton Administrations. He agreed to be tested because, he says:

> Any scientist will tell you that in order to do good research, you need good data. Biomonitoring can produce the data we need. From a health policy perspective, this is an essential step in the effort to protect the health of people no matter where they live.

Jo Behm, past President of the Learning Disabilities Association of California, describes why she agreed to learn what her chemical body burden is:

> I got connected to the world of learning disabilities, then all disabilities, because of our dear son Sean, now a 21year-old junior in college who has dyslexia. Neurodevelopmental disabilities can impact a child or teen's ability to learn, pay attention, memorize, organize, write legibly, make friends. No disability occurs in isolation—there is a constellation of challenges, some life-altering or life-limiting. I am passionate about doing as much as possible to ensure that students with disabilities are able to succeed and prosper in school and life. But I also must look upstream at cause and prevention. Why are learning and other disabilities increasing across the nation and becoming far more complex?

Father Stephen Privett, President of the University of San Francisco, put his interest in participation with great simplicity:

> As an educator, I believe that knowledge is our most valuable asset and what could be more valuable than learning about the chemicals our bodies have absorbed without our prior knowing or consent?

Wanna Wright, a community organizer with Communities for a Better Environment and a board member of the Breast Cancer Fund and the Women's Cancer Resource Center is herself a cancer survivor. She agreed to participate for these reasons:

> I had focused on early detection as key in terms of cancer activism, but when we lost Andrea[1] to cancer, I became more focused on prevention, and wanted to be tested as a way to raise public awareness about the possible environmental connections to cancer.

The biomonitoring results showing the levels of over 25

toxic chemicals and metals in these eleven Californians would not have been possible just a few years ago. Sophisticated new analytical techniques make it possible for us to precisely measure the levels of toxic chemicals in blood, urine and other body fluids and tissues.

At the same time, an explosion of new studies are showing that small amounts of toxic chemicals can have large effects on health, especially for babies in the womb and young children. New science is challenging the old notions that "the dose makes the poison" and that low doses are always safe. Instead, new science is teaching us that small amounts of chemicals, at critical times of development, can have lifelong health impacts. Animal and human studies have linked 200 diseases to chemical exposure, including infertility, asthma, learning problems and cancer. Sometimes the resulting disease is diagnosed decades after the exposure took place.

Taking in all this new science will bring new insights and solutions to the health problems we face today, as it has before. For example, when science addressing the link between tobacco smoke and cancer spawned new policy protections, cigarette smoking in public places went down and health improved. When science on the link between lead and brain and nervous system development resulted in a ban on lead in gasoline and in paint, blood lead levels in children went down and children's ability to learn went up.

The tobacco industry and the lead industry worked hard to block those reforms from taking place, arguing that smoking was safe and that the levels of lead in children were normal. The chemical industry is following in the footsteps of those industries by arguing that the presence of toxic chemicals in people is acceptable and necessary. *Kathy Gerwig*, the Vice President of a major health care organization and board member of Health Care Without Harm, explains this industry lobbying strategy:

> There's a concept called the "normalization of deviance" which means as gradual degradation from the ideal state occurs, we adapt to or ignore the deviation. The lower standard of performance becomes accepted as normal. There is nothing normal about having measurable amounts of industrial chemicals in my body—including some that have been banned for decades, like DDT. It isn't normal, but it is typical. We need to learn more about what it means to carry these chemicals in us.

Learning more is what biomonitoring is all about. Biomonitoring is an essential scientific tool that will help our society figure out which chemicals are safer and which chemicals are more dangerous. Biomonitoring can guide the innovations to safer jobs and safer communities. Companies across the United States and across the world, such as Dell Computers, Avalon, S.K. Johnson, Herman Miller, Kaiser Permanente, and Interface Carpet are already innovating their way to greater market share with more safe, and fewer less safe, chemicals. But these trailblazing companies need more data to be able to make their products even more safely.

The truth is that we don't have very much information about most of the chemicals in commerce. As study participant, writer, educator and organizational consultant *Martin Krasney*, says:

> For my entire lifetime, since 1945, we have been proliferating synthetic chemicals with no idea what they might be doing to us and our descendants.

The current federal law that regulates chemicals has promoted ignorance instead of information. By allowing all chemicals in the marketplace in 1976 to stay in use with no testing, and requiring only limited health and safety testing for the introduction of new chemicals, the Toxic Substances Control Act of 1976 has punished innovation and promoted the false notion that what we don't know can't hurt us. Biomonitoring will help us know more and allow us to turn what we learn into enlightened corporate and government policies that better protect our health.

LaDonna Williams was supposed to be among the Californians who were biomonitored in this study. Ms. Williams is a community leader from the Daly City, California neighborhood of Midway Village. As she explains:

> I had moved to Midway, a low-moderate income community of color built by HUD, believing it was a clean and safe environment to raise my young family with a big, beautiful park for my children to play in. But soon my kids were having health problems. Many of the young mothers from Midway, including myself, started noticing each other with our children in tow in the halls of Kaiser, and that our children were suffering from many of the same symptoms, everything from skin rashes, hair falling out, to severe neurological problems and deformities, the kinds of things you might expect from chemical exposures.
>
> In 1997 we formed a organization to deal with the fact that our community, as we discovered through months of research, had been built on a Superfund

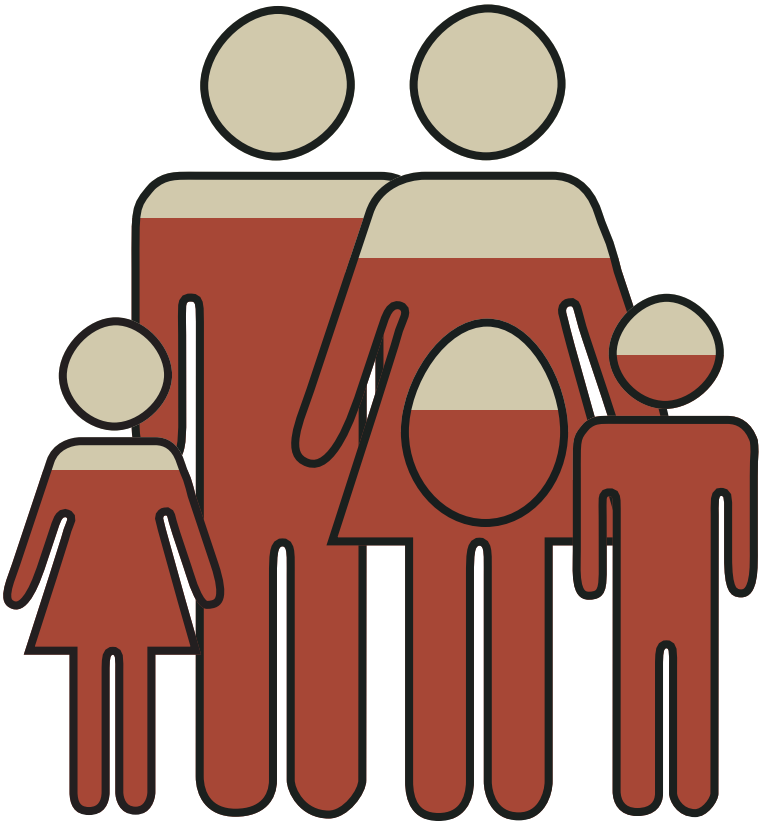
site, now managed by PG&E which should be responsible for remediation and containment. Arsenic, chromium, cyanide, lead are among the 350 hazardous chemicals found in the soil used as landfill in our community.

We need more research and I wanted to take part in the Commonweal study, in order to promote testing in Midway and other highly exposed communities. Such information will help us understand health and chemical exposure linkages and move our community decontamination campaigns. The health of all our children is at stake.

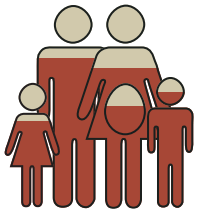
LaDonna's chronic health problems prevented her from providing the blood donation necessary for this study. We dedicate this report to her and to the day when we have the information we need to produce chemicals that are safe when they are made, safe when they are used and safe when they are thrown away. As more people know their own body burdens of toxic chemicals, public support for policies that reduce the body burdens of toxic chemicals that *all* Americans carry will grow increasingly strong.

Biomonitoring brings that day a little closer.

1. Wanna is referring to Andrea Martin, the founder of the Breast Cancer Fund who died in 2003 of metastatic brain cancer. Andrea was a participant in the Environmental Working Group's biomonitoring study along with several Commonweal staff members. (www.ewg.org/reports/bodyburden.)



PROJECT FINDINGS



In the spring of 2005, the Commonweal Biomonitoring Resource Center (CBRC) invited a group of Californians known for their integrity, wisdom, and commitment to community health and justice to participate in a study that would test their bodies for the presence of chemical body pollution. We wanted to learn more about the California chemical neighborhood, and we wanted to catalyze pubic discussion about how California might use biomonitoring as a public health tool by listening carefully to this group's responses to learning their chemical body burden.

Understanding more about how toxic chemicals within our bodies may form internal reservoirs capable of delivering environmental insult to our bodies' immune, reproductive, neurological and endocrine systems begins by collecting sound data. We hope this report will encourage support for further biomonitoring studies so the significance of chemical exposures and their possible linkages to health outcomes can better guide public health policy and individual choice.

The study measured the levels of over 25 chemicals in 6 categories, testing for seven phthalates; bisphenol-A (BPA) and one marker for bisphenol-A exposure; ten PFCs (perfluorochemicals); six PBDEs (polybrominated diphenyl ethers); mercury; and DDT and its metabolites.

An effort was made to compare our measurements with data from other contemporary U.S. populations with no known direct exposures to these chemicals. The only statistically-based, representative compilation of nationwide measurements is the U.S. Centers for Disease Control and Prevention (CDC) National Reports on Human Exposure to Environmental Chemicals (http://www.cdc.gov/exposurereport/). These reports, produced every two years, utilize biospecimens collected by the National Health and Nutrition Examination Survey (NHANES).

NHANES is a survey of the health and nutritional status of the U.S. civilian, non-institutionalized population with each year of data constituting a representative population sample. The most recent CDC National Report (2005) was used for comparison with this study whenever possible. Other relevant studies were also used to complement the CDC/NHANES information. Given the small sample size (eleven participants), comparison with other studies should not be considered definitive nor representative of the general population of California.

CBRC chose to biomonitor for a small number of chemicals, some of which have been inadequately studied by governmental agencies for their effects on human and ecosystem health. In some cases, studies by government regulators have either not yet been done, or information about chemicals' capacity to harm human and ecosystem health is out of date or incomplete.

However, a rapidly growing body of peer-reviewed studies in the field link exposure to these chemicals with a wide range of diseases and disabilities, including infertility, a variety of cancers, neurological defects, developmental abnormalities, obesity, heart disease, behavior disorders, immune system dysfunction, and organ failure, among other health outcomes.

We narrowed our list by selecting those chemicals currently under public scrutiny because of compelling new data generated by independent research. Recent studies are looking carefully at how these chemicals might act in mixtures, given that humans are rarely exposed to only one chemical at a time. Equally important are new studies about the vulnerability of certain populations, such as the developing child or individuals whose genetic structures may be particularly susceptible to those chemicals that can alter gene expression, and studies that look at effects linked to low-level chemical exposures *in utero*.

All of these studies are using biomonitoring data to revolutionize the old toxicology paradigms and are becoming increasingly part of mainstream science. Modern toxicol-

ogy is moving away from the simplistic concept that "the dose makes the poison" to the consideration of timing, multiple chemical exposures, genetic vulnerability, and low-level dose effect. Other factors such as nutrition, stress, and other environmental threats are also important when assessing the linkages between chemical exposure and health outcome.

Out of the six categories of chemicals tested, all study participants had detectable levels for at least one chemical within each category, although the amounts of chemicals found in the study participants differed widely both among the participants and with average American levels as reported by CDC.

Bisphenol A

In blood serum, four participants had measurable levels of bisphenol A (BPA) and all had measurable levels of the marker for bisphenol A exposure, known as BADGE-40H.

BPA is a building block of polycarbonate plastics, and is also found in food can linings, epoxy resins, fungicides, dyes, and dental sealants. BPA has been used by the food and beverage industry for more than forty years.

BPA has been found in 40 percent of stream water samples surveyed by the USGS. Bisphenol A diglycidyl ether (BADGE) is an epoxy resin derivative of BPA, used in coatings and dental sealants. Both BPA and BADGE are rapidly metabolized, but the hydrolysis product of BADGE (BADGE-4OH) has been proposed as a biomarker of exposure.

There are no CDC data from its National Exposure Reports on BPA in serum to use for comparison. However, a separate CDC study detected BPA in the urine of 95% of the 394 adults tested. The distribution of BPA and its metabolites in serum and excretion in urine are not well understood.

Mercury

The median level was 918 nanograms/gram, which is within the expected range of other studies which have measured mercury in hair. The CDC 2005 report tested for mercury in blood and urine.

Mercury is a naturally occurring metal with several industrial and pharmaceutical uses. Mercury is released through mining, coal combustion, and waste incineration. Elemental mercury can be transformed to methylated forms and can bioaccumulate in the food web. Consumption of seafood is a major exposure pathway to methyl mercury. Health effects include neurological impairment, kidney damage, and adverse reproductive outcomes.

