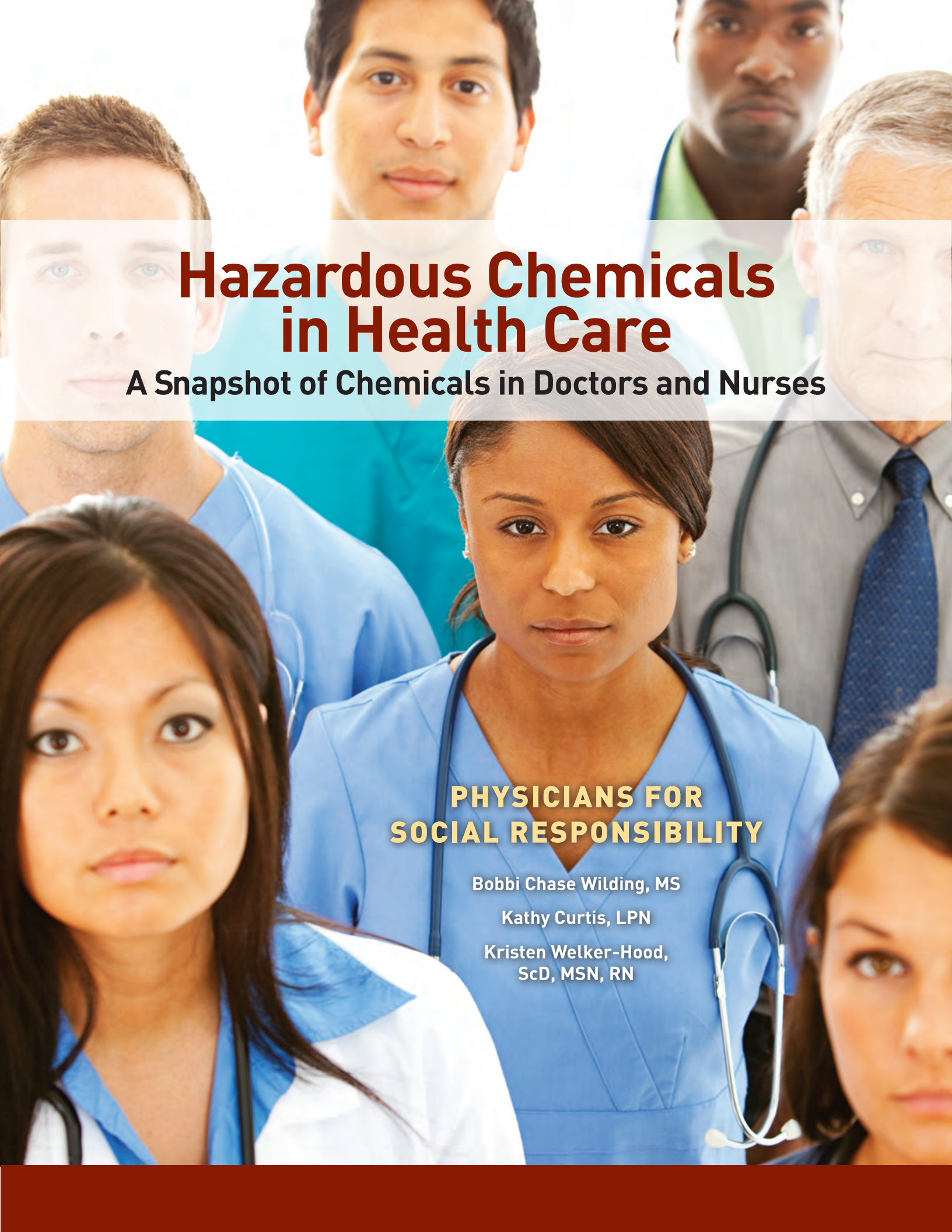

Hazardous Chemicals in Health Care

A Snapshot of Chemicals in Doctors and Nurses

PHYSICIANS FOR SOCIAL RESPONSIBILITY

Bobbi Chase Wilding, MS

Kathy Curtis, LPN

Kristen Welker-Hood, ScD, MSN, RN

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Authors

- Bobbi Chase Wilding, MS, *Clean New York*
- Kathy Curtis, LPN, *Clean New York*
- Kristen Welker-Hood, ScD, MSN, RN, *Physicians for Social Responsibility*

Biomonitoring Staff

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- Kristen Welker-Hood, *Co-Principle Investigator*
- Richard Grady, MD, *Co-Principle Investigator and Physician-on-Record*
- Bobbi Chase Wilding, *Project Manager*
- Kathy Curtis, *Project Co-Manager*

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PREFACE

IT IS IMPOSSIBLE TO LIVE IN TODAY'S WORLD without being exposed to hundreds of chemicals. Studies conducted by the Centers for Disease Control and Prevention (CDC) have documented this exposure for years, and the more chemicals the CDC tests for, the more they find in human bodies. And the more we study these chemicals, the more direct link we find to illness and disease. Health care professionals, particularly nurses, are at increased risk for chemical and pharmaceutical exposure and so are health care patients. Reducing exposures is an important step as the health care sector fulfils its oath to "first do no harm."

"Documentation of chemicals present in health care personnel will increase awareness of chemical exposure among health care workers and will help us understand more about the effectiveness of exposure reduction efforts, and treatments."

— ANNA GILMORE HALL, RN, CAE

Physicians for Social Responsibility, in partnership with the American Nurses Association, Health Care Without Harm's Nurses Working Group, and Clean New York, is to be commended for producing this "*Hazardous Chemicals in Health Care: A snapshot of chemicals in Doctors and Nurses*" report. Not only does this report document the chemical burden in a sampling of nurses and physicians, it proposes guidance on identifying and reducing the chemical exposures in health care. Most importantly, it provides further evidence about the importance of a comprehensive nationwide chemical management policy.

Reducing the risk of chemical exposure is not an easy task, and must be addressed at a number of levels. The health care sector is beginning to recognize the need to enact comprehensive chemical exposure policies. Health Care Without Harm, for example, has developed a number of materials to help hospital staff choose safer products and chemical alternatives. But the health care sector cannot manage this problem alone. Government agencies such as the Food and Drug Administration, the Environmental Protection Agency, and the CDC, need to make chemical management a greater priority, and conduct more research on the health effects of environmental chemical exposures. Businesses and chemical manufacturers need to be held accountable for the safety of their products, and be required to provide full disclosures of the contents of their products and any health risks they might pose. Consumers need to have access to information to make purchasing decisions.

The *Hazardous Chemicals in Health Care* report is a very important and timely document that helps us understand the high risk of chemical exposure in health care and the steps that must be taken to reduce this risk. Documentation of chemicals present in health care personnel will increase awareness of chemical exposure among health care workers and will help us understand more about the effectiveness of exposure reduction efforts, and treatments.

As a nurse, I take these findings very seriously and I urge other nurses and health professionals to take this report to heart and become involved in the "greening" of your health care facility. Use your voices to advocate for stronger chemicals policy. Become active in organizations working to reduce chemical exposures in health care. Share these finding with your managers and colleagues. Most important, be an advocate for health—if not your own, for your patients—and for generations to come who will be condemned to live in a toxic environment unless we act now.