DDT

All eleven participants tested positive for 4.4'-DDT and its metabolite, 4.4'-DDE. However, the actual levels present a somewhat complicated picture and one that may indicate good news. In general, participant levels of 4,4'- DDT were lower than CDC average levels, but levels of a metabolite of DDT, 4,4'- DDE, were in general higher. The ratio of 4,4'- DDE to 4, 4'- DDT is considered an indication of time of exposure, indicating that study participants' DDT exposure was not recent, probably evidence that the 1972 ban on DDT use in the United State has been effective in lowering DDT exposures.

Many organochlorine pesticides have been banned for decades, yet their persistence in the food web results in measurable albeit decreasing levels in human tissues.

Phthalates

All participants had measurable levels of at least four phthalates. The metabolites of seven phthalates were found in all eleven participants. Because phthalates are found everywhere and can easily contaminate laboratory equipment, scientists test for breakdown products or metabolites to ensure that actual body contamination is being measured.

Monoethyl phthalate, (mEtP—a metabolite for diethyl phthalate DEP) was the dominant phthalate found in the study. The next highest concentrations were found for mBuP, a metabolite of dibutyl phthalate (DBP).

Median concentrations were comparable to those found in the CDC 2005 report. However, individual levels of phthalates found in study participants diverged widely, some levels exceeding the CDC's 95th percentile, and others much lower, depending on the individual and the particular phthalate being tested for.

Phthalates are used extensively as plasticizers in vinyl or polyvinyl chloride (PVC) plastic, including children's toys, home furnishings, construction material, automobile accessories, cleaners, food packaging, and medical supplies. They are also scent stabilizers and are found in a variety of personal care products.

Perfluorochemicals (PFCs)

All participants had detectable levels of the perfluorochemicals PFOA and PFOS, chemicals used in surfactants, food packaging, stain-resistant textiles, paints, lubricants, and cleaners. Members of this group have been marketed under name brands such as Teflon, Stainmaster, Scotchgard, and Gore-Tex.

Perfluorochemicals (PFCs) are chains of carbon atoms to which fluorine atoms are strongly bonded. An important characteristic is their extreme persistence; there is virtually no evidence that they ever break down in the environment. Since the 1960s, PFCs have been measured in the blood of workers who have been occupationally exposed. PFOA and PFOS are the major PFCs in the blood of the general population in the United States.

The CDC has not yet tested for PFC exposures for the average American. The levels detected in this study were within the lower end of ranges observed in other US populations as measured by independent studies.

Polybrominated diphenyl ethers (PBDEs)

All participants showed detectable levels of 5 PBDEs, which are flame retardants. The concentrations were among the lowest reported from the U.S. to date. The CDC, however, has not yet biomonitored for PBDEs.

PBDEs are widely used as flame retardants in consumer electronics, foams, fabrics and other furnishings. PBDEs migrate out of parent consumer products and bioaccumulate in fatty tissue in the body. Increasing levels in human tissues and wildlife everywhere around the world, even in locations far from sites of production and use, have prompted legislative bans or voluntary withdrawals of some PBDE formulations in some jurisdictions.

Studies within the US have measured human milk or adipose tissue for concentrations of PBDEs, and it is difficult to make comparisons with this study since blood serum was used as a biospecimen.

BDE-47, which is a main component of the "penta" BDE commercial mixture, was the most prevalent congener found in our participants, although the measured concentrations varied dramatically in the group—the difference between the lowest and highest is approximately 10 fold. Concentrations of PBDEs found in the "octa" BDE commercial mixture were also detected in all of our study participants.

With the exception of a few chemicals (such as mercury or arsenic), individual chemical body burden levels are generally not predictive for individual health outcomes, for many reasons. Some chemicals simply have not been adequately tested for their effects on humans, either singly or in combination. Recent science indicates that timing of exposure, individual susceptibilities, and the interaction of chemical exposures with other factors such as nutrition, exercise and stress need to be considered in the evaluation of chemical safety. Although future epidemiological studies involving large numbers of participants may help us understand more about the complexities linking chemical exposures to health outcomes, individuals can use information about their own body pollution levels to help limit their exposures until testing is done to indicate which chemicals are truly safe.

More data is needed to determine what exposures in these study participants may be linked to diseases including certain cancers, asthma, Parkinson's Disease, infertility, learning disabilities and some birth defects. Without wider biomonitoring to establish patterns of exposures within California communities, including sources and pathways of exposure, we will be missing key information that can help us understand how chemical exposures may be linked to rising incidents of some diseases. Comprehensive, regular biomonitoring programs would enable us to establish baselines and track exposure trends. Until then, Californians will continue to be part of a vast chemistry experiment.

SUMMARY TABLE OF STUDY PARTICIPANTS

Chemical	Units	Philip Lee	Jo Behm	Peter Coyote	Luz Martinez	Wanna Wright	Kathy Gerwig	Stephen Privett	Catherine Dodd	Martin Krasney	Van Jones	Steve Lopez	Median	Min	Max
Mercury	ng/g	1,730	646	1,230	N/A	269	918	N/A	1,330	617	N/A	N/A	918	269	1,730
Pesticides:															
4,4'-DDE	ng/g fat	1,090	396	663	764	440	203	204	489	198	164	115	396	115	1,090
4,4'-DDT	ng/g fat	10.6	3.7	17.1	4.5	3.8	3.3	5.2	4.6	6.8	3.4	5.0	4.6	3.3	17.1
DDE/DDT	ratio	103	108	39	168	116	61	40	106	29	49	23	61	23	168
Flame Retardants:															
BDE-47	ng/g fat	14.1	37.4	5.6	54.5	4.9	13.1	48.1	28.8	5.3	25.4	7.4	14.1	4.9	54.5
BDE-99	ng/g fat	2.8	3.2	1.1	16.3	0.9	3.4	9.7	3.1	0.9	4.4	1.0	3.1	0.9	16.3
BDE-100	ng/g fat	2.1	3.6	1.3	8.7	1.0	1.8	8.6	5.4	0.7	9.9	0.9	2.1	0.7	9.9
BDE-153	ng/g fat	2.9	2.7	3.8	4.8	3.4	2.0	13.3	11.7	2.3	60.6	1.4	3.4	1.4	60.6
BDE-154	ng/g fat	0.3	0.2	0.3	1.2	0.1	0.2	0.9	0.4	0.1	0.6	0.1	0.28	0.08	1.16
Perfluorochemicals:															
PFOS	ng/mL	38	28.9	33.6	11.2	45.8	14.4	23	12.3	25.6	21	32	25.6	11.2	45.8
PFHxS	ng/mL	4.82	1.79	4.52	1.24	2.91	0.87	2.44	0.86	4.80	4.18	2.40	2.44	0.86	4.82
PFOA	ng/mL	6.31	8.28	5.55	2.58	4.28	7.94	5.28	3.18	5.30	6.65	4.62	5.30	2.58	8.28
PFPeA	ng/mL	0.26	0.56	0.36	0.23	0.19	0.56	0.18	0.46	0.23	0.22	0.18	0.23	0.18	0.56
PFHpA	ng/mL	0.08	0.24	0.20	0.04	0.10	0.61	0.16	0.05	0.14	0.32	0.08	0.14	0.04	0.61
PFNA	ng/mL	3.68	1.67	2.33	0.57	2.94	2.68	1.23	1.25	1.10	1.45	1.76	1.67	0.57	3.68
PFDA	ng/mL	0.57	0.49	0.56	0.19	0.70	0.79	0.43	0.34	0.32	0.38	0.41	0.43	0.19	0.79
PFUnA	ng/mL	0.40	0.40	0.83	0.10	0.59	0.38	0.57	0.26	0.31	0.41	0.61	0.40	0.10	0.83
PFDoA	ng/mL	0.12	0.13	0.14	0.16	0.11	0.10	0.20	0.10	0.08	0.09	0.12			
Bisphenol A:															
BADGE-4	ng/mL	37.7	20.2	5.26	4.03	12.8	11.9	13.5	49.1	17.8	7.18	1.24	12.80	1.24	49.10
BA	ng/mL	<0.267	0.447	<0.249	0.274	0.72	0.922	1.17	0.47	0.6	0.386	<0.264			
Phthalates:															
mMeP	ng/mL	10.21	<1.418	<0.807	2.22	33.1	42.05	14.15	<1.158	<9.066	7.4	<3.255	2.2	<1	42.05
mEtP	ng/mL	22.8	12.6	30.3	120	2150	190.5	636	28.2	72.8	25.2	3020	72.8	12.6	3020
mBuP	ng/mL	45.1	7.18	7.66	22.4	64.1	44.55	40.2	11	136	11	12.3	22.4	7.18	136
mBzP	ng/mL	12.3	<2.552	2.51	3.76	12.8	9.76	11.95	4.62	14.7	5.47	3.56	5.5	2.51	14.7
mEHP	ng/mL	2.5	1	1.56	13.3	18.4	2.275	157.5	8.63	7.26	5.78	9.49	7.3	1	157.5
mEOHP	ng/mL	5.415	1.54	1.7	38.3	55.1	7.835	368.5	17.7	15.7	12.5	35.2	15.7	1.54	368.5
mEHHP	ng/mL	7.825	2.57	3.61	58.9	95.2	14.8	749.5	37.1	40.2	17.3	68.9	37.1	2.57	749.5

INDIVIDUAL CHEMICAL PROFILE

Jo Rupert Behm

Jo Rupert Behm, M.S., RN, has been a health care educator for over 25 years. She is a recent past President of the California Learning Disabilities Association. Among her many affiliations are membership in the California Department of Education's Key Performance Stakeholders Committee; California coordinator for the Learning Disabilities Association of America's Healthy Children Project; membership in the U.C. Davis M.I.N.D. Institute CHARGE Study [Childhood Autism Risks from Genetics and the Environment] Community Advisory Council; and an active contributor and participant with the Environmental Health Legislative Working Group [EHLWG] in California.

Chemical	Specimen	Units	Jo Behm	Median
Mercury	hair	ng/g	646	918
Pesticides:				
4,4 -DDE	serum	ng/g fat	396	396
4,4 -DDT	serum	ng/g fat	3.7	4.6
DDE/DDT	serum	ratio	108	61
Flame Retardants:				
BDE-47	serum	ng/g fat	37.4	14.1
BDE-99	serum	ng/g fat	3.2	3.1
BDE-100	serum	ng/g fat	3.6	2.1
BDE-153	serum	ng/g fat	2.7	3.4
BDE-154	serum	ng/g fat	0.2	0.28
Perfluorochemicals:				
PFOS	serum	ng/mL	28.9	25.6
PFHxS	serum	ng/mL	1.79	2.44
PFOA	serum	ng/mL	8.28	5.30
PFPeA	serum	ng/mL	0.56	0.23
PFHpA	serum	ng/mL	0.24	0.14
PFNA	serum	ng/mL	1.67	1.67
PFDA	serum	ng/mL	0.49	0.43
PFUnA	serum	ng/mL	0.40	0.40
PFDoA	serum	ng/mL	0.13	
Bisphenol A:				
BADGE-4	serum	ng/mL	20.2	12.80
Bisphenol A	serum	ng/mL	0.447	
Phthalates:				
mMeP	urine	ng/mL	<1.418	2.2
mEtP	urine	ng/mL	12.6	72.8
mBuP	urine	ng/mL	7.18	22.4
mBzP	urine	ng/mL	<2.552	5.5
mEHP	urine	ng/mL	1	7.3
mEOHP	urine	ng/mL	1.54	15.7
mEHHP	urine	ng/mL	2.57	37.1

Jo Behm's Comments:

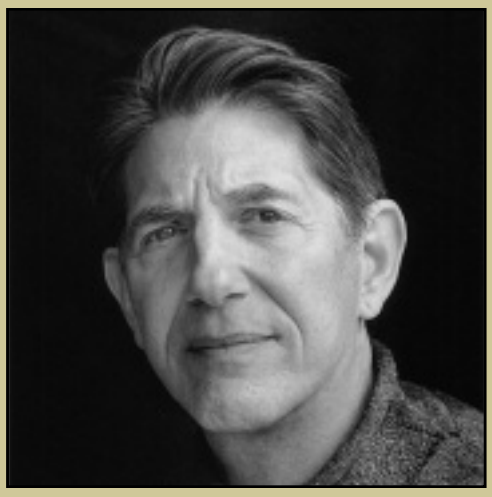
I agreed to participate in the Commonweal biomonitoring project basically to be able to support and give added credibility to my theory that nearly every living creature on all corners of the planet is loaded with an assortment of non-natural potentially harmful toxic substances. While mega-billions are committed to create more drugs [chemicals] to combat the rise of chronic disease, illness, and neurodevelopmental disabilities, these afflictions nevertheless continue to escalate, many far out-pacing the population growth over the same time period. While leaders and policymakers who could have made a difference have been oblivious, generation after generation has continued to carelessly poison our offspring and our environment.

Sadly, the average person is still naïve or in denial or too busy carpooling to be concerned so the necessary political will and momentum has yet to be realized. Meanwhile, the chemical industry has had free and unrestricted access to all unsuspecting life forms for over a half a century without any substantive, consistent regulatory oversight. The industry is incapable of policing itself so research on potential harm from toxins, especially in combination, is practically non-existent or a token effort. Bottom line is no industrialized country has connected the pollutant dots. If each of us harbors a couple hundred toxins at various levels, when will the other shoe drop—our own dreaded diagnosis or our child? No one knows. The U.S. government and American society have turned a blind eye and now we are dealing with a behemoth of almost unimaginable proportions.

I got connected to the world of learning disabilities, then all disabilities, because of our dear son Sean, now a 21 year-old junior in college who has dyslexia. Starting from scratch after he was diagnosed in first grade I have continued my new education and moved up the volunteer chain to advocate first locally, now statewide and nationally, for children with all forms of disabilities.

Neurodevelopmental disabilities can impact a child or teen's ability to learn, pay attention, memorize, organize, write legibly, make friends. No disability occurs in isolation—there is a constellation of challenges, some life-altering or life-limiting. As past state president of the Learning Disabilities Association of California, a mother, a nurse, and a public policy consultant, I am passionate about doing as much as possible to ensure that students with disabilities are able to succeed and prosper in school and life. But I also must look upstream at cause and prevention. Why are learning and other disabilities increasing across the nation and becoming far more complex?

INDIVIDUAL CHEMICAL PROFILE

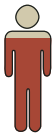


Peter Coyote

After graduating from Grinnell College with a BA in English Literature in 1964, and despite having been accepted at the prestigious Writer's Workshops in Iowa, Coyote moved to the West Coast to pursue a Master's Degree in Creative Writing at San Francisco State University. After a short apprenticeship at the San Francisco Actor's Workshop, he joined the San Francisco Mime Troupe, a radical political street theater. From 1975 to1983 Peter was a member of the California State Arts Council, the State agency that determines art policy. Mr. Coyote has performed in over 70 films, many of them award-winning. He is currently a board member of Baykeepers, a proactive organization which tracks pollution and polluters in the San Francisco Bay and aggressively pursues cessation of damage to the Bay. He is a member of the Academy of Motion Picture Arts and Sciences, The Screen Actor's Guild, and in 1997 was a delegate to the Democratic National Convention, which he also covered for *Mother Jones* Magazine.

Chemical	Specimen	Units	Peter Coyote	Median
Mercury	hair	ng/g	1,230	918
Pesticides:				
4,4 -DDE	serum	ng/g fat	663	396
4,4 -DDT	serum	ng/g fat	17.1	4.6
DDE/DDT	serum	ratio	39	61
Flame Retardants:				
BDE-47	serum	ng/g fat	5.6	14.1
BDE-99	serum	ng/g fat	1.1	3.1
BDE-100	serum	ng/g fat	1.3	2.1
BDE-153	serum	ng/g fat	3.8	3.4
BDE-154	serum	ng/g fat	0.3	0.28
Perflourochemicals:				
PFOS	serum	ng/mL	33.6	25.6
PFHxS	serum	ng/mL	4.52	2.44
PFOA	serum	ng/mL	5.55	5.30
PFPeA	serum	ng/mL	0.36	0.23
PFHpA	serum	ng/mL	0.20	0.14
PFNA	serum	ng/mL	2.33	1.67
PFDA	serum	ng/mL	0.56	0.43
PFUnA	serum	ng/mL	0.83	0.40
PFDoA	serum	ng/mL	0.14	
Bisphenol A:				
BADGE-4	serum	ng/mL	5.26	12.80
Bisphenol A	serum	ng/mL	<0.249	
Phthalates:				
mMeP	urine	ng/mL	<0.807	2.2
mEtP	urine	ng/mL	30.3	72.8
mBuP	urine	ng/mL	7.66	22.4
mBzP	urine	ng/mL	2.51	5.5
mEHP	urine	ng/mL	1.56	7.3
mEOHP	urine	ng/mL	1.7	15.7
mEHHP	urine	ng/mL	3.61	37.1

Peter Coyote's Comments



I take my temperature to see if I have a bacterial infection. It helps maintain health in my life. Now it's possible to examine more of the body's inner workings and judge my internal life. Is it healthy? Working well?

Recently I had a "body-burden" test, where 18 vials of blood, hair and urine were taken to test me for industrial pollutants like Teflon, mercury, and flame-retardants. It produces a picture of which stealth molecules have invaded me, molecules I did not know I drank or breathed or ate.

Having spent the last thirty years on the West Coast, breathing relatively clean air, and eating virtually only organic food, I was curious to see what my internal toxicology appeared to be. Needless to say, my system is loaded with numerous chemicals and toxins, known carcinogens, etc. While it is too early to tell the health effects, one can only imagine what people in the Midwest must be carrying.

The reason I took the test was to bring attention to the thousands and thousands of chemicals that are loosed in our environment with virtually no health testing. Unlike Europe, we do NOT follow a "precautionary principle" where manufacturers must demonstrate that a product is safe before it is released. Consequently, every mother on the planet has DDT in her breastmilk along with a host of other substances, many of which mimic hormones and fool the body into taking them up.

Well known metals like lead and mercury can raise my "toxic temperature" but, equally important, any of the 85,000 molecules that humans have invented and let loose in the world may do so as well. That's about 1,000 new molecules each year which are mysterious—we do not know what they do, or even how they get into us.

We are being poisoned by our wealth. I would like to see our legislators tested. If they were informed, they would have to take responsibility to stand up to the specious claims of industry that resists the testing of such substances. I would like to see biomonitoring made available to all Californians.

Taxpayers pay tens of millions of dollars to monitor and clean up Superfund sites. We can spend just a fraction of that to see if we, ourselves, have become toxic storage sites and have upset our own biochemical equilibrium. Our bodies should not be toxic waste storage sites.

INDIVIDUAL CHEMICAL PROFILE

Catherine Dodd

A native of the San Francisco Bay Area, Catherine Dodd, RN, MS, is the outgoing District Chief of Staff to Congresswoman and House Democratic Leader Nancy Pelosi. During the Clinton Administration, she served as Region 9 Director for the United States Department of Health and Human Services.

Trained as a Registered Nurse, Ms. Dodd has worked on a mobile health unit providing services to farmworkers and as a high-risk perinatal nurse. She has been active in the American Nurses Association at the local, state and national levels. She is the former Director of the Women's Health Center at San Francisco General Hospital.

Ms. Dodd also holds a master's degree in community health administration and is completing a Ph.D. in Medical Sociology. She teaches "Health Policy and Politics" in the graduate nursing program at San Francisco State University.

Her civic and community involvement includes serving on the Glide Foundation Board of Trustees, the Advisory Committee to the San Francisco Homeless Prenatal Project, and an elected member of San Francisco Democratic County Central Committee.

Chemical	Specimen	Units	Catherine Dodd	Median
Mercury	hair	ng/g	1330	918
Pesticides:				
4,4 -DDE	serum	ng/g fat	489	396
4,4 -DDT	serum	ng/g fat	4.6	4.6
DDE/DDT	serum	ratio	106	61
Flame Retardants:				
BDE-47	serum	ng/g fat	28.8	14.1
BDE-99	serum	ng/g fat	3.1	3.1
BDE-100	serum	ng/g fat	5.4	2.1
BDE-153	serum	ng/g fat	11.7	3.4
BDE-154	serum	ng/g fat	0.4	0.28
Perfluorochemicals:				
PFOS	serum	ng/mL	12.3	25.6
PFHxS	serum	ng/mL	0.86	2.44
PFOA	serum	ng/mL	3.18	5.30
PFPeA	serum	ng/mL	0.46	0.23
PFHpA	serum	ng/mL	0.05	0.14
PFNA	serum	ng/mL	1.25	1.67
PFDA	serum	ng/mL	0.34	0.43
PFUnA	serum	ng/mL	0.26	0.40
PFDoA	serum	ng/mL	0.10	
Bisphenol A:				
BADGE-4	serum	ng/mL	49.1	12.80
Bisphenol A	serum	ng/mL	0.47	
Phthalates:				
mMeP	urine	ng/mL	<1.158	2.2
mEtP	urine	ng/mL	28.2	72.8
mBuP	urine	ng/mL	11	22.4
mBzP	urine	ng/mL	4.62	5.5
mEHP	urine	ng/mL	8.63	7.3
mEOHP	urine	ng/mL	17.7	15.7
mEHHP	urine	ng/mL	37.1	37.1

Catherine Dodd's Comments

When I first got my results, I was immediately curious to know how I compared to others in the study. Was I normal or did I have high exposure relative to others? But I quickly realized there is no "normal." Synthetic chemicals in the body do not belong there in any amount. It is abnormal to have these chemicals inside us.

I was educated as an OB-GYN nurse, and have had a long personal and professional interest in women's health. My goal has always been to help make pregnancy safer for women. My experience in this biomonitoring study reinforces my commitment, but also raises new threats that I cannot address alone.

I am approaching my 50th birthday and have type 2 diabetes. I can take steps to control my blood sugar and prevent complications by making better choices with diet and exercise. My biomonitoring lab results reveal my chemical exposure, but I have no control of the risk I face. I am exposed when I open a can of food, or eat pizza because of the chemicals that are added to the lining of the can or the pizza box.

I can't control the risk because the chemical industry prevents us from learning about our exposures and their possible links to disease. We have a right to know what we are being exposed to and what risks these chemicals pose over our lifetime.

We label women who smoke, drink, or use drugs during pregnancy as irresponsible because they are exposing their fetus to dangerous substances. But where is the obligation for chemicals companies who put compounds in pizza boxes that expose pregnant women to potentially hazardous chemicals?

We have laws that restrict consumption and exposure to alcohol and tobacco because of the risks they pose. If we can take on the alcohol and tobacco companies, then we must muster the political will to challenge the chemical industry too. There is a Right To Know movement that enables us to know where hazardous waste and nuclear materials are transported. What we need now is the mechanism to know what risks we face from chemical exposure.

INDIVIDUAL CHEMICAL PROFILE

Kathy Gerwig

Kathy Gerwig is Vice President with a major healthcare organization, directing their national program aimed at eliminating occupational injuries. Previously, for this same organization, Kathy was responsible for developing and managing an award-winning national environmental stewardship initiative and she directed the national Environmental, Health and Safety department. Kathy is a member of the Board of Directors of Health Care Without Harm and of the Center for Environmental Health. She has an MBA, is a Certified Professional Healthcare Risk Manager, a Certified Healthcare Environmental Manager, and a Certified Professional Environmental Auditor.

Chemical	Specimen	Units	Kathy Gerwig	Median
Mercury	hair	ng/g	918	918
Pesticides:				
4,4 -DDE	serum	ng/g fat	203	396
4,4 -DDT	serum	ng/g fat	3.3	4.6
DDE/DDT	serum	ratio	61	61
Flame Retardants:				
BDE-47	serum	ng/g fat	13.1	14.1
BDE-99	serum	ng/g fat	3.4	3.1
BDE-100	serum	ng/g fat	1.8	2.1
BDE-153	serum	ng/g fat	2.0	3.4
BDE-154	serum	ng/g fat	0.2	0.28
Perfluorochemicals:				
PFOS	serum	ng/mL	14.4	25.6
PFHxS	serum	ng/mL	0.87	2.44
PFOA	serum	ng/mL	7.94	5.30
PFPeA	serum	ng/mL	0.56	0.23
PFHpA	serum	ng/mL	0.61	0.14
PFNA	serum	ng/mL	2.68	1.67
PFDA	serum	ng/mL	0.79	0.43
PFUnA	serum	ng/mL	0.38	0.40
PFDoA	serum	ng/mL	0.10	
Bisphenol A:				
BADGE-4	serum	ng/mL	11.9	12.80
Bisphenol A	serum	ng/mL	0.922	
Phthalates:				
mMeP	urine	ng/mL	42.05	2.2
mEtP	urine	ng/mL	190.5	72.8
mBuP	urine	ng/mL	44.55	22.4
mBzP	urine	ng/mL	9.76	5.5
mEHP	urine	ng/mL	2.275	7.3
mEOHP	urine	ng/mL	7.835	15.7
mEHHP	urine	ng/mL	14.8	37.1

Kathy Gerwig's Comments

There's a concept called the "normalization of deviance" which means as gradual degradation from the ideal state occurs, we adapt to or ignore the deviation. The lower standard of performance becomes accepted as normal. There is nothing normal about having measurable amounts of industrial chemicals in my body—including some that have been banned for decades, like DDT. It isn't normal, but it is typical.

How can we possibly hope to change what appears to some to be a hopelessly insurmountable problem? We can empower ourselves with knowledge.

I work in the health care sector, and I've seen firsthand the positive impact individuals can have in achieving global change once they possess the knowledge to take action. Because health care practitioners were appalled to learn that incineration of plastic medical waste was a significant source of dioxin (a potent carcinogen), they joined a campaign to find safe waste treatment alternatives. Today, hundreds of incinerators in the US have been closed as a result, and the message is being heard internationally. The knowledge that the health care professionals had about the effects of incineration led to change.

Health care leaders have also demanded that manufacturers of building products develop safer materials. Now, those safer products — like vinyl-free carpet — are readily available. The knowledge these individuals had about the health effects of toxic materials led to change. Many, many manufacturers are vying for market positioning in response to the signals being sent by big healthcare purchasers.

If knowledge is power, then we are powerless when it comes to knowing the linkages between most industrial chemicals and diseases or illnesses. We need to understand how small exposures impact our health. We need to understand the cumulative effects of the mixture of chemicals we carry —without permission — inside us. Biomonitoring is the first step. It documents what's inside us. That knowledge, put to good use, will inform economic and political decisions.

Chemical pollution is a manmade problem, and we can and must create solutions. But a healthy outcome will only occur if we demand information and data, and use it wisely. This problem is far from insurmountable. We are up to the task.

My sister, Corinne, died one year ago from cancer. I participated in this study to honor her and the millions like her who make up a tragically growing statistic.

INDIVIDUAL CHEMICAL PROFILE

Van Jones

Van Jones is the founder and Executive Director of the Ella Baker Center for Human Rights in Oakland, a national organization that challenges human rights abuses in the U.S. criminal justice system. Born in rural west Tennessee in 1968, Van is a 1990 graduate of the University of Tennessee at Martin and a 1993 graduate of the Yale Law School.