Anna Gilmore Hall, RN,CAE
Executive Director
Health Care Without Harm

EXECUTIVE SUMMARY

TOXIC CHEMICALS ARE ALL AROUND US. Everyday products in our homes, workplaces, schools, stores or places of worship are made from a mixture of chemicals. The majority of the chemicals in use have very limited hazard information available and some have been associated with adverse health effects. We are exposed to chemicals directly when they are released through industrial processes, agricultural applications or through waste streams in which the agent is able to get into our air, water or food. We are also exposed to chemicals indirectly, when unstable chemicals break down into more dangerous forms, leach out of products to contaminate food or beverages, and are released into indoor air during everyday use, settling into dust which people inhale or ingest.

The opportunities for exposure and subsequent internalization of these chemicals are quite extensive. But is there evidence that these chemicals are actually getting into people's bodies? Through biomonitoring, a technique in which blood, urine, hair, semen, breast milk, or other biologic specimens are analyzed for the presence of chemicals, scientists are able to track how much and what kinds of chemicals are in people.

The U.S. Centers for Disease Control and Prevention has been conducting biomonitoring since the 1970's. It has released numerous reports over the years documenting that many of the chemicals currently on the market and even some that have since been banned are detectable in blood and urine samples coming from the general population. Industrial chemicals do not belong in our bodies. Yet, they are in all of us.

Industrial chemicals act on the body much like pharmaceuticals do. Put simply, as long as a chemical can be absorbed, transported to a part of the body most susceptible to its influence or metabolized into a more reactive agent, it is able to produce an effect. Chemicals can: mimic or block hormones, disrupt normal signaling pathways, interact with gene expression or even interfere with sensitive periods of fetal development. The links between the growing number of biologically active chemicals found in our bodies and the rising rates of conditions like cancer, developmental disability, reproductive problems, birth defects and other chronic diseases have yet to be fully understood. That said, the burgeoning collection of scientific studies associating many chemicals with these diseases suggest that the U.S. chemicals management system is not adequately health protective and could be contributing to the widespread prevalence of chronic diseases now burdening the nation's health care system.

> "As a nurse caring for women and newborns, I volunteered for the biomonitoring project to learn more about the environmental risks to my patients. It was not just about my health but was my professional responsibility to understand how chemicals in our everyday environment impact the health of those I care for."
>
> **— MIMI POMERLEAU, DNP, MASSACHUSETTS**

Hazardous Chemicals in Health Care

Physicians for Social Responsibility (PSR)conducted the first biomonitoring investigation of health care professionals. Twelve doctors and eight nurses, two in each of 10 states (Alaska, California, Connecticut, Maine, Massachusetts, Michigan, Minnesota, New York, Oregon and Washington) agreed to be tested for the presence in their bodies of chemicals that are linked to health problems and are ubiquitous in our environment. PSR tested their blood and urine for six chemicals or chemical groups (62 chemicals in all): Bisphenol A (BPA), Mercury, Perfluorinated compounds (PFCs), Phthalates, Polybrominated diphenyl ethers (PBDEs) and Triclosan. These chemicals were specifically identified because they are emerging or known chemicals of concern, are known to be used in the health care setting, may be endocrine disruptors and have been reported in peer reviewed literature as associated with certain diseases, the incidences of which are on the rise.

Each participant had at least 24 individual chemicals in their body, and two participants had a high of 39 chemicals detected.

- Eighteen chemicals were detected in every single participant**.**
- All 20 participants had at least five of the six kinds of chemicals for which we tested, and thirteen of our participants had all six.
- All participants had bisphenol A, and some form of phthalates, PBDEs and PFCs.
- Thirteen participants had participants had dimethyl phthalate metabolites, with nine above CDC's 95th percentile.

Preventing Exposures through Public Policy Interventions

The manufacture, processing, distribution in commerce, use, and disposal of chemical substances are regulated by the US Environmental Protection Agency (EPA) under the Toxic Substances Control Act (TSCA). This law was enacted by Congress in 1976 to prevent unreasonable risks of injury to health or the environment associated with industrial chemicals. Through TSCA the EPA has been able to ban only five chemicals and mandate comprehensive health safety testing for only 200 of the over 80,000 chemicals registered with the EPA.

TSCA is fraught with limitations that have largely resulted in many failures to prevent widespread chemical exposures to persistent, bioaccumulative, endocrine disrupting and known or suspected carcinogenic toxicants. Necessary changes to TSCA to ensure a health protective chemical management system include: requiring chemical producers and manufacturers to demonstrate safety of their products prior to bringing them to market, requiring health and environmental impacts for chemicals already in commerce, eliminating overly arduous "unreasonable risk" and "least burdensome" regulation criteria that the EPA must satisfy in order to require producers to complete further health testing or to ban a chemical, and overhauling confidential business information rules that would prevent producers from hiding chemical exposures from consumers or obscuring chemical-related health information.

A reformed Toxic Substances Control Act would serve as the backbone of a sound and comprehensive chemicals policy that protects public health and the environment, while restoring consumer confidence in US goods in both the domestic and world market.

Effective Chemical Policy reform should:

- **Take immediate action on the most dangerous chemicals**—Persistent, bioaccumulative toxic chemicals should be phased out of commerce.
- **Hold industry responsible for the safety of their chemicals and products**—Chemical companies should be required to provide full information on the health and environmental impacts of all their chemicals.
- **Use the best science to protect all people and vulnerable groups**—Chemicals should meet a standard of safety for all people, including children, pregnant women, and workers.

Personal and Professional Actions to Avoid Exposure

There are several measures each of us can take to reduce our exposure, but it is important to note that we cannot shop, eat, or exercise our way out of this problem. Only a major shift in the way chemicals are managed will achieve the necessary systemic change. Doctors and nurses can make environmental health part of patient services by providing disease prevention information to their patients, accurately and proactively recognizing the first stages of diseases of environmental origin and their causes, and making changes in the health care setting to avoid chemicals that trigger the onset of those diseases by adopting environmentally preferable purchasing policies.

Shifting to Safety

Beyond individual or professional actions to avoid exposure, the most important thing every physician, nurse or public health professional must do is advocate for change in how chemicals are managed in the US. Whether working in their state or nationally, health professionals can educate their law makers on the inherent potential hazards of allowing existing or new chemicals to be used in commerce without being adequately tested for their ability to persist in the environment, be detected in infant cord blood, cause cancer, birth defects, reproductive problems or neurologic disorders, or act as endocrine disruptors.

INTRODUCTION

TOXIC CHEMICALS ARE ALL AROUND US. Everyday products in our homes, workplaces, schools, stores or places of worship are made from chemicals. Some chemicals are safer than others. However, the majority of the chemicals in use have very limited hazard information available and some have been associated with adverse health effects. Many studies have quantified chemicals found in products or sampled in environmental media (such as water, soil, house dust, air or food).

What type of evidence demonstrates these chemicals are actually getting into people's bodies? By testing for substances in people's blood, urine, hair, semen, breast milk, or other specimens, also known as "biomonitoring," scientists can track how much and determine what types and concentrations of chemicals are in people. Biomonitoring is an important and health-relevant standard for assessing people's exposure to potentially toxic substances and for responding to serious environmental public health problems.

Physicians for Social Responsibility conducted the first biomonitoring investigation of health care professionals. Twelve doctors and eight nurses, two in each of 10 states (Alaska, California, Connecticut, Maine, Massachusetts, Michigan, Minnesota, New York, Oregon and Washington) agreed to be tested for the presence in their bodies of chemicals that are associated with health problems and are ubiquitous in our environment.