During his extensive work in media and communications, Van has worked as a professional journalist, independent publisher, cartoonist, columnist, and board member for progressive media organizations. He has built bridges between socially responsible business leaders and human rights activists, reflected in his service as a board member of the Social Venture Network.

He has been named a Global Leader for Tomorrow (2002); an Ashoka Fellow (2000-03); a Kerry Kennedy Cuomo "Human Rights Defender" (2000); a Reebok International Human Rights Award recipient (1998); a Rockefeller Foundation "Next Generation Leadership" Fellow (1997-99); and a Do Something BRICK Community Leader (1996).

Chemical	Speciman	Units	Van Jones	Median
Mercury	hair	ng/g	N/A*	918
Pesticides:				
4,4 -DDE	serum	ng/g fat	164	396
4,4 -DDT	serum	ng/g fat	3.4	4.6
DDE/DDT	serum	ratio	49	61
Flame Retardants:				
BDE-47	serum	ng/g fat	25.4	14.1
BDE-99	serum	ng/g fat	4.4	3.1
BDE-100	serum	ng/g fat	9.9	2.1
BDE-153	serum	ng/g fat	60.6	3.4
BDE-154	serum	ng/g fat	0.6	0.28
Perfluorochemicals:				
PFOS	serum	ng/mL	21	25.6
PFHxS	serum	ng/mL	4.18	2.44
PFOA	serum	ng/mL	6.65	5.30
PFPeA	serum	ng/mL	0.22	0.23
PFHpA	serum	ng/mL	0.32	0.14
PFNA	serum	ng/mL	1.45	1.67
PFDA	serum	ng/mL	0.38	0.43
PFUnA	serum	ng/mL	0.41	0.40
PFDoA	serum	ng/mL	0.09	
Bisphenol A:				
BADGE-4	serum	ng/mL	7.18	12.80
Bisphenol A	serum	ng/mL	0.386	
Phthalates:				
mMeP	urine	ng/mL	7.4	2.2
mEtP	urine	ng/mL	25.2	72.8
mBuP	urine	ng/mL	11	22.4
mBzP	urine	ng/mL	5.47	5.5
mEHP	urine	ng/mL	5.78	7.3
mEOHP	urine	ng/mL	12.5	15.7
mEHHP	urine	ng/mL	17.3	37.1

* No sample given.

Van Jones's comments

This experience has reinforced for me, at a personal level, the importance of respecting the precautionary principle in our environment and health policy making.

Many chemicals have been designed to serve some useful function, whether it is to prevent deaths in fires through the use of flame retardants, or to keep our clothes clean with grease repellents.

The problem is we haven't done our homework in assessing these substances, and we now find there are unintended consequences which are quite serious, often outweighing the benefits we thought we were getting. We have discovered that the very same acts that we thought were improving our lives have actually been poisoning us.

Corporate motivations focus on maximizing profits. The private sector isn't out to screw the public, but there are no incentives to encourage private sector policies that take a longer view. If health and environmental costs can be externalized, if someone else will pay for them, the corporation will stand aside and let this happen every time.

To fix this, we need to go beyond changing our personal or individual behavior. Working out at the gym, drinking filtered water, or meditation won't protect you. No one is exempt from exposure. We have to go beyond simply looking at how we stack up compared to others.

Therefore, we want to reward a slower, more wisdom-based approach to the development of science and innovation. If this means products come to market more slowly, it's because we all agree that the extra time will result in a better product.

Innovation must be for something more than just speeding products to market for higher profits. The government needs to provide incentives that reflect and reward our evolving scientific understanding of chemicals and their impacts. The power of government as a public partner is essential. The private sector can't make these changes without a framework of common rules, penalties and supports that only government can provide. This is a collective problem that will require collective solutions.

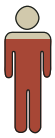
INDIVIDUAL CHEMICAL PROFILE

Martin Krasney

Martin Krasney is a writer, educator and management consultant who divides his time between organizational work and writing literary fiction. From 2000 to 2003, he managed The Lasker Millennial Ethics Forum examining the ethical and public policy ramifications of recent advances in biomedical research. From 1991 to 1996, he was the executive director of The Coalition for the Presidio Pacific Center, a collaborative initiative working toward the establishment of a major new international center for sustainable development in the Presidio of San Francisco. Previous employers include Levi Strauss & Co, ARCO, The Aspen Institute, The Woodrow Wilson Foundation and American Leadership Forum. He attended the Global Summit at the United Nations Conference on Sustainable Development. He is married with two children, one grandson, and a second grandson on the way.

Chemical	Specimen	Units	Martin Krasney	Median
Mercury	hair	ng/g	617	918
Pesticides:				
4,4 -DDE	serum	ng/g fat	198	396
4,4 -DDT	serum	ng/g fat	6.8	4.6
DDE/DDT	serum	ratio	29	61
Flame Retardants:				
BDE-47	serum	ng/g fat	5.3	14.1
BDE-99	serum	ng/g fat	0.9	3.1
BDE-100	serum	ng/g fat	0.7	2.1
BDE-153	serum	ng/g fat	2.3	3.4
BDE-154	serum	ng/g fat	0.1	0.28
Perfluorochemicals:				
PFOS	serum	ng/mL	25.6	25.6
PFHxS	serum	ng/mL	4.80	2.44
PFOA	serum	ng/mL	5.30	5.30
PFPeA	serum	ng/mL	0.23	0.23
PFHpA	serum	ng/mL	0.14	0.14
PFNA	serum	ng/mL	1.10	1.67
PFDA	serum	ng/mL	0.32	0.43
PFUnA	serum	ng/mL	0.31	0.40
PFDoA	serum	ng/mL	0.08	
Bisphenol A:				
BADGE-4	serum	ng/mL	17.8	12.80
Bisphenol A	serum	ng/mL	0.6	
Phthalates:				
mMeP	urine	ng/mL	<9.066	2.2
mEtP	urine	ng/mL	72.8	72.8
mBuP	urine	ng/mL	136	22.4
mBzP	urine	ng/mL	14.7	5.5
mEHP	urine	ng/mL	7.26	7.3
mEOHP	urine	ng/mL	15.7	15.7
mEHHP	urine	ng/mL	40.2	37.1

Martin Krasney's Comments



It is appalling to learn the diversity and magnitude of the residual unregulated chemical waste in my body and to contemplate the unknown unhealthy ramifications that might result. And to recognize that if this is what I'm carrying without ever having worked in industry or agriculture or lived in close proximity to them, how much worse it must be for those who work on heavily fertilized and sprayed farms or in heavy manufacturing. And to think that for my entire lifetime, since 1945, we have been proliferating synthetic chemicals with no idea what they might be doing to us and to our descendants.

I asked Dr. Michael McCally, health director for the Commonweal study, whether any human being one hundred years ago would have carried in his or her body burden any of the manufactured chemicals that my tests revealed and he replied that no one would have had them.

Among the everyday sources for the chemicals found through biomonitoring in me and my Commonweal colleagues are adhesives, aerosols, anti-lock brakes, aviation fuel, batteries, bleach, brake fluid, carpeting, ceramics, child-proof wall finishes, colognes, computers, contact lens cleaning solution, copper & brass polishes, cosmetics, crystal tableware, decorative ink, dental amalgams, detergents, dyes, electronic equipment, explosives, floor cleaners, fluorescent lamps, food additives, food packaging, fungicides, furniture refinishers, gasoline, hair sprays, hand cream, inks, insect repellent, lacquer, light switches in cars, liniment, liquid soap, lotion, lozenges, nail polish, paint, paint brush cleaners, paper, pesticides, pigments, polishing compounds, primers, rubber, rubbing alcohol, rug shampoos, seafood, sealants, shampoo, shaving cream, silicone sprays, spot cleaners, spray lubricants, thermometers, thermostats, vaccinations, varnish and VCR head cleaners.

It is inconceivable that most Americans will be willing to forego these advances. It is therefore imperative that we be able to ascertain what they really and fully cost us; and that those who manufacture and profit from them be held responsible for remediation and compensation, and for strenuous efforts to produce healthy alternatives.

I also think that it is essential for laws to be written that facilitate biomonitoring for anyone who wants it, as a means of gauging personal health and attaining understanding and healing. Furthermore, because so much toxicity aggregates in specific populations, it is important and just that support be provided for community-based biomonitoring, which would enable groups aligned or affiliated though geography, vocation, ethnicity or other pertinent characteristics to aggregate their biomonitoring results and interpretations, and therefore be able to search together for remedies and remediation.

INDIVIDUAL CHEMICAL PROFILE

Philip Lee

(receiving the Director's Award for his contributions to the Human Biology Program, Stanford University, 2004-05)

Philip R. Lee, MD is one of the living legends of American public health. He has been Chancellor of the University of California, San Francisco, United States Assistant Secretary of Health for two presidential administrations, first President of the San Francisco Health Commission, and for many years a professor in the medical schools of both Stanford University and UCSF.

Chemical	Specimen	Units	Philip Lee	Median
Mercury	hair	ng/g	1,730	918
Pesticides:				
4,4 -DDE	serum	ng/g fat	1,090	396
4,4 -DDT	serum	ng/g fat	10.6	4.6
DDE/DDT	serum	ratio	103	61
Flame Retardants:				
BDE-47	serum	ng/g fat	14.1	14.1
BDE-99	serum	ng/g fat	2.8	3.1
BDE-100	serum	ng/g fat	2.1	2.1
BDE-153	serum	ng/g fat	2.9	3.4
BDE-154	serum	ng/g fat	0.3	0.28
Perfluorochemicals:				
PFOS	serum	ng/mL	38	25.6
PFHxS	serum	ng/mL	4.82	2.44
PFOA	serum	ng/mL	6.31	5.30
PFPeA	serum	ng/mL	0.26	0.23
PFHpA	serum	ng/mL	0.08	0.14
PFNA	serum	ng/mL	3.68	1.67
PFDA	serum	ng/mL	0.57	0.43
PFUnA	serum	ng/mL	0.40	0.40
PFDoA	serum	ng/mL	0.12	
Bisphenol A:				
BADGE-4	serum	ng/mL	37.7	12.80
Bisphenol A	serum	ng/mL	<0.267	
Phthalates:				
mMeP	urine	ng/mL	10.21	2.2
mEtP	urine	ng/mL	22.8	72.8
mBuP	urine	ng/mL	45.1	22.4
mBzP	urine	ng/mL	12.3	5.5
mEHP	urine	ng/mL	2.5	7.3
mEOHP	urine	ng/mL	5.415	15.7
mEHHP	urine	ng/mL	7.825	37.1

Philip Lee's Comments

I'm now 81 years old. I've lived for extended periods in California, Minnesota, New York, Washington DC, and Boston. Regarding biomonitoring, I was very curious to learn not only what chemicals I have been exposed to, but where and how.

Biomonitoring only answers the first of those questions, but it's the most important one. Any scientist will tell you that in order to do good research, you need good data. Biomonitoring produces data we need. From a health policy point of view, it is the start of some very important efforts to protect the health of people no matter where they live.

Every year, more scientific evidence is gathered which elucidates the diverse and complex mechanisms by which industrial chemicals found in human bodies can impact our health. Some esteemed scientists even speak of a "revolution" in this field, wherein previously unknown impacts at small exposures, such as developmental effects traced to exposure in the womb and at young ages, are being established in well-conducted research published in the best peer-reviewed scientific journals. As we learn more about which of the tens of thousands of chemicals used by humans have such impacts, it becomes ever more important that we also learn which of these chemicals are already present in human bodies, and in what quantities.

Any good public health effort starts with good science. As good science starts with the collection of relevant data, assessing human exposure to chemicals and other substances known or suspected to harm human health is imperative if we are to learn how to best use California's resources for identification and prevention of a wide range of health conditions.

The scientific measurement of true exposures of chemicals gathered in biomonitoring programs can be used to improve public health by identifying individuals and communities affected by chemical exposure; by assessing the effectiveness of current legislative regulations; by creating a base for appropriate regulatory action, and by educating professionals and the public.

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INDIVIDUAL CHEMICAL PROFILE

Steve Lopez

Journalist Steve Lopez grew up in Pittsburg, California. He joined the staff of the Los Angeles Times in May 2001 where his popular column "Points West" appears.

He has written for *Time*, *Sports Illustrated*, *Life*, *Entertainment Weekly*, the *San Jose Mercury News*, the *Oakland Tribune*, and *The Philadelphia Inquirer*. During his 12 years at the Inquirer, he filed dispatches from Iraq, Bosnia, Colombia and the Soviet Union. He has been awarded the H.L. Mencken Writing Award; the Ernie Pyle Award for human interest writing; a National Headliner Award for column writing; and a Society of Professional Journalists Award for national magazines.

He is the author of three novels: "Third and Indiana," "The Sunday Macaroni Club," and "In the Clear." A collection of his columns is published in the book "Land of Giants: "Where No Good Deed Goes Unpunished."

Chemical	Specimen	Units	Steve Lopez	Median
Mercury	hair	ng/g	N/A*	918
Pesticides:				
4,4 -DDE	serum	ng/g fat	115	396
4,4 -DDT	serum	ng/g fat	5.0	4.6
DDE/DDT	serum	ratio	23	61
Flame Retardants:				
BDE-47	serum	ng/g fat	7.4	14.1
BDE-99	serum	ng/g fat	1.0	3.1
BDE-100	serum	ng/g fat	0.9	2.1
BDE-153	serum	ng/g fat	1.4	3.4
BDE-154	serum	ng/g fat	0.1	0.28
Perfluorochemicals:				
PFOS	Serum	ng/mL	32	25.6
PFHxS	serum	ng/mL	2.40	2.44
PFOA	serum	ng/mL	4.62	5.30
PFPeA	serum	ng/mL	0.18	0.23
PFHpA	serum	ng/mL	0.08	0.14
PFNA	serum	ng/mL	1.76	1.67
PFDA	serum	ng/mL	0.41	0.43
PFUnA	serum	ng/mL	0.61	0.40
PFDoA	serum	ng/mL	0.12	
Bisphenol A:				
BADGE-4	serum	ng/mL	1.24	12.80
Bisphenol A	serum	ng/mL	<0.264	
Phthalates:				
mMeP	urine	ng/mL	<3.255	2.2
mEtP	urine	ng/mL	3020	72.8
mBuP	urine	ng/mL	12.3	22.4
mBzP	urine	ng/mL	3.56	5.5
mEHP	urine	ng/mL	9.49	7.3
mEOHP	urine	ng/mL	35.2	15.7
mEHHP	urine	ng/mL	68.9	37.1

* Lab unable to test.

Steve Lopez's Comments

Excerpted from Steve Lopez's column "Points West" in the Los Angeles Times*, April 13, 2005 and June 8, 2005.*

I've always been curious about the long-term health effect of growing up in the industrial Bay Area town of Pittsburg. Pittsburg was home to Dow Chemical, DuPont, Allied Chemical, U.S. Steel, Johns Manville and PG&E, among other smokestack companies. They were the lifeblood of the town, putting food on tables for tens of thousands of people. But cancer and respiratory diseases always seemed to keep the mortuary busy.

It turns out I'm a walking cocktail of toxic chemicals. None of this came as a surprise. We've all ingested and inhaled chemicals in our lifetimes, and some of them linger in the body for decades. What's different in my case is that I've got the evidence right here in front of me.

Why are rates of breast cancer, testicular cancer, lymphocytic leukemia, autism and asthma on the rise? The correct answer is that we don't know. To biomonitoring advocates, this is a good reason to start gathering more data.

Should I be worried about any of this? I don't intend to lose any sleep, and far as I can tell, there's no need for me to go running to the nearest emergency room. To be honest, I would rather not die from being terrified of life.

Despite the many modern conveniences made possible by chemicals, I have trouble trusting the chemical industry any more than I ever trusted the drug-manufacturing and cigarette industries, all of which have excelled at buying off politicians and keeping regulators at bay. We ought to be capable of stain-resistant rug products that don't leave chemical deposits in children for years.

INDIVIDUAL CHEMICAL PROFILE

Luz Alvarez Martinez

Luz Alvarez Martinez is a self-described Chicana, indigena, Mexicana, mestiza woman dedicated to the empowerment of Latina women and girls. She has worked and traveled in many parts of the world, giving her a broad understanding into connections between the health of indigenous women and women of color, and the politics of their countries.

Luz co-founded the National Latina Health Organization in 1986 in Oakland, and served as its Executive Director until 2005. She is a member of the Minority Women's Health Panel of Experts of the National Office of Women's Health (1997-2005); member of the Women's Health Council of the Office of Women's Health of the State of California (1997-present); and co-founder of Sister Song, a women of color collective focused on reproductive health rights.

She grew up in a California farmworker family that worked in the fields in Gilroy, Fremont, and Santa Rosa. An early supporter of the United Farm Workers, Luz was a feminist and environmentalist before "environmentalism" and "feminism" became terms in wide usage. She has four children and three grandchildren, and has been an Aztec ceremonial dancer since 1993.

Chemical	Specimen	Units	Luz Martinez	Median
Mercury	hair	ng/g	N/A*	918
Pesticides:				
4,4 -DDE	serum	ng/g fat	764	396
4,4 -DDT	serum	ng/g fat	4.5	4.6
DDE/DDT	serum	ratio	168	61
Flame Retardants:				
BDE-47	serum	ng/g fat	54.5	14.1
BDE-99	serum	ng/g fat	16.3	3.1
BDE-100	serum	ng/g fat	8.7	2.1
BDE-153	serum	ng/g fat	4.8	3.4
BDE-154	serum	ng/g fat	1.2	0.28
Perfluorochemicals:				
PFOS	serum	ng/mL	11.2	25.6
PFHxS	serum	ng/mL	1.24	2.44
PFOA	serum	ng/mL	2.58	5.30
PFPeA	serum	ng/mL	0.23	0.23
PFHpA	serum	ng/mL	0.04	0.14
PFNA	serum	ng/mL	0.57	1.67
PFDA	serum	ng/mL	0.19	0.43
PFUnA	serum	ng/mL	0.10	0.40
PFDoA	serum	ng/mL	0.16	
Bisphenol A:				
BADGE-4	serum	ng/mL	4.03	12.80
Bisphenol A	serum	ng/mL	0.274	
Phthalates:				
mMeP	urine	ng/mL	2.22	2.2
mEtP	urine	ng/mL	120	72.8
mBuP	urine	ng/mL	22.4	22.4
mBzP	urine	ng/mL	3.76	5.5
mEHP	urine	ng/mL	13.3	7.3
mEOHP	urine	ng/mL	38.3	15.7
mEHHP	urine	ng/mL	58.9	37.1

* Lab unable to test.

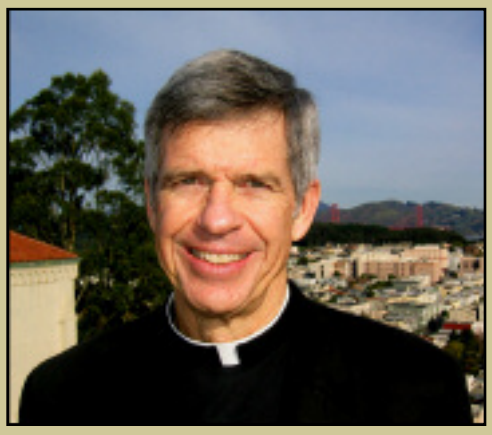
Luz Alvarez Martinez's Comments

When I was first recruited for the study, I wondered why I was being asked to participate rather than people who are clearly more highly exposed to chemicals, like farm workers. I now see it's important for us to understand that everyone carries a body burden, but we cannot forget or neglect those who are at higher risk.

I am still trying to digest my results. It's difficult to know what the impact may be from my exposures. Certainly more information needs to be made available—this is critical. Government and corporations continue to deny there is a problem despite mounting evidence that many diseases are on the rise that have plausible links to environmental exposure to chemicals. Industry's interests—to generate profits—are simply assumed to be beneficial for everyone. Meanwhile, the costs to people's health are ignored while we continue to be exposed without our knowledge or our consent.

But it is scary that the general public isn't getting sufficient information about the pervasive exposure we all experience to these chemicals. We need a comprehensive education strategy that brings messages about chemicals into the homes of our communities on a daily basis. Part of this strategy should be placing stories in mainstream media outlets that target women's health or mothers. In California, the Spanish language media is enormous and offers great opportunities.

INDIVIDUAL CHEMICAL PROFILE



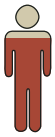
Stephen Privett

Father Stephen Privett, S.J. is the 27th president of the University of San Francisco, a graduate of the Catholic University of America, the Jesuit School of Theology in Berkeley, and Gonzaga University. His expertise is the Hispanic community and the role it plays in the Catholic Church. Fr. Privett serves as a trustee at Seattle University, Universidad Iberoamericana in Mexico City, and Brophy College Preparatory in Phoenix, AZ. He is a member of the Board of Governors of the Commonwealth Club of California, and serves on the Board of Directors of the Association of Catholic Colleges and Universities.

Chemical	Specimen	Units	Stephen Privett	Median
Mercury	hair	ng/g	N/A*	918
Pesticides:				
4,4 -DDE	serum	ng/g fat	204	396
4,4 -DDT	serum	ng/g fat	5.2	4.6
DDE/DDT	serum	ratio	40	61
Flame Retardants:				
BDE-47	serum	ng/g fat	48.1	14.1
BDE-99	serum	ng/g fat	9.7	3.1
BDE-100	serum	ng/g fat	8.6	2.1
BDE-153	serum	ng/g fat	13.3	3.4
BDE-154	serum	ng/g fat	0.9	0.28
Perfluorochemicals:				
PFOS	serum	ng/mL	23	25.6
PFHxS	serum	ng/mL	2.44	2.44
PFOA	serum	ng/mL	5.28	5.30
PFPeA	serum	ng/mL	0.18	0.23
PFHpA	serum	ng/mL	0.16	0.14
PFNA	serum	ng/mL	1.23	1.67
PFDA	serum	ng/mL	0.43	0.43
PFUnA	serum	ng/mL	0.57	0.40
PFDoA	serum	ng/mL	0.20	
Bisphenol A:				
BADGE-4	serum	ng/mL	13.5	12.80
Bisphenol A	serum	ng/mL	1.17	
Phthalates:				
mMeP	urine	ng/mL	14.15	2.2
mEtP	urine	ng/mL	636	72.8
mBuP	urine	ng/mL	40.2	22.4
mBzP	urine	ng/mL	11.95	5.5
mEHP	urine	ng/mL	157.5	7.3
mEOHP	urine	ng/mL	368.5	15.7
mEHHP	urine	ng/mL	749.5	37.1

* Lab unable to test.

Stephen Privett's Comments



I chose to participate in Commonweal's biomonitoring project because it seemed to be a relatively painless way to contribute to the overall well being of the community. As an educator, I believe that knowledge is our most valuable asset and what could be more valuable than learning about the chemicals our bodies have absorbed without our prior knowing or consent. The project was for me a learning experience, and one that I hope will generate some interest and enthusiasm for exploring the consequences, for myself and the community, of our carrying within us so many toxic chemicals. Participation in the biomonitoring project has been a catalyst to learn more about the health threats posed by the toxic chemicals that are in the air that we breathe, the water that we drink and the food that we consume.

INDIVIDUAL CHEMICAL PROFILE

LaDonna Williams

LaDonna Williams founded and serves as Executive Director for "People for Children's Health and Environmental Justice." She has traveled from Louisiana's Cancer Alley to the island of Vieques in Puerto Rico helping impacted community members address the negative environmental health impacts caused by irresponsible business, military and government agency actions. Ms. Williams is a California EPA Environmental Justice Advisory Committee member who is currently working with the Midway Village community to demand relocation from a hazardous Superfund site.

Chemical	Specimen	Units	Median
Mercury			
Pesticides:			
4,4 -DDE			
4,4 -DDT			
DDE/DDT			
Flame Retardants:			
BDE-47			
BDE-99			
BDE-100			
BDE-153			
BDE-154			
Perfluorochemicals:			
PFOS			
PFHxS			
PFOA			
PFPeA			
PFHpA			
PFNA			
PFDA			
PFUnA			
PFDoA			
Bisphenol A:			
BADGE-4			
Bisphenol A			
Phthalates:			
mMeP			
mEtP			
mBuP			
mBzP			
mEHP			
mEOHP			
mEHHP			

LaDonna Williams needed to withdraw from the biomonitoring testing segment of the project because of anemia, a health problem directly related to exposure of Naphthalene, one of the toxins contaminating the Midway village site.

She and Midway Village community members believe that a community-based biomonitoring project in Midway could be critically important in their relocation and chemical containment campaigns.

LaDonna Williams's Comments

I wanted to be part of the project and be tested for my own chemical body burden level because of illnesses suffered in my family relating to many years of toxic exposure as members of a highly contaminated community, Midway Village, part of Daly City, California. I moved to Midway, a low-moderate income community of color built by HUD, believing it was a clean and safe environment to raise my young family with a big, beautiful park for my children to play in.

But shortly after we moved to the site, my kids began experiencing severe health problems. Many of the young mothers from Midway, including myself, would see each other regularly with our children in tow in the halls of Kaiser and St. Mary's Hospital, many suffering the same symptoms, everything from skin rashes, hair falling out, to severe neurological problems, seizures and deformities, the kinds of things you might expect from chemical exposures.

Although agencies were fully aware of the toxins in the community, residents were not warned or informed of the danger to our health, lives and environment, which resulted in myself and neighbors allowing our children to play on a toxic playground, toxic mounds of dirt and a creek which was located on site. Many current and former neighbors have died and many more suffer from cancers and other related illnesses. To date children are required to use the site for their Physical Education requirements for school.

In 1997 we formed an organization to deal with the fact that our community, as we discovered through months of research, had been built on a heavily contaminated superfund site now managed by PG&E which should be responsible for remediation. We wanted to be tested for the presence of these chemicals in our bodies and we couldn't find any agency that would initiate that process.

Many of the mothers in Midway were forced to be our own doctors, identifying our illnesses and diseases related to the toxic exposures, since most doctors haven't studied the possible linkages between chemical exposures and the kinds of diseases we are all experiencing—diabetes, cancer, high rates of asthma, and a high suicide rate that may indicate neurological defects. We need more research, and I wanted to take part in the Commonweal study in order to promote testing in Midway and other highly exposed communities. The health of our children, ourselves, and communities is at stake.

INDIVIDUAL CHEMICAL PROFILE

Wanna Wright

Wanna Wright is a women's health advocate, poet, playwright and producer. Her works include "Alive to Testify" and "No Neva Mind/It's Mind/I Mind." She is a cervical and breast cancer survivor. She serves on the board of directors for the Women's Cancer Resource Center and the Breast Cancer Fund.

Wanna has tirelessly contributed her time to assist women with cancer in the Bay Area and beyond. Wright works to ensure that women with cancer have access to treatment, information and the support that they need as they go through the process of living with cancer. She has worked as a community educator participating in various projects designed to educate low-income women about their cancer screening options.