A majority of the participants are practicing clinicians, with the exception of two retired physicians. Seven men and 13 women ranging in age from 33 to 85 years participated in the sample, 18 of which were Caucasian, one African American and one Asian American. We tested their blood and urine for six chemicals or chemical groups:

- Bisphenol A
- Mercury
- Perfluorinated compounds
- Phthalates
- Polybrominated diphenyl ethers
- Triclosan

These chemicals were identified specifically because they are emerging or known chemicals of concern, are known to be used in the health care setting, and have been associated with certain diseases, the incidences of which are on the rise.

PSR's *Hazardous Chemicals in Health Care* project was designed to provide a snapshot of chemical exposure in a small sample of targeted doctors and nurses. The investigators sought to determine if these chemicals would be detected in blood or urine samples of the project participants, how these results compared to those of the CDC *National Report on Biomonitoring*, and if there were any chemicals for which health professionals appeared to have higher exposure risk. Due to the small sample size and geographic diversity, the biomonitoring data discussed here does not lend itself to statistical analysis for relating exposure to health outcomes nor can it represent the complete exposure picture for doctors and nurses in the US. The data does offer preliminary indicators of what the broader health care community may be experiencing.

All research protocols received institutional review board (IRB) approvals by the Western Institutional Review Board (*www.WIRB.com*), including participant selection, recruitment, informed consent, blood and urine specimen collection, laboratory analysis, and informing participants of their results. WIRB provides review services for more than 100 institutions (academic centers, hospitals, networks and in-house biotech research), as well as for individual investigators in all 50 states and internationally. Biological Samples were analyzed by AXYS Analytic Services Ltd. for all chemicals except mercury, for which Brooks Rand Laboratories conducted the analysis. (See Appendix I for details about methods and protocols used.) All participants agreed to make their personal data public.

Why Test Health Care Professionals?

We asked the nurses and doctors in this project to step into the unusual role of project participant rather than researcher for several reasons.

First, little is known about health professional exposures to toxic chemicals and yet organizations like Health Care Without Harm have demonstrated that there are many health care workplace sources of exposure to potentially toxic chemicals including those

in our project. Furthermore, health care workers "share many of the same types of exposures to chemicals and hazards found in 'blue collar' industrial settings," according to the National Institute for Occupational Safety and Health (NIOSH).[1]

The NIOSH State of the Sector Report for Health Care and Social Assistance found mounting evidence that healthcare professionals are being widely exposed to both hazardous drugs and chemicals hazards in the workplace.[2] NIOSH identified a need to establish surveillance systems designed to track health outcomes in health professionals as well as improved studies to evaluate the relationship between hazardous exposures and work-related disease.

"Biomonitoring measurements are considered the most health-relevant assessments of exposure because they measure the amount of the chemical that actually gets into people."

— HOWARD FRUMKIN, MD, DR PH
Director of CDC's National Center for Environmental Health and Agency for Toxic Substances and Disease Registry[3]

Second, this project provides participants with the dual layers of scientific research and personal experience needed to become leaders in the conversation about preventing disease by changing how we manage chemicals. Doctors and nurses are the most trusted individuals to speak on health related issues. People rely on them to provide scientifically accurate information about health hazards and to advocate for preventative policies that will lower the burden of disease.

Third, we seek to engage members of the broader health care community in the dialogue about chemical policy reform by sharing this report, along with the personal and professional perspectives of the participants. The connections between chemicals in our environment and human disease are being drawn ever more clearly through peer-reviewed scientific studies. It is now more important than ever for health care professionals to understand the kinds of chemicals that are likely to be in their own and their patients' bodies, and how these chemicals may relate to observed symptoms.

Health care professionals are in an ideal position to assess and prevent diseases of environmental origin. Knowledge of symptoms caused by acute or chronic exposure to toxic chemicals will aid these professionals, often on the front lines of collecting detailed health histories, in accurate diagnoses and treatment of environmental illnesses.

Given the high level of respect in which they are held by the public and policy makers, health care professionals can serve as effective spokespeople for transformation of the nation's chemicals policy to one which does not cause harm.

What Biomonitoring Tells Us

Biomonitoring is a tool used by the CDC, state health departments (such as in blood lead testing in children), academic-based researchers, non-governmental organizations (NGOs), and communities to characterize the presence of exposure to potential toxicants. Repeated biomonitoring also allows for tracking of changes in exposure to toxicants that are suspected risk factors for disease development and gauging the impact of public health intervention to prevent exposures.

Specific public health uses of exposure information provided by biomonitoring include:

- Determining which chemicals are getting into people and at what concentrations.
- Determining the prevalence of people whose body burden exceeds toxicity thresholds for chemicals, when such thresholds are known.
- Establishing reference ranges that can be used by physicians and scientists to determine whether a person or a group has an unusually high exposure.
- Assessing the effectiveness of public health interventions to lower exposures to known toxicants.
- Tracking trends in levels of exposure of the population over time.
- Setting priorities for policy action to eliminate chemicals that are known to be persistent, bioaccumulative, and/or toxic.

At the Centers for Disease Control and Prevention (CDC), the Environmental Health Laboratory of the National Center for Environmental Health has been performing biomonitoring measurements for more than 30 years. Of the over 80,000 chemicals registered with the U.S. EPA for market use, the CDC's National Biomonitoring Program now measures 220 chemicals in blood and urine. This program directly measures the exposures of Americans to environmental chemicals through biomonitoring of a random sample of the non-institutionalized US population.

Since the release of the CDC's *Third National Report on Biomonitoring* in 2005 (which tested 146 chemcals) 75 chemicals have been added to the list of emerging chemicals of concern that the biomonitoring program will be tracking now and into the future. The new CDC biomonitoring results published in the peer-reviewed literature since the release of the *Third National Report* includes several chemicals tested in PSR's *Hazardous Chemicals in Health Care* biomonitoring project: Triclosan (found in 74.6% of the US population),[4] additional phthalate metabolites (found in 99.9% of the population),[5] bisphenol A (found in 92.6% of the US population),[6] and PBDEs (one or more congeners found in 100% of US population).[7] The overall findings from CDC's *National Report on Biomonitoring* tell us that all Americans are living with synthetic chemicals in their bodies that are associated with health problems. In our Results section, we will discuss CDC's findings along with our own results.

The CDC Biomonitoring Program and the CDC National Environmental Public Health Tracking Program work closely together to combine biomonitoring and environmental health tracking information that can be used to plan, apply, and evaluate actions to prevent and control environmentally related diseases.

Learning Lessons from Pharmaceuticals

Lessons of pharmacology have long illustrated that various individual attributes such as genetics, age, weight, nutritional level and stage of development can have surprising effects on how chemicals (namely drugs) might act in the body. Similarly, the effects of synthetic chemicals vary in different people. It is, therefore, important to keep in mind several key points about chemicals in commerce:

- Frequently chemicals enter the market when there is little data about their inherent hazard, only to find later that these chemicals are able to be absorbed into a person's body, become metabolized, reach a target organ and cause damage.
- Chemicals enter the market without any regulatory requirement to meet safety thresholds; they subsequently lead to ubiquitous exposure and potential adverse health effects.
- There is little difference between the actions of pharmaceutical and industrial chemicals in the human body but vast differences in the safeguards provided to us by their respective chemical management agencies—the Food and Drug Administration (FDA) for pharmaceuticals and the EPA for industrial chemicals.