In 1999 Wright received Zeta Phi Beta's Phenomenal Woman Award and in 2000 she received both the Intercultural Cancer Council's Hope Award and Channel 7's Profile in Excellence Award. In 2001 Wright was the recipient of the Breast Cancer Fund's Bella Abzug Advocacy Award.

Chemical	Specimen	Units	Wanna Wright	Median
Mercury	hair	ng/g	269	918
Pesticides:				
4,4 -DDE	serum	ng/g fat	440	396
4,4 -DDT	serum	ng/g fat	3.8	4.6
DDE/DDT	serum	ratio	116	61
Flame Retardants:				
BDE-47	serum	ng/g fat	4.9	14.1
BDE-99	serum	ng/g fat	0.9	3.1
BDE-100	serum	ng/g fat	1.0	2.1
BDE-153	serum	ng/g fat	3.4	3.4
BDE-154	serum	ng/g fat	0.1	0.28
Perfluorochemicals:				
PFOS	serum	ng/mL	45.8	25.6
PFHxS	serum	ng/mL	2.91	2.44
PFOA	serum	ng/mL	4.28	5.30
PFPeA	serum	ng/mL	0.19	0.23
PFHpA	serum	ng/mL	0.10	0.14
PFNA	serum	ng/mL	2.94	1.67
PFDA	serum	ng/mL	0.70	0.43
PFUnA	serum	ng/mL	0.59	0.40
PFDoA	serum	ng/mL	0.11	
Bisphenol A:				
BADGE-4	serum	ng/mL	12.8	12.80
Bisphenol A	serum	ng/mL	0.72	
Phthalates:				
mMeP	urine	ng/mL	33.1	2.2
mEtP	urine	ng/mL	2150	72.8
mBuP	urine	ng/mL	64.1	22.4
mBzP	urine	ng/mL	12.8	5.5
mEHP	urine	ng/mL	18.4	7.3
mEOHP	urine	ng/mL	55.1	15.7
mEHHP	urine	ng/mL	95.2	37.1

Wanna Wright's Comments

My beloved friend, Andrea Martin, who founded the Breast Cancer Fund, was tested for the presence of chemicals in her body, and strongly believed that many of those chemicals found were connected to the cancers she suffered from. Before then, I had focused on early detection as key, in terms of cancer activism, but when we lost Andrea to cancer, I became more focused on prevention, and wanted to be tested as a way to raise public awareness about the possible environmental connections to cancer.

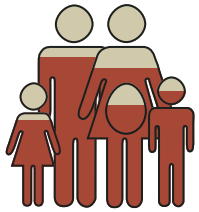
I was born and raised in New Iberia, Louisiana, in a community surrounded by cotton, sugar cane, and pepper fields constantly being sprayed with pesticides. When you are from a poor community and are African-American, you become desensitized and don't really expect that the government is interested in protecting you from harm, so I have long realized that we are not adequately protected from chemicals considered to be toxic, and that many chemicals are simply never tested for their effects on human health. Nevertheless, when I received my own results and saw the numbers of chemicals my body carries, I became incensed and felt as vulnerable as I truly was as a child when I played and worked in those Louisiana fields.

I've made changes since receiving my results, using different cooking pots, eating organic food when I can, and buying different personal care products, but I also am working to promote policies that require companies to prove that their products are safe for ourselves and our babies. I also strongly support biomonitoring programs. We test water, soil, and products. The next most reasonable step is to test ourselves. Two of my children have asthma and I am deeply concerned about any chemical impact on causation and aggravation of this life-threatening disease.

I have talked to people, mostly people of color, about my own chemical body burden. There is a lot of fatalism. People tend to be more concerned about what they can see, such as the flares from Richmond refineries. They ask if some of the chemicals in my body come from the refineries. I can only tell them that these chemicals come from many sources. Biomonitoring is a new science, and we need to continue to use it, because the more we know, the more patterns we develop, the more we can identify the sources of exposure.

Chemical Fact Sheet

BISPHENOL A



Sources

First synthesized in the 1930s, BPA is the monomer building block of polycarbonate plastic. The food and beverage industry has used BPA for 40 years. Global production is 6.4 billion pounds per year.

BPA is used extensively in the manufacture of epoxy resins, polymers, fungicides, antioxidants, dyes, flame retardants and dental sealants. Epoxy resins are used in linings of canned food to protect from contamination.

BPA is commonly used in plastic water bottles, baby bottles, returnable juice containers, microwave ovenware and eating utensils. Also in films, sheets, and laminations; reinforced pipes; floorings; watermain filters; enamels and vanishes; adhesives; artificial teeth; nail polish; compact discs; electric insulators; and as parts of automobiles, certain machines, tools, electrical appliances, and office automation instruments.

Pathways of exposure

BPA has been shown to leach from cans and bottles into food, especially after heating or as plastic ages, leading to widespread human exposure. It is widespread in the environment, and found in virtually everyone tested.

Some exposure is likely through ingestion of foods that have been contaminated by BPA in containers, such as metal cans linings or plastic bottles.

Health Effects

BPA is one of first chemicals to be studied showing impacts at very low doses in animal tests. In animal experiments, BPA alters cellular function and disrupts developmental processes at very low exposures, well below EPA's reference dose.

BPA may have several mechanisms of toxicity. Estrogenicity is one of them, causing adverse effects on the development of the prostate in fetal mice, at levels beneath common exposures experienced by the American public. The results raise questions about the possible contribution of BPA in human prostate diseases, including prostate cancer.

In addition, BPA is capable of altering the expression of a multitude of genes, and has been connected through cell or animal studies to obesity in adults through *in utero* exposure, early puberty, reduced sperm count, breast cancer susceptibility, impaired immune system functioning, changes in brain chemistry, and changes in behavior.

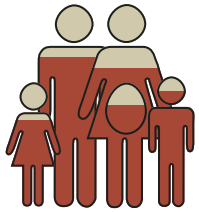
Animal studies have found low exposures of BPA cause chromosomes to misalign, leading to errors in cell division called aneuploidy. In humans, aneuploidy is linked to spontaneous miscarriage and birth defects, including Down Syndrome. Although a link between BPA and Down Syndrome in people is not established, there is a concern that women may be at higher risk for recurrent miscarriages due to BPA exposure.

Bisphenol A diglycidyl ether (BADGE) is an epoxy resin derivative of BPA which is also used in coatings and dental sealants. The hydrolysis product of BADGE (BADGE-4OH) has been proposed as a biomarker of exposure.

Source: *Our Stolen Future:*
http://www.ourstolenfuture.org/NewScience/oncompounds/bisphenola/bpauses.htm

Chemical Fact Sheet

MERCURY



Sources

Mercury is a naturally occurring metal which has several forms. Metallic mercury is a shiny, silver-white, odorless liquid. It can vaporize at room temperature into a colorless, odorless gas.

It has several industrial and pharmaceutical uses. Various forms of mercury can be used to produce chlorine gas and caustic soda, and is also used in thermometers, dental fillings, batteries, eye care products, skin lightening creams, antiseptic creams and ointments. It has been used in the manufacture of vaccines, although thimerosal has now largely been removed.

Mercury is released into the environment through mining, coal combustion and waste incineration. Elemental mercury can be transformed to methylated forms by bacteria in the environment which can bioaccumulate in the food web.

Pathways of exposure

Methylmercury builds up in the tissues of fish. Larger and older fish, and predatory fish higher in the food web, tend to have the highest levels of mercury. Consumption of seafood is a major exposure pathway to methylmercury.

Other exposures occur from breathing contaminated air, ingesting contaminated water and food, and from some dental and medical treatments. Exposure can also occur from the practice of some ritual practices which use mercury.

Health Effects

The nervous system is very sensitive to all forms of mercury. Methylmercury and metallic mercury vapors are more harmful than other forms, because more mercury in these forms reaches the brain. However, new studies in non-human primates suggest that ethylmercury leaves more mercury residue than the methylmercury.

Exposure to high levels of metallic, inorganic, or organic mercury can permanently damage the brain, kidneys, and developing fetus. Effects on brain functioning may result in irritability, shyness, tremors, changes in vision or hearing, and memory problems.

Short-term exposure to high levels of metallic mercury vapors may cause effects including lung damage, nausea, vomiting, diarrhea, increases in blood pressure or heart rate, skin rashes, and eye irritation.

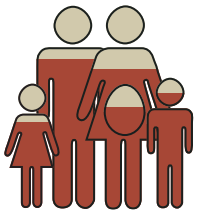
The fetus and very young children are more sensitive to mercury than adults. Mercury in the mother's body passes to the fetus and may accumulate there. It can also pass to a nursing infant through breastmilk.

Harmful effects from high doses of mercury that may be passed from the mother to the fetus include brain damage, mental retardation, loss of coordination, blindness, seizures, and inability to speak. Lower levels of exposure exceeding an estimated threshold may result in memory, attention, and language problems. Children poisoned by mercury may develop problems of their nervous and digestive systems, and kidney damage.

Source: *Agency for Toxic Substances and Disease Registry:* http://www.atsdr.cdc.gov/tfacts46.html

Chemical Fact Sheet:

ORGANOCHLORINE PESTICIDES (DDT AND METABOLITES)



Sources

DDT (dichlorodiphenyltrichloroethane) is a pesticide once widely used to control insects in agriculture, and insects that carry diseases such as malaria. It is a white, crystalline solid with no odor or taste. Its use in the U.S. was banned in 1972 because of damage to wildlife, yet its persistence in the environment and food web results in measurable levels in human tissues.

DDT sticks strongly to soil. Most DDT in soil is broken down slowly to the metabolites DDE and DDD by microorganisms; half the DDT in soil will break down in 2-15 years, depending on the type of soil.

DDT and its breakdown products in air are rapidly broken down by sunlight. Half of what's in air breaks down within 2 days.

Only small amounts of DDT will go through the soil into groundwater; it does not dissolve easily in water.

Pathways of exposure

DDT, and especially DDE, build up in fatty tissues of fish, birds, and other animals. Therefore, the primary route of exposure to DDT and its metabolites is through food consumption, particularly fatty meat, fish, and poultry.

Exposure can also occur by breathing contaminated air, drinking contaminated water, or swallowing soil particles near waste sites and landfills that may be contaminated. Infants can be exposed from ingesting breastmilk from mothers who have been exposed.

Health Effects

Adverse health effects in animals include reproductive and developmental failure, and possible immune system effects. The U.S. EPA classifies DDT as a probable human carcinogen.

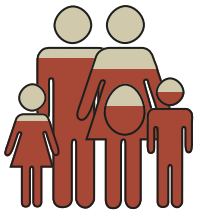
High levels of DDT in humans can affect the nervous system causing excitability, tremors and seizures. In women, DDE can cause a reduction in the duration of lactation and an increased chance of having a premature baby.

In animals, short-term exposure to large amounts of DDT in food affect the nervous system, while long-term exposure to smaller amounts affect the liver. Short-term oral exposure to small amounts of DDT or its breakdown products may also have harmful effects on reproduction in animals.

Source: *Agency for Toxic Substances and Disease Registry:* http://www.atsdr.cdc.gov/tfacts35.html

Chemical Fact Sheet

PERFLUOROCHEMICALS



Sources

Perfluorochemicals (PFCs) are a family of related perflourinated compounds used in a wide range of consumer products, including surfactants, stain-resistant textiles, lubricants, furniture, cosmetics, clothing, paints, food wrap, leather spray, fire-fighting foam, and household cleaners. They are designed to repel grease and water, and have been marketed under brand names such as Teflon, Stainmaster, Scotchgard, SilverStone and Gore-Tex.

As a class, PFCs are highly resistant to degradation and poorly understood toxicologically. In PFCs, the normal carbon-hydrogen bonds of organic chemicals are replaced with carbon-fluorine bonds.

The carbon-fluorine bond is one of the strongest known in chemistry, which accounts for the astonishing persistence of PFCs. Scientists have found no mechanism by which many PFCs can be broken down in the environment—they appear to be completely resistant to biodegradation. Therefore, opportunities for humans and other animals to be exposed continuously to PFCs will continue from this point in history forward even if they were to be banned.

The most prominent PFCs in the environment are the Perfluoroalkanesulfonates, such as perfluorooctane sulfonate (PFOS) and perfluorohexane sulfonate (PFHxS); and the Perfluorocarboxylates, such as perfluorooctanoic acid (PFOA) and perfluorononanoic acid (PFNA).

Historically, PFCs have been unregulated, so emissions are legal and reporting is not complete. PFOS, a key ingredient in 3M's Scotchguard, was forced off the market in 2000 by EPA because of concerns that the chemical had been detected broadly in the environment and in people, and because high levels in animals causes mortality. 3M stopped manufacturing PFOA shortly thereafter.

However, PFOA has been used by DuPont for decades in its Teflon products. In 1999 alone, DuPont released 86,806 pounds (over 40 tons) of PFOA into the air and the Ohio River from its Washington Works Teflon production facility in West Virginia.

Pathways of exposure

Exposure to PFCs is ubiquitous, found in human and wildlife tissues around the world, but pathways of exposure are poorly understood.

Fifteen PFCs have been found in human blood. Based on recent human biomonitoring data, PFOA and PFOS are the major PFCs in the blood of the general population in all geographic regions of the United States. The half life for PFOS is 8.7 years; for PFOA, the half-life is 4.4 years, but exposure appears to be continually renewed though daily contact.