THE IMPACT OF BIOMONITORING

The success in the lowering of childhood blood lead levels over the past several decades illustrates the effectiveness that biomonitoring provides to "red flag" hazardous exposures in the general population and spur necessary intervention strategies. In the case of childhood blood lead levels , the CDC began tracking them in 1976, when it was found that 88% of children had blood lead at unacceptable levels. As a result of this biomonitoring and continued public health advocacy, federal regulations banned lead additives to gasoline and non-industrial paint, and state regulations laid out requirements for mitigating existing lead paint in residences. Subsequently, the national average has dropped such that only 2.2% of children between one and five years of age have blood lead concentrations above the 10 µg/dL level of concern.[8]

The principles of pharmacology provide a starting frame of reference for understanding the toxic effects of hazardous chemicals.[9] To the human body, it doesn't matter whether the chemical agent is a drug or an industrial chemical as long as it can be absorbed, transported, metabolized, reach its target organ to produce its effect (desired or undesired) and eventually be excreted.

The impact of drugs or industrial chemical exposure can be immediate, or long term with chronic effects, and some exposures show impacts only after a latency period. A critical difference between pharmaceuticals and industrial chemicals is that pharmaceuticals are delivered in known, measured doses and there is stringent pre-market safety testing required by the FDA before these types of chemicals are able to be marketed.

Industrial chemicals, on the other hand, are able to enter our bodies as they leach out of consumer products in uncontrolled doses and its producers were not required to demonstrate basic safety prior to releasing this chemical into the market place. Pharmaceutical producers are required to comprehensively label the efficacy, interactions and specific side effects, yet there is only extremely limited information available for industrial chemicals. Pharmaceuticals also have a system for reporting adverse side effects or issuing recalls, but no formal system exists for industrial chemicals.

ABOUT THE CHEMICALS

Bisphenol A (BPA)

Used to make rigid plastic polycarbonate (roughly 70% of BPA),[10] used in baby bottles, plastic water cooler bottles, kitchen appliances, CDs and DVDs, and shatter-proof 'glass' applications and to make epoxy resins (roughly 25% of BPA), including for linings of metal food and drink containers, printer toners and inks, industrial paints, dental sealants and other products. Approximately seven billion pounds are manufactured every year.[11] BPA is an endocrine disruptor shown to induce health impacts identified in animal studies at the same levels found in people through biomonitoring by CDC and PSR.[12] Disorders associated with BPA exposure include miscarriages, infertility,[13,14] breast[15] and prostate cancer,[16] altered brain development and function,[17] obesity,[18] heart disease,[19] diabetes and thyroid dysfunction.[20]

Mercury

Used in widely in the health care setting, including in blood pressure gauges, thermometers, bougies, foley catheters, thermostats, fluorescent lights, switches and dental amalgam. Spills and breaks can lead to direct exposure. Mercury is found in coal and released from power plants. Environmental mercury builds up through the aquatic food chain and is common in large fish (like tuna and swordfish). Mercury is a heavy metal and a neurotoxin that attacks the central nervous system and damages the brain. It can also pass from mother to the embryo and fetus, affecting brain development, resulting in mental retardation, abnormalities of fine motor skills, impaired visual-spatial perception, learning disabilities, attention deficit disorders, and hyperactivity.[21]

Perfluorinated compounds (PFCs)

Used in manufacturing of protective coatings for carpets, stain- and grease-resistant clothing, paper coatings (like microwave popcorn bags), and non-stick pans. Our project tested for perfluorooctanoic acid (PFOA), perfluorononanoic acid (PFNA), perfluorodecanoic acid (PFDA), perfluorohexansulfonate (PFHxS), and perfluoroundecanoic acid (PFUnA). All of these are breakdown chemicals for coatings still in use. We also tested for perfluorooctanesulfonate (PFOS), which was an active ingredient in ScotchGard prior to 2000, and which has now been restricted by EPA. PFCs persist in people and wildlife[22] and have been linked to hormone and immune disruption in laboratory animals. PFC exposure can lead to liver and pancreatic tumors in animals, and can disrupt fetal development in humans.[23]

Phthalates

Used as plasticizers and found in many consumer items such as cosmetics, hair spray, plastic products, and wood finishes. Many IV bags and tubing in the health care setting are made from PVC plastic, which relies on phthalates to be flexible. Vinyl wallpaper may also contain phthalates. We tested for metabolites (chemicals after the body has digested them) of five phthalates: dimethyl phthalate (DMP) diethyl phthalate (DEP), dibutyl phthalate (DBP), benzyl butyl phthalate (BzBP), and Di(2-ethylhexyl) phthalate (DEHP), which has three metabolites. Low-level exposures affect the development of reproductive organs,[24] potentially causing adverse health effects in embryos, fetuses, and preterm babies.

Polybrominated diphenylethers (PBDEs)

Used as flame retardants in products like furniture, computers, electronic medical equipment and mattresses. There are three primary commercial formulations of PBDEs, based around the number of bromine atoms attached to the molecule (called congeners: see the Results section for more details). Two of the common commercial formulations, penta- and octa-BDE (with five and eight bromines, respectively), have been voluntarily phased out of US production. Deca-BDE continues to be produced. PBDEs are toxic at low levels and persistent in the environment. PBDEs are associated with learning, memory, and behavior disorders,[25] reproductive impairment, thyroid disruption and cancer.[26]

Triclosan

Used as a synthetic broad-spectrum antimicrobial agent used in hundreds of products such as toothpaste, antibacterial soaps, cosmetics, fabrics, deodorants, and plastics. In the health care setting, Triclosan is used primarily in the health care setting as a hand-sterilizer. Triclosan can be converted to dioxin in sunlight or when heated.[27] This chemical is very stable over long periods of time and bioaccumulates in aquatic organisms and even in human breast milk. It can disrupt thyroid function[28] and can alter some hormone functions in humans,[29] though the health implications of this are still being explored.

THE PARTICIPANTS

ALASKA

ROXANNE CHAN, RN is a licensed acupuncturist and registered nurse who was born and raised in North Carolina, and has lived in San Francisco, and currently resides in Anchorage, Alaska. She is a volunteer for Alaska Community Action on Toxics, and serves as board Secretary. She enjoys hiking, cooking, eating fresh food, and exploring the local neighborhood.

Our testing found 19 PBDEs in Roxanne's blood, along with four PFCs. Bisphenol A, triclosan and metabolites for four phthalates were detected in her urine. Metabolites for DEHP were the highest in the study, well above CDC's 95th percentile.

"It was very much a reality check to know that there were chemicals from everyday products being detected in my blood. I hope to help raise the awareness about the effects of toxic chemicals on people and the environment so that we can work together to find better alternatives."

ANONYMOUS MALE PHYSICIAN had 26 PBDEs in his blood, including decaBDE, eight of which were the highest among our participants. In addition, we found three perfluorinated compounds, bisphenol A, triclosan (at the highest level among our participants) and mercury. He had metabolites for all five phthalates, and his dimethyl phthalate metabolites were the highest among participants and more than six times the CDC's 95th percentile.

CALIFORNIA

SANDRA ARONBERG, MD, MPH is a board certified OB/Gyn, Assistant Clinical Professor, UCLA School of Medicine and an Adjunct Assistant Professor in the UCLA School of Public Health with a degree in environmental and occupational health and toxicology. She has extensive experience in patient care and also as an executive in health care organizations, including Blue Shield of California. Currently Dr. Aronberg is a health care consultant and teaches at UCLA. She serves on the Beverly Hills Health and Safety Commission and the Los Angeles County Fish and Game Commission. Dr. Aronberg is a devoted grandparent and enjoys golf, fishing, and cooking.

Our tests found 21 PBDEs in Sandra's blood, including decaBDE, along with four PFCs and mercury. We found bisphenol A, triclosan and metabolites for four phthalates in her urine.

"This project has captured my attention and has made me more aware of the pervasive presence of toxins in our world and the lack of proper health studies before people are exposed to products. I was surprised to learn that BPA in a water bottle could undermine the health of a family member with estrogen sensitive breast cancer."

DEBORAH LERNER, MD has dedicated her professional life to caring for the working poor. She has worked at Eisner Pediatric and Family Medical Center, a non-profit community health center in downtown Los Angeles, since her residency in Family Medicine at UCLA. As Chief Medical Officer, she is responsible for overseeing over 50 providers from a range of health specialties and continues to treat patients herself. She is married to Peter Sinsheimer, PhD, of the Sustainable Technology and Policy Program at UCLA. They are the parents of Zachary, 11, and Aliya, 8. Dr. Lerner's interests include cooking, travel, theater, and rooting for whatever team her children are playing on.

Our tests found 24 PBDEs in Deborah's blood, with six of them the highest among participants, along with three perfluorinated compounds and mercury. She had the highest level of total PBDEs of all project participants. We found bisphenol A, triclosan, and metabolites for all five phthalates in her urine.

"What's most disturbing about my results is the apparent randomness: I expected high levels of Teflon-related chemicals, but instead I had higher levels of flame retardants and I don't know why. How can I prevent exposure? Now I have far more worries about my kids' contamination levels of the whole gamut of chemicals we tested for."

CONNECTICUT

CARRIE REDLICH, MD, MPH is the Acting Director of the Occupational and Environmental Medicine Program at Yale University School of Medicine, where she received her medical and masters degrees. Her research focuses on lung diseases linked to occupational exposures, isocyanate asthma and biomarker research.

Carrie had 17 PBDEs in her blood, including the highest value for BDE-183 (a hexaBDE), as well as four perfluorinated compounds and mercury. We found bisphenol A and metabolites for four phthalates in her urine.

"It was unsettling to realize how many different chemicals were circulating in my body. I've stopped spraying bug repellant so liberally and am more careful what type of containers I microwave food in."

TIMOTHY E. SQUIRES RN-BC, MS, works at the MidState Medical Center in Meriden, CT as a Clinical Professional Development Consultant working with the clinical staff and as Adjunct Clinical Faculty for Southern Connecticut State University's School of Nursing working with senior nursing students in the clinical setting. He is the past president and current board member of the Connecticut Nurses' Foundation and serves as the chairperson of the Supervisory Committee and Board member for the Hartford Healthcare Federal Credit Union. Tim lives in Rocky Hill, Ct and enjoys reading, rollerblading, a variety of exercises as well as movies of all types, especially science fiction, during his free time.

Our tests found 20 PBDEs, four perfluorinated compounds and mercury in his blood and bisphenol A, triclosan and metabolites for three phthalates.

"As a registered nurse, I recognize the impact biohazards such as the chemicals being tested in this project can have on the health of individuals and communities. It is essential that the public become aware of the benefits of avoiding or reducing exposure. As we move forward education and support of actions that reduce exposure must be the focus."

MAINE

STEPHANIE LASH, MD, is Chief of Neurology Section and Director of Stroke Services at Eastern Maine Medical Center. She is President of the Maine Medical Association 2008–2009, and serves on both the Practice Committee and the Governance Committee of the American Academy of Neurology. She received her MD from Dartmouth Medical School and as resident and fellow at University of Washington, Seattle, trained with a specialization in stroke. She has research interest in Transcranial Doppler. Dr. Lash enjoys skiing, sailing and hiking with her family.

Stephanie had 18 PBDEs in her blood, including decaBDE, along with three perfluorinated compounds and mercury. She had bisphenol A, triclosan and metabolites of four phthalates in her urine.

"I was surprised to find that despite living a rural life, eating organic food whenever possible and trying to avoid toxics whenever possible, I have significant levels of several known toxins in my system. I think we need to do more to keep these substances out of our environment."

ANNE PERRY, BSN, MSN, is serving her fourth term as a member of the Maine House of Representatives and a certified family nurse practitioner residing and practicing in Calais. She is a member of the Maine Advanced Practice Nurses Association, the Maine State Nurses Association and is a co-founder of Neighbors Against Drug Abuse (NADA), the Substance Abuse Services Commission and the National Legislative Association of Prescription Drug Pricing, a nonpartisan, nonprofit organization. She has been a member of the Calais School Committee, chair of School Union #106 and a board member of the Maine State School Boards Association. She also belongs to the Rotary Club. In her spare time, Rep. Perry enjoys canoeing, weaving and knitting. She has three grown children and two grandchildren.

Our tests found 19 PBDEs in Anne's blood, along with three perfluorinated compounds. We also found bisphenol A, triclosan and metabolites for all five phthalates in her urine.

"I'm a nurse living in a small town in rural Maine. If I've got toxic chemicals in my system, then chances are we all do—just from simply going about our daily lives. Here in Maine we've taken important steps to replace dangerous chemicals with safer alternatives, but it's time for Congress to take action to protect our kids and families."

MASSACHUSETTS

SEAN PALFREY, MD is a general pediatrician who has practiced in teaching centers in Massachusetts for the past 30 years. He is a professor of pediatrics and public health at Boston University and an outpatient and inpatient clinician and teacher at Boston Medical Center. He has focused his public health work on vaccines, lead and other environmental toxins, and advocacy for child health policy initiatives. He has traveled extensively, both as a physician and a photographer, has served as president of the Massachusetts Chapter of the American Academy of Pediatrics, and with his wife, Judith S. Palfrey, MD, has worked and played as housemaster of Adams House at Harvard University for the past ten years.

Sean had 21 PBDEs, four perfluorinated compounds and mercury in his blood, and bisphenol A, triclosan, and metabolites of all five phthalates in his urine.

"Having read about and spoken for so many years on my concerns about the presence of environmental toxins in mother's, fetuses' and children's bodies and blood, I welcomed the chance to participate in a high quality study of toxin levels in my own body. Hopefully this research will enable us to bring a greater personal force and urgency to the issues all of us, as professionals in the field, present in our work and advocacy."

MIMI POMERLEAU, DNP, is the Course Coordinator/Assistant Clinical Professor for Family Focused Nursing at Lawrence Memorial Regis College. She has worked for many years as a staff nurse in perinatal settings, most currently at Massachusetts General Hospital on an antepartum/postpartum unit. Mimi has been actively involved in AWHONN as a member of the Board of Directors, and as the Massachusetts Section Chair and Secretary Treasurer. Mimi served on the Board of Directors of the Massachusetts Center for Nursing. Mimi received her Masters Degree as a Women's Health Nurse Practitioner at Boston College, and Doctor of Nursing Practice at Regis College.

Our tests found 18 PBDEs, three perfluorinated compounds and mercury in her blood and bisphenol A and metabolites for all five phthalates in her urine.