Perfluorochemicals have been found in 18 pooled blood bank samples since the late 1960s, including samples from rural China in 1984 and 1994. In only one group of samples were PFCs not found: ten archived blood samples taken from Korean War-era U.S. military recruits sampled between 1948 and 1951, about 10 years before PFC chemicals went into commercial production.

Since the 1960s, PFCs have been measured in the blood of workers occupationally exposed to these chemicals or their precursors.

In a 2001 study which 3M submitted to the government, PFOA was found in the blood of 96 percent of 598 children tested in 23 states and the District of Columbia. DuPont found PFOA in umbilical cord blood in 1981. PFOA was first tentatively identified in human blood as early as 1976.

Health Effects

In lab animals, perfluorooctanoic acid (PFOA) causes mammary, pancreatic, liver, and testicular cancers. PFOA alters reproductive hormones in the male, causing increased levels of estrogen and abnormal testosterone regulation.

Low doses of PFOA harm lab animals at estimated blood levels lower than those found in some children. Research also shows organ weight changes, often a gross sign of toxicity and damage to organ function, among lab animals exposed to PFOA in the womb and into early adulthood.

Perfluorooctane sulfonate (PFOS) is toxic in laboratory animals at levels close to the range already found in animals and people in the real world. It is linked with mammary, pancreatic, thyroid, and liver tumors in lab animals as well as hypothyroidism. It is suspected of being a carcinogen for humans.

An important distinction between perfluorochemicals and other persistent organic pollutants is that perfluorinated compounds don't accumulate in fat but instead in the liver and gall bladder.

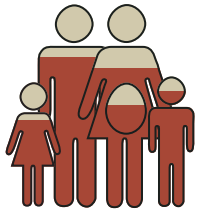
Both PFOS and PFOA are more toxic to animals exposed *in utero* than to adult animals, and cause death to developmentally exposed animals at doses that do not cause parental mortality. Both PFOS and PFOA are associated with increasing levels of cholesterol and triglycerides.

Sources: *Our Stolen Future:*
http://www.ourstolenfuture.org/NewScience/oncompounds/PFOS/2001-04pfosconcerns.htm

Environmental Working Group:
http://www.ewg.org/issues/siteindex/issues.php?issueid=5014

Chemical Fact Sheet

PHTHALATES



Sources

Phthalate acid esters (phthalates—pronounced THAL-ates) are a class of widely-used industrial compounds with many uses. Approximately a billion pounds are produced worldwide yearly. They have become ubiquitous both in the products in which they are intentionally used, and as contaminants.

Intentional uses of phthalates include softeners of vinyl in children's toys, food packaging, construction materials, and medical devices. They are also used as fillers in perfumes, stabilizers in nail polish, additives to hairsprays, lubricants, wood finishers, vinyl shower curtains, flooring, and wallpaper.

Pathways of exposure

Because phthalates are ubiquitous and can appear as contaminants during laboratory analysis, their metabolites are generally measured to accurately reflect body burdens. However, exposure pathways, absorption and metabolism of these contaminants are not well understood.

Phthalates are not tightly bound into the molecular structure of many consumer products and readily leach into the wider environment. Heat, agitation, and storage time can lead to faster degradation and release.

Phthalates tend to pass through the body quickly, but because of ubiquitous and ongoing exposure from a variety of sources, it is probable that most human tissue contains detectable levels of phthalates.

Likely exposure pathways are the breathing of indoor air where phthalates have volatilized out of the parent consumer product; and ingestion of food that has been contaminated with phthalates. For example, microwave heating of food in plastics containing phthalates accelerates the leaching of the phthalates from the plastic container or wrap into the food.

Newborn babies in neonatal intensive care units can receive high phthalate exposures directly from the medical devices which connect them to treatment regimes.

Health Effects

Depending on the particular phthalate, they are anti-androgenic or weakly estrogenic. In rats, they have been associated with teratogenicity and cancer, although the cancer in rodents is not thought to be relevant to people.

However, reproductive and developmental problems associated with phthalate exposure are relevant to humans.

Studies indicate that male reproductive development is acutely sensitive to some phthalates, including at very low doses of exposure during crucial windows of fetal development. For example, the phthalates dibutyl phthalate (DBP), diethylhexyl phthalate (DEHP), and benzyl butyl phthalate (BBP) produced dramatic changes in male sexual characteristics when exposure took place *in utero*, at levels far beneath those of previous toxicological concern. These changes included increases in the rates of the birth defect hypospadias and other indications of demasculinization.

The National Toxicology Program's Center for the Evaluation of Risks to Human Reproduction (CERHR), issued a draft report in 2000 which expressed "serious concern" about the developing male's reproductive tract to exposure to the metabolite of the phthalate DEHP (known as monoethylhexyl phthalate or MEHP). MEHP damages developing Sertoli cells, which are central to sperm formation, potentially leading to sperm maladies in adulthood, including low sperm counts.

In winter/spring 2002-2003, three studies linked phthalate exposure to reductions in semen quality. Phthalate levels associated with the damage were well within the range experienced by many Americans.

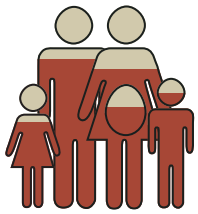
In May 2005, researchers identified an association between pregnant women's exposure to phthalates and adverse effects on genital development in their male children, marking the first time a peer-reviewed study has shown a correlation between phthalate exposure and a developmental effect in humans.

The study showed that women with higher levels of four different phthalates were more likely to have baby boys with a range of conditions, from smaller penises and undescended testicles to a shorter perineum, the distance between the genitals and the anus. This indicates a feminization of the boys similar to that seen in animals exposed to the chemicals, the so-called "phthalate syndrome" observed in rodents pre-natally exposed to phthalates.

Sources: *Our Stolen Future:* http://www.ourstolenfuture.org/NewScience/oncompounds/phthalates/phthalates.htm

Chemical Fact Sheet

POLY-BROMINATED DIPHENYL ETHERS



Sources

Poly-brominated diphenyl ethers (PBDEs) are widely-used, man-made chemicals used in a variety of consumer products to make them difficult to burn. These flame retardants are found in mattresses, polyurethane foam in upholstered furniture, ceiling tile, textiles, and hard plastic casing as in computer monitors and hair dryers.

There are different kinds of PBDEs; some have only a few bromine atoms attached, while some have as many as ten bromine attached to the central molecule.

The penta-BDE commercial mixture consists primarily of the BDE-47 and BDE-99 congeners. The octa-BDE commercial mixture contains primarily the BDE-153 and BDE-183 congeners. The deca-BDE commercial mixture is almost entirely BDE-209.

Pathways of exposure

PBDEs enter air, water, and soil during their manufacture and use in consumer products. In air, PBDEs can be present as particles, but eventually settle to soil or water. They do not dissolve easily in water. Sunlight can degrade some PBDEs. Some PBDEs can accumulate in fish but usually at low concentrations.

PBDEs have been measured in serum, breastmilk and adipose (fat) tissues around the world. The concentrations of PBDEs in people indicate that most people are exposed to some levels of PBDEs.

The highest levels ever found have been in human tissue in California and New York. Residents of North America have over 10 times higher levels of PBDEs than residents of Europe or Asia, but the reasons are unknown. California law recently banned the manufacture and use of the penta and octa forms of PBDEs in the state.

PBDEs can migrate out of consumer products and can bioaccumulate because of their persistence and lipophilicity. According to recent studies, a main source of exposure to PBDEs may be through household dust.

Other pathways of exposure are from eating foods or breathing air contaminated with PBDEs. Workers involved in the manufacture of PBDEs or products that contain PBDEs may be exposed to higher levels than others. Occupational exposure can also occur in people who work in enclosed spaces where PBDE-containing products are repaired or recycled, although the relative contributions of these various pathways in people is not well understood.

Health Effects

Although little is known about the health effects of PBDEs in people, there is concern because PBDEs have a similar chemical structure to poly-chlorinated biphenyls (PCBs). Health effects of PCBs are much more extensively studied, and include acne-like skin conditions in adults at high levels of exposure and neurobehavioral and immunological changes in children at much lower levels. PCBs are known to cause cancer in animals, and are probable carcinogens in humans.

Animal studies have shown that PBDEs can cause liver toxicity, disrupt thyroid hormone levels, and lead to developmental neurotoxicity and reproductive toxicity. Large differences in effects are seen between highly-brominated and less-brominated PBDEs.

Newborn mice exposed to PBDEs experienced damage to their nervous systems, resulting in learning and motor deficits that worsened as the animals grew older. PBDEs also affect sexual development. Rats exposed to PBDEs experienced late onset of puberty and male rats had low

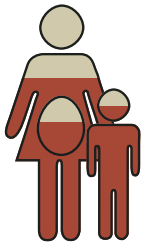
prostate weights. These effects in animals occur at exposure levels considerably higher than concentrations measured in most people, but people who are the most highly exposed have levels that approach those that cause effects in animals.

Children are exposed to PBDEs in generally the same way as adults, mainly by eating contaminated food. Because PBDEs dissolve readily in fat, they can accumulate in breastmilk and may be transferred to babies and young children. PBDEs may impair intelligence and motor skills of children.

Based on evidence from animal studies, the EPA has classified decabromodiphenyl ether (one form of PBDEs) as a possible human carcinogen.

Source: *Agency for Toxic Substances and Disease Registry:* http://www.atsdr.cdc.gov/tfacts68-pbde.html

WHAT IS A SAFE LEVEL OF CHEMICAL EXPOSURE?



The Commonweal Biomonitoring Project chose to test for chemicals that are known or strongly suspected of being harmful to humans. We are especially concerned with those chemicals that are currently in the news because of recent studies that lead to questions about what might be safe exposure levels. Given the health outcomes associated with these exposures, many scientists and health advocates are asking whether these chemicals should continue to be used until more research is done.

Rapid advances in biomonitoring technology are making it possible to detect increasing numbers of chemicals at lower levels of concentration in the body. This data is contributing to a revolution in environmental health science research.

The new science is challenging our views of traditional toxicology and the maxim that "the dose makes the poison." In fact, peer-reviewed studies are showing that health effects at very low dose effects can appear and cause harm at levels below the previously identified No Observed Adverse Effect Level (NOAEL). In some cases, however, there isn't enough data for a NOAEL to even be established, and in others it is out of date.

The chemical Bisphenol A (BPA) is generating headlines because of low dose studies. BPA is used to manufacture polycarbonate plastic, and global production now exceeds 6.4 billion pounds per year. It readily leaches from water bottles, metal food can linings, and dental sealants. Exposure is ubiquitous and continual, and BPA is found in most individuals tested in biomonitoring studies.

Earlier this year, Environmental Health Perspectives published an important literature review by vom Saal and Hughes.[i] The authors reviewed 115 studies, of which 94 reported significant low dose effects. 31 studies with animals reported effects below the predicted "safe" or reference dose of 50 microgram/kg/day.

Another study on BPA[ii] indicates that women with higher levels of BPA were more likely to suffer recurrent miscarriages. This study builds on earlier research[iii] that found that eggs in mice with exposures as small as 20 parts per billion caused mis-alignment in chromosomes, leading to errors in cell division called aneuploidy. In humans, aneuploidy is linked to spontaneous miscarriage and birth defects, including Down Syndrome. Since 40 to 70 percent of spontaneous abortions are linked to chromosomal abnormalities, it is reasonable to suspect that Bisphenol A may be wreaking chromosomal havoc.

All of the Commonweal study participants carried markers for BPA exposure. It makes sense to assume that most Californians have been and continue to be exposed to BPA, including women of childbearing age.

In addition to low dose, it is increasingly apparent that the timing of exposure can be a critical variable in the impact of chemical exposure, particularly *in utero*. Windows of vulnerability during fetal development for specific impacts can be extremely narrow. One study showed that a single exposure to the anti-androgen flutamide caused hypospadias in over 50 percent of rat fetuses exposed on gestational day 17, but none on day 16 and less than 10 percent on day 18.[iv] (Hypospadias is a birth defect where the urethra emerges from the penis on the underside of the shaft instead of at the tip.)

Epidemiologists are starting to use biomonitoring data to develop and test new hypotheses for human effects. Shanna Swan and her colleagues at the University of Rochester recently published a statistically significant study showing boys exposed in the womb were at higher risk for anti-androgenic effects on the developing male reproductive tract from phthalate exposure.[v] Phthalates are chemicals used as fragrance stabilizers in personal care

products such as perfume, shampoos, body lotion, and nail polish. They are used to soften plastic and are found in vinyl toys and many medical devices. Biomonitoring studies show broad exposure to multiple phthalates in humans, including in Commonweal's study.

The Swan study collected the urine of 85 pregnant women who were expecting boys. Metabolites of three phthalates found in the pregnant women were correlated to shorter than normal distances between the anus and penis, called the ano-genital index (AGI), measured after their sons were born. Boys exposed to multiple phthalates simultaneously were also more likely to have shorter AGI measurements. Boys with smaller AGIs had smaller penis volume and were more likely to experience incomplete testicular descent. It is not clear whether these effects signal possible reproductive problems later in life for humans, but in laboratory animals, such markers are related to subsequent lower sperm counts, lower testosterone levels, testicular abnormalities and infertility. Significantly, levels of phthalates associated with the observed AGI reductions in the Swan study are today found in 25 percent of American women.