"As a nurse caring for women and newborns, I volunteered for the biomonitoring project to learn more about the environmental risks to my patients. It was not just about my health but it was my professional responsibility to understand how chemicals in our everyday environment impact the health of those I care for. Although my levels were low, it concerned me that these chemicals were even in my body."

MICHIGAN

WILLIAM WEIL, MD, is professor emeritus of Pediatrics and Human Development at Michigan State University. He was founding chair of that department in 1968 and served in that role for 11 years. He is a past president of the Society for Pediatric Research and is a recipient of the Michigan State University Distinguished Faculty Award. He was on the National Academy of Sciences task force that published "Pesticides in the Diets of Infants and Children." He was a member of the AAP Committee on Environmental Health. He currently serves on the Michigan Network for Children's Environmental Health, the Scientific Advisory Board of the Michigan Environmental Council and the Pesticide Advisory Board for the Michigan Department of Agriculture.

William had 18 PBDEs in his blood, along with three perfluorinated compounds and mercury. He had bisphenol A, triclosan and metabolites of all five phthalates in his urine.

"It is certainly clear that one cannot live in the present environment without harboring a wide range of potentially harmful substances and avoiding serious exposure seems more a matter of chance than design. We need to clean up this entire chemical quagmire in order to protect everyone."

REP. JIMMY WOMACK, MD, MDIV, is serving his first term in the Michigan House of Representatives, representing the 7th House District in the city of Detroit. Dr. Womack is a retired anesthesiologist who worked in the Detroit area for 13 years, retiring from full-time practice in 1995. He formerly served as the President of the Detroit Board of Education. Dr. Womack is a graduate of Dillard University, Meharry Medical College and McCormick Theological and Ecumenical Theological Seminary. He presently serves on the Boards of Detroit's Ecumenical Theological Seminary and the Detroit Medical Centers Harper-Hutzel Hospital, among many others. He has two children.

Our tests found 24 PBDEs, including decaBDE, mercury and all six of the perfluorinated compounds for which we tested in Jimmy's blood. He was the only participant to have all six PFCs, resulting in his having the greatest amount of total PFCs of our participants. He was also the only participant to have BDE-151, a hexaBDE, detected. We found bisphenol A, triclosan and metabolites for four phthalates in his urine.

"It was an honor to take part in a study that would help to highlight the potential toxic exposure that comes from everyday living."

MINNESOTA

GEORGE LUNDGREN, MD, a Minnesota family practice physician, has cared for his patients for thirty six years and is employed by Allina. He enjoys helping patients to balance and integrate the physical, mental, emotional, social, and spiritual self caring needed to achieve their goals of having healthy, productive, and happy lives. As a supporter of Physicians for Social Responsibility for thirty nine years, and a recent Clean Water Action volunteer, social justice and environmental causes have been an important ways he serves others. He lives in Minneapolis with his wife and cares for his 90-year-old father.

George had 22 PBDEs, four perfluorinated compounds, and mercury in his blood, and bisphenol A, triclosan and metabolites for all five phthalates in his urine.

"When you do find out some of the specific unnatural chemicals in your body it is hard to deny, minimize, rationalize or justify their presence. It is disturbing to know the only body I have is permanently contaminated."

MARY ROSEN, RN, has been a pediatric oncology nurse for nineteen years. She currently works at Children's Hospitals and Clinics of Minnesota in St. Paul. She also works in a medical spa administering Botox injections. Mary lives in Woodbury, along with her husband and their two children. In 2007, PFBAs (chemicals used in a variety of consumer products) were detected in Woodbury's drinking water.

Our tests found 13 PBDEs, two perfluorinated compounds, and mercury in Mary's blood and bisphenol A, triclosan and metabolites for four phthalates in her urine.

"Although knowing what is in my body makes me a little uncomfortable, I was not at all surprised at my test results. Working in the environments that I do, I am exposed to lots of various, unknown chemicals. I am most concerned about the future effects these chemicals may have on my family and my patient population and the growing incidence of cancers in my community."

NEW YORK

BARBARA CRANE, CCRN, currently works in the critical care unit at St. Catherine of Siena Medical Center. She has worked in critical care for 35 years and and is a very active advocate for patients and nurses alike. As president of a 70,000 member national nurses union she speaks on behalf of her profession and her colleagues from the steps of the capitol in Albany, NY to Seattle, Washington and on to Washington DC. Barbara is married with two adult children and six grandchildren.

Our tests found 19 PBDEs, five perfluorinated compounds and mercury in Barbara's blood and bisphenol A, triclosan and metabolites of four phthalates in her urine.

"Since my results were documented I have come to realize that just being a citizen of a developed country exposes me to unimagined chemical intruders. I guess I always believed that our health would be protected by government or environmental policy and practice. I have since come to realize that nothing is further from the truth."

CATHEY EISNER FALVO, MD, MPH, a long time activist in the movement for peace and justice, trained in pediatrics and preventive medicine/public health. She was pediatrician for a neighborhood health center and professor and chair of public health at New York Medical College School of Public Health until 2005. She has been associated with PSR since 1983; has been on the Board of Directors and now represents PSR to the International Society of Doctors for the Environment and the UN. She has worked in Nicaragua since 1989 and made frequent trips to Haiti and Vietnam. She worked in the USPHS Indian Health Service on the Turtle Mountain Reservation in North Dakota. In her spare time she swims, goes to the opera, chamber music concerts and the theater, and is relearning playing the bassoon.

Cathey had 22 PBDEs, four perfluorinated compounds and mercury in her blood, and bisphenol A, triclosan and metabolites of all five phthalates in her urine. Her total phthalate levels were the second highest among participants, and she had the highest levels of BPA and mercury of the participants.

"Despite knowing the extent of chemical contamination, it is unnerving knowing I am as contaminated as the tests showed."

OREGON

KEVIN CHATHAM-STEPHENS, MD, finished his position as Chief Pediatric Resident at Doernbecher Children's Hospital this past June and is currently working as a pediatrician in Portland, OR, where he lives with his wife and 2 children (son Kai is two years old, while daughter Sage is just five months). Next year, Kevin will move to New York City next year for a pediatric environmental health fellowship at Mt Sinai School of Medicine, where he will combine his interests in medicine and the environment. In addition to the typical Northwest outdoor activities such as hiking, Kevin is training for a cross-country bike ride from Oregon to North Carolina next spring.

We found 20 PBDEs, including decaBDE, in Kevin's blood, along with three perfluorinated compounds. Kevin had bisphenol A, triclosan and metabolites of all five phthalates in his urine, including the highest levels in the project for perfluorohexanesulfonate (PFHxS).

"As a pediatrician, one of the most worrisome aspects of this study is the prospect that these chemicals may be be present in my patients and my own children, and the potential impact that these chemicals may have on their development and overall well-being. Since there have been studies showing that many of these chemicals can affect human subjects in various ways, such as disrupting the endocrine system, it is imperative that we use the precautionary principle to reduce human exposure and the resultant potential adverse health outcomes."

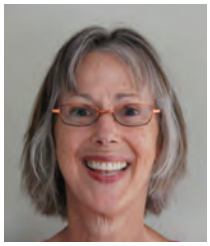
ANONYMOUS FEMALE NURSE had 18 PBDEs, three perfluorinated compounds and mercury in her blood, and bisphenol A, triclosan and metabolites for four phthalates in her urine.

WASHINGTON

CARMEN McDERMOTT, MD, practices Internal Medicine in Seattle, WA. She attended University of Washington for Medical School and Residency. She also received a Bachelor of Science on Conservation Biology and Ecology from the University of Washington.

Carmen had seventeen PBDEs, two perfluorinated compounds and mercury in her blood, and bisphenol A and metabolites of all five phthalates in her urine.

"I was very surprised and pleased because my levels for many of the chemicals were on the lower side. I hope this represents many efforts I have taken to reduce toxins in my home and eat organically."



DONNA YANCEY, RN, is a nurse at Seattle Children's Hospital. She has worked in the health care field for 45 years. The focus of her work is on nurturing and helping children to heal. She finds her personal re-booting in our environment through hiking and kayaking.

Donna had 20 PBDEs in her blood, including decaBDE, along with two perfluorinated compounds and mercury. She had bisphenol A and metabolites of all phthalates in her urine. She had the second highest level of mMeP (metabolite for dimethyl phthalate), which was more than six times the CDC's 95th percentile value.

"I am pleased to take part in this research project to see how chemicals affect our bodies. I was not surprised, but expected, I would have a bio load. I have worked 45 years in the health care environment where chemicals abound from cleaning materials to plastics. I want the children I work with and all children everywhere to receive nurturing from their environment."

RESULTS

EACH PARTICIPANT WAS TESTED FOR SIX different kinds of chemicals or chemical groups: bisphenol A, mercury, triclosan, and groups of perfluorinated compounds (PFCs), phthalates and polybromodiphenyl ethers (PBDEs). In total, the labs conducted analysis for 62 individual chemicals. **Eighteen chemicals were detected in every single participant. At least 24 chemicals were found in every paricipant's body, and two participants had as many as 39 chemicals detected.** All 20 participants had at least five of the six kinds of chemicals for which we tested, and 13 of our participants had all six. All participants had bisphenol A, and some phthalates, PBDEs and PFCs.

Each participant had detectible levels of bisphenol A, PFOA, PFOS, metabolites for DEHP, BuP, BzP, and PBDEs 15, 28, 47, 99, 100, 153 and 154, 183, 203, 206, 207 and 208.

WHAT'S A METABOLITE?

When some chemicals enter the body, they are partially broken down—or metabolized—before they are excreted. This is true for the class of chemicals called phthalates, and thus when testing for phthalates, it is the 'metabolite' and not the chemical itself that can be detected in urine.

WHAT'S A CONGENER?

Some chemicals can have many different configurations. A congener is a specific variation of the overall chemical class. In the case of polybromodiphenyl ethers (PBDEs), there are 209 congeners, which differ in the number and placement of bromine atoms onto the overall structure (which is two carbon rings joined by an oxygen atom). There can be between one and ten bromine atoms on each PBDE, which gives the more generic names of pentaBDE (has five bromine atoms), octaBDE (has eight bromine atoms) and decaBDE (which has ten bromine atoms). There is only one decaBDE congener, in which all possible placements of bromine are filled.

The results presented here are in µg/L of serum or urine (which is the same as ng/mL and roughly equates to parts per billion—ppb). The one exception is PBDEs, which are reported in pg/g lipid weight (parts per trillion—ppt—of lipids in serum), unlike the other two chemicals (mercury and perfluorinated compounds) which were detected in serum. This allows us to compare our data to that collected by CDC. Urine-related values are not creatinine-adjusted and are compared to non-adjusted CDC data.

In general, these results are consistent with CDC findings, and the quantities of chemicals detected were, for the most part, within the range of 2003–2004 CDC data. The one exception was for dimethyl phthalate metabolites, which is discussed in the phthalate section below. Throughout the Results sections, when we refer to CDC data, we are referring to results published as part of the CDC's *National Report on Biomonitoring* based on the 2003–2004 sample collection period While we compare our results to CDC's data, it is important to bear in mind that a growing body of research shows that there is not necessarily a linear correlation between dose and response. Many of the chemicals in this study have significant health effects at low levels. Higher quantities of chemicals in a body can no longer be assumed to mean greater likelihood of adverse health outcome.

On an individual basis, the presence of these chemicals does not indicate that a particular person will develop any specific disorder. Connections between chemical exposures, individual susceptibility, and health disorders continue to be researched.

	AK	AK	CA	CA	CT	CT	MA	MA	ME	ME	MI	MI	MN	MN	NY	NY	OR	OR	WA	WA
	Chan	Anonymous	Aronberg	Lerner	Redlich	Squires	Palfrey	Pomerleau	Lash	Perry	Weil	Womack	Lundgren	Rosen	Crane	Falvo	Chatham-Stephens	Anonymous	McDermott	Yancey
Triclosan	■	■	■	■	□	■	■	□	■	■	□	■	■	■	■	■	■	■	□	□
Bisphenol A	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Mercury	■	■	■	■	■	■	■	■	■	□	■	■	■	■	■	■	□	■	■	■
Perfluorinated Compounds																				
PFOA	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PFNA	■	■	■	■	■	■	■	■	■	■	■	■	■	□	■	■	□	■	□	□
PFOS	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PFDA	□	□	□	□	□	□	□	□	□	□	□	■	□	□	■	□	□	□	□	□
PFOnA	■	□	□	□	□	□	□	□	□	□	□	■	□	□	■	■	□	□	□	□
PFHxS	□	□	■	□	■	■	■	□	□	□	□	■	■	□	□	□	■	□	□	□
Phthalate Metabolites																				
mMeP	□	■	□	■	■	□	■	■	□	■	■	■	■	□	□	■	■	□	■	■
mEtP	■	■	■	■	□	□	■	■	■	■	■	□	■	■	■	■	■	■	■	■
mBOP	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
mBzP	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
mEHP	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
mEOHP	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
mEHHP	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
PBDEs Tested but not detected: BDEs 7, 8, 10, 11, 12, 13, 25, 32, 33, 35, 77, 105, 116, 120, 126, 128, 166, 181, 190																				
BDE-15	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-17	■	■	■	■	■	■	■	■	■	■	■	■	■	□	■	■	■	■	■	■
BDE-25	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
BDE-28	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-30	□	□	■	□	■	■	■	□	□	□	■	■	□	□	□	■	■	■	□	□
BDE-37	□	■	□	■	□	□	□	□	□	■	□	□	□	□	□	□	□	□	□	□
BDE-47	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-49	■	■	■	■	■	■	■	■	■	■	■	■	■	□	■	■	■	■	■	■
BDE-51	□	■	□	■	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	■
BDE-66	■	■	■	■	■	■	■	■	■	■	■	■	■	□	■	■	■	■	■	■
BDE-71	□	■	□	■	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□	□
BDE-75	□	■	□	■	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□
BDE-79	□	■	■	□	□	□	■	□	□	□	□	■	□	□	□	■	■	□	□	□
BDE-85	■	■	■	■	■	■	■	■	■	■	■	■	■	□	■	■	■	■	■	■
BDE-99	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-100	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-119	□	■	□	■	□	□	□	□	□	■	■	■	□	□	□	■	■	□	□	□
BDE-138	□	■	■	■	□	■	■	□	□	□	□	■	■	□	■	■	■	■	□	□
BDE-140	■	■	□	■	□	■	■	■	□	■	□	■	■	□	□	■	■	□	□	■
BDE-153	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-154	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-155	■	■	■	■	□	■	■	■	■	□	□	■	■	□	■	■	■	□	■	■
BDE-183	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-190	□	□	□	□	□	□	□	□	□	□	□	■	□	□	□	□	□	□	□	□
BDE-203	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-206	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-207	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-208	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
BDE-209	■	■	■	□	□	□	□	□	■	□	□	■	■	■	■	□	■	□	□	■

■ Positive □ Negative

PHTHALATES

We tested for five different phthalates. This was done by testing participants' urine for phthalate metabolites. For four of the phthalates in question, there is only one metabolite, but for DEHP, there are three metabolites, so in total we tested for seven separate chemicals.