As recently reported in the Journal of the American Medical Association, some chemical exposures appear to result in transgenerational effects. Striking research[vi] showed that exposure to the anti-androgenic fungicide vinclozolin (used in wine vineyards) at mid-gestation of pregnant rats resulted in adult subfertility in the male offspring. Further, the animals were then bred for four subsequent generations, and each generation of males showed the same disease state even though they were never exposed to the chemical. One researcher commented, "It appears we have endocrine receptor–induced disease that's permanent to the lineage. With an environmental toxin, we've induced a disease state that is inherited in greater than 90 percent of all the males in subsequent generations, even though the exposure occurred only once in the original gestating mother."[vii]

One take-home message from the new science is we need a new paradigm to assess risk. The complexity of chemical exposure with other factors makes confident decision-making daunting. Yet traditional risk assessment looks at only one chemical at a time, and asks the question, "How much harm is allowable?" We need a more precautionary model that asks a fundamentally different question, "How little harm is possible?" Alternatives assessments must be placed at the center of the process.

The dose no longer always makes the poison, as some dose response curves now indicate. Timing of exposure can be critical. What about multiple exposures with possible additive or synergistic effects? Mixtures are a huge unknown in toxicology. Or the complex interactions between genes and environmental factors? Nutritional status, socioeconomic conditions, and personal lifestyle factors are additional variables that must be considered. At the very least, we must have safety data supplied by chemical manufacturers before chemicals are approved for use.

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i vom Saal, F and C Hughes. An Extensive New Literature Concerning Low-Dose Effects of Bisphenol A Shows the Need for a New Risk Assessment. Environ Health Perspect 113:926-933 (2005). doi:10.1289/ehp.7713 available via http://dx.doi.org/ [Online 13 April 2005]

ii Sugiura-Ogasawara, M, Y Ozaki, S Sonta, T Makino and Kaoru Suzumori 2005. Exposure to bisphenol A is associated with recurrent miscarriage. Hum. Reprod. Advance Access published online on June 9, 2005 Human Reproduction, doi:10.1093/humrep/deh888

iii Patricia A. Hunt, Kara E. Koehler, Martha Susiarjo, Craig A. Hodges, Arlene Ilagan, Robert C. Voigt, Sally Thomas, Brian F. Thomas, and Terry J. Hassold. Bisphenol A Exposure Causes Meiotic Aneuploidy in the Female Mouse. Current Biology, Vol 13, 546-553, 1 April 2003

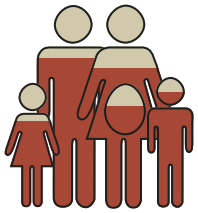
iv Paul M. D. Foster and Martha W. Harris. Changes in Androgen-Mediated Reproductive Development in Male Rat Offspring Following Exposure to a Single Oral Dose of Flutamide at Different Gestational Ages Toxicol. Sci., Jun 2005; 85: 1024 - 1032.

v Swan, SH, KM Main, F Liu, SL Stewart, RL Kruse, AM Calafat, CS Mao, JB Redmon, CL Ternand, S Sullivan, JL Teague, EZ Drobnis, BS Carter, D Kelly, TM Simmons, C Wang, L Lumbreras, S Villanueva, M Diaz-Romero, MB Lomeli, E Otero-Salazar, C Hobel, B Brock, C Kwong, A Muehlen, A Sparks, A Wolk, J Whitham, M Hatterman-Zogg, M Maifield and The Study for Future Families Research Group 2005. Decrease in Anogenital Distance Among Male Infants with Prenatal Phthalate Exposure. Environ Health Perspect 113: 1056-1061 (2005). doi:10.1289/ehp.8100 available via http://dx.doi.org/ [Online 27 May 2005]

vi Anway et al. *Science.* 2005;308:1466-1469.

vii Michael Skinner in *JAMA.* 2005;294:291-293.

RECOMMENDATIONS



In the United States, efforts are underway to educate and promote discussion of chemical reform policy in corporations and at the local, state, regional, and federal levels. The Louisville Charter for Safer Chemicals is the name for this platform for creating a safe and healthy environment through innovation.

The Louisville Charter states:

> A first step to creating a safe and healthy environment is a major reform of our nation's chemicals policy. 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 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 Persistent, Bioaccumulative, or Highly Toxic Chemicals**—prioritize for elimination chemicals that are slow to degrade, accumulate in fatty tissues, or are highly hazardous to humans or the environment.
> - **Give the Public and Workers the Full Right-to-Know**—label products that contain hazardous chemicals, list quantities of hazardous chemicals used in agriculture and in manufacturing facilities, and provide public access to safety data on chemicals.
> - **Act on Early Warnings**—act to 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**—assume that a chemical is highly hazardous unless comprehensive safety data are available for the chemical and require manufacturers to provide this data by 2015 for a chemical to remain on the market—this is the principle of "No Data, No Market."
> - **Take Immediate Action to Protect Communities and Workers**—when communities and workers are exposed to levels of chemicals that pose an immediate health hazard, immediate action is necessary to eliminate these exposures.

More information on the Louisville Charter can be found at http://www.louisvillecharter.org

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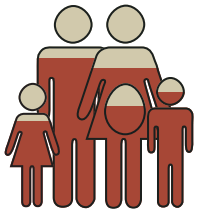


The information about health and toxic chemical exposures in this report comes from several sources, including:

Collaborative on Health and the Environment
http://www.healthandenvironment.org for a summary of the science linking environmental exposures and disease.

Environmental Working Group
http://www.ewg.org/reports/bodyburden for EWG's report on chemical body burdens.

http://www.ewg.org/reports/bodyburden2/ for EWG's report on umbilical cord blood contamination.

Our Stolen Future
http://www.ourstolenfuture.org/ for the latest scientific studies on environmental chemicals and links to disease.

The Campaign for Safe Cosmetics
http://www.safecosmetics.org/

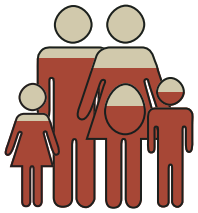
Environmental Health News
http://www.environmentalhealthnews.org for recent news articles about health and environment.

Breast Cancer Fund
http://www.breastcancerfund.org for information about breast cancer, environment, and advocacy initiatives.

Health Care Without Harm
http://www.noharm.org for information about the use of toxic chemicals in the healthcare industry and safer alternatives.

Agency for Toxic Substances and Disease Registry (ATSDR)
http://www.atsdr.cdc.gov for toxic substances profiles.

ANALYTICAL METHODS



Laboratory analyses were performed by AXYS Technologies, Inc. (http://www.axystechnologies.com/) of Sidney, BC, Canada, with the exception of mercury, which was analyzed by by BrooksRand LLC (http://www.brooksrand.com/) of Seattle, Washington.

Analysis of Brominated Diphenyl Ethers and Organochlorine Pesticides

Serum samples were analyzed for polybrominated diphenyl ethers (PBDE) by Axys Method MLA-033 (which is in accordance with EPA Draft Method 1614) and organochlorine pesticides were analyzed by Axys Method MLA-028.

30–50 gram serum samples were spiked with a suite of 13C-labeled brominated diphenyl ether and organochlorine pesticide surrogates, mixed with equal volumes of ethanol and ammonium sulfate, and liquid-liquid extracted with hexane. The hexane extracts were quantitatively split into a 1/5th portion for pesticide analysis, and a 4/5th portion for PBDE analysis.

The portion for pesticide analysis was cleaned up using a Florisil chromatographic column; an aliquot of 13C-labeled recovery (internal) standard was added to each extract prior to instrumental analysis. Analysis was performed on a high-resolution mass spectrometer (HRMS) coupled to a high-resolution gas chromatograph (HRGC) equipped with a J&W DB5 chromatography column (60 m, 0.25 mm i.d., 0.10 µm film thickness). The HRMS was operated at a static (8000) mass resolution (10% valley) in the electron ionization (EI) mode using multiple ion detection (MID).

The portion for PBDE was cleaned up using an automated chromatographic cleanup apparatus equipped with silica gel, acid/base silica gel, and alumina columns. Following the automated cleanup, an additional manual cleanup on an alumina chromatography column was performed. The final extract was spiked with isotopically labelled recovery (internal) standard prior to instrumental analysis. Analysis of the extract was performed on a Micromass Ultima or VG70 mass spectrometer (MS) coupled to a Hewlett Packard 5890 or 6890 gas chromatograph equipped with a DB-5HT chromatography column (30 m, 0.25 mm i.d., 0.10 µm film thickness). The HRMS was operated at a static (5000) mass resolution in the electron ionization (EI) mode using voltage selected ion recording.

PBDE and organochlorine pesticide target concentrations were determined by isotope dilution or internal standard quantification against the labeled surrogates added at the beginning of analysis using Micromass OPUSQUAN software.

Analysis of Bisphenol A and its Diglycidyl Ether

Serum was analyzed for total Bisphenol A (BPA) and Bisphenol A diglycidyl ether (BADGE), according to procedures documented in Axys Method MLC-004 *Analysis of Total Bisphenol A and Bisphenol A Diglycidyl Ether in Human Blood Serum by Liquid Chromatography–Mass Spectrometry.*

BPA and BADGE may be present in serum as both the free phenol and glucuronated conjugate. Samples were therefore enzymatically hydrolyzed to convert any glucuronates to the free phenol. BADGE is unstable in aqueous solutions due to hydrolytic ring opening of the two epoxide rings and for this reason BADGE was analyzed as its hydrolyzed product, BADGE-4OH.

1mL samples were spiked with deuterated BPA and 13C-labeled 4-methylumbelliferone, buffered with ammonium acetate, and further spiked with native 4-methylumbelliferone glucuronide, and J-glucuronidase enzyme. The treated samples were then incubated to hydrolyze the BPA and BADGE glucuronides (the completeness of hydrolysis was monitored by the ratio of native to labeled 4-methylumbelliferone). The incubated samples were diluted with high-purity water and loaded onto precon-

ditioned SPE cartridges. The cartridges were washed with a series of solutions, and then eluted with ethyl acetate. The cleaned extracts were reduced in volume, reconstituted with methanol, filtered, spiked with recovery standard, and analyzed by LC/MS/MS.

Analysis was performed on a Micromass Quattro Ultima MS/MS coupled to a Waters 2795 HPLC equipped with a reverse-phase C18 column (7.5cm, 2.1mm i.d., 3.5µm particle size). The LC/MS/MS was operated in the MRM mode at unit resolution, using Negative Ion Electrospray ionization.

BPA concentrations were determined by isotope dilution, while BADGE-4OH was determined by internal standard quantification against the labeled BPA added at the beginning of the analysis

Analysis of Perfluorinated Organic Compounds (PFCs)

Human blood serum samples were analyzed for perfluorinated organic compounds (PFCs) according to procedures documented in Axys Method MLA-042 *Analytical Procedure for the Analysis of Perfluorinated Organic Compounds in Blood Serum by LC-MS/MS.*

2mL samples were spiked with 13C-labeled perfluorooctanoic acid and 13C-labeled perfluorodecanoic acid, and vortexed with a solution of formic acid. The sample was loaded onto a preconditioned styrene divinylbenzene SPE cartridge (Waters Oasis HLB, 60mg/3cc). After washing with a series of solutions, the cartridge was eluted with a solution of ammonium hydroxide in methanol. The collected extract was spiked with recovery standard (13C-perfluorohexylethanoic acid) prior to analysis by HPLC/MS/MS.

Analysis was performed on a Micromass Quattro Ultima MS/MS coupled to a Waters 2795 HPLC equipped with a reverse-phase C18 column (7.5cm, 2.1mm i.d., 3.5µm particle size). The LC/MS/MS was operated in the MRM mode at unit resolution, using Negative Ion Electrospray ionization.

PFCs target concentrations were determined by isotope dilution or internal standard quantification against the surrogate standards added at the beginning of analysis.

Analysis of Phthalate Ester Metabolites

Phthalate metabolites in human urine were analyzed according to procedures derived from a published method (Silva et al, 2003). Because phthalate esters in humans are metabolized to their respective monoesters, which in turn may be glucuronidated, samples were enzymatically hydrolyzed prior to extraction to convert any monoester glucuronides to their respective free monoesters.

1mL samples were buffered with ammonium acetate, and spiked with 13C-labeled phthalate monoesters, 13C-labeled 4-methylumbelliferone, native 4-methylumbelliferone glucuronide, and J-glucuronidase enzyme. The treated samples were then incubated to hydrolyze the glucuronides (the completeness of hydrolysis was monitored by the ratio of native to labeled 4-methylumbelliferone). The incubated urine was diluted with a phosphate buffer and loaded onto pre-conditioned SPE cartridges, which were washed and then eluted with acetonitrile followed by ethyl acetate. Extracts were reduced in volume and spiked with a 13C-labeled recovery standard.

Analysis was performed on a Micromass Quattro Ultima MS/MS coupled to a Waters 2795 HPLC equipped with a reverse-phase C18 column (7.5cm, 2.1mm i.d., 3.5µm particle size). The LC/MS/MS was operated in the MRM mode at unit resolution, using Negative Ion Electrospray ionization.

Phthalate monoester concentrations were determined by the isotope dilution method.

Analysis of Mercury

Seven of the eleven participants provided hair samples which were able to be accurately tested for total mercury. Samples were cut and cleaned to remove surface contaminants, acid digested according to USEPA Method 1631 and analyzed with a Cold Vapor Mercury Analyzer. Hair analysis is not a well accepted approach to assess exposures because hair analysis generally cannot differentiate *internal* from *external* exposure (ATSDR 2003). Additionally, it is difficult to compare results expressed on a hair weight basis since the type, quality, density and texture of hair vary across individuals.

References

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ATSDR.Analysis of hair samples. 2003. http://www.atsdr.cdc.gov/HAC/hair_analysis/03-0330HairSampleTesting-Scientific.pdf

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