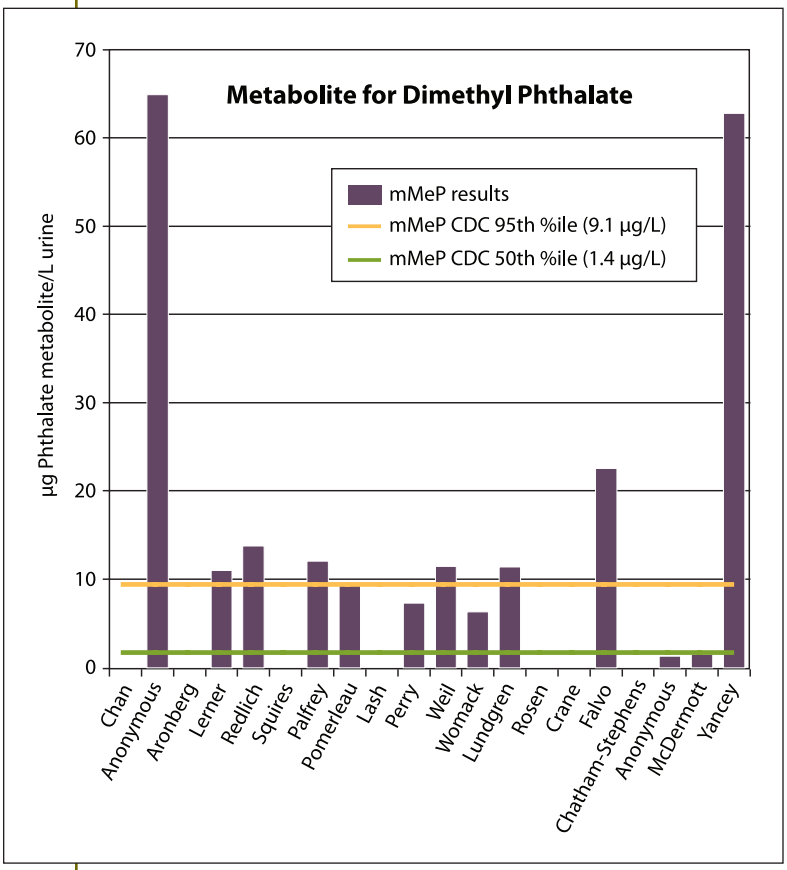
Dimethyl phthalate (DMP): Thirteen participants had DMP metabolite in their bodies, and 12 had levels above CDC's 50th percentile of 1.4 µg/L. Our project median (50th percentile) was 4.61 µg/L. Nine participants had levels above CDC's reported 95th percentile of 9.1 µg/L, and two had levels more than six times CDC's 95th percentile. While the small sample size makes it difficult to demonstrate any statistical significance, further biomonitoring of health care professionals might illuminate a work-related source of exposure. Both physicians and nurses had high levels. The fact that some participants had no detectible levels of DMP metabolite in their samples gives us confidence that there was no contamination of collection containers or laboratory equipment.

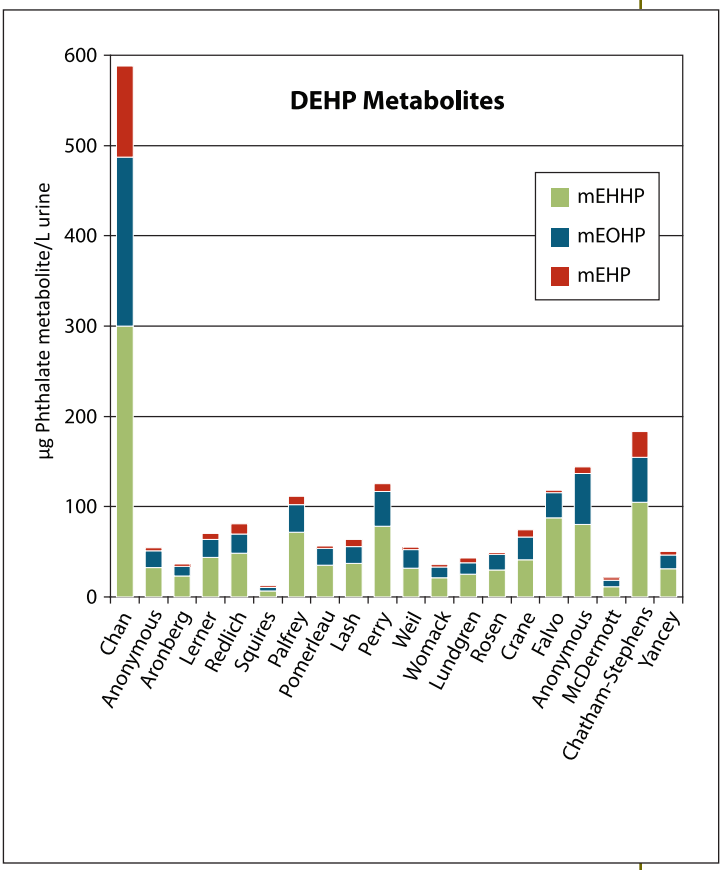
Diethyl phthalate (DEP): Seventeen participants had diethyl phthalate metabolite in their bodies, and all fell within the CDC's range of results (CDC calculated a median of 181 µg/L, ours was 54.4).

Dibutyl phthalate (DBP): All 20 participants had dibutyl phthalate metabolite in their bodies. CDC's median was 19.1 µg/L; ours was 21.5 µg/L.

Benzyl butyl phthalate: (BBP) We detected the metabolite for this phthalate in all twenty participants. CDC's median was 13.8 µg/L, ours was 7.14.

Di(2-ethylhexyl) phthalate (DEHP): All 20 participants had detectible levels of all three metabolites of DEHP. The project medians were consistently above CDC data (4.61 µg/L vs CDC's 4.1 for mEHP; 19.5 µg/L vs CDC's 12.2 for mEOHP; 36.4 µg/L vs. CDC's 17.7 for mEHHP). One participant, Roxanne Chan, had levels of each DEHP metabolite exceeding CDC's 95th percentile.





PERFLUORINATED COMPOUNDS

We tested for six perfluorinated compounds. This was done by analyzing serum samples for the specific chemicals in question. The CDC conducted biomonitoring or PFCs for the first time in their 2003-2004 sample collection. CDC tested for a different but overlapping set of PFCs, so two of our compounds had no CDC data for comparison. PFCs are reported here, as in CDC data, as µg/L serum. All participants had some PFCs in their blood. Several only had two PFCs—PFOA and PFOS. Only one participant, Rev. Jimmy Womack, had all six of the PFCs for which we tested.

Perfluorooctanoic Acid (PFOA):
All participants had PFOA in their serum. Our median, 2.93 µg/L, was below CDC's median of 4.0.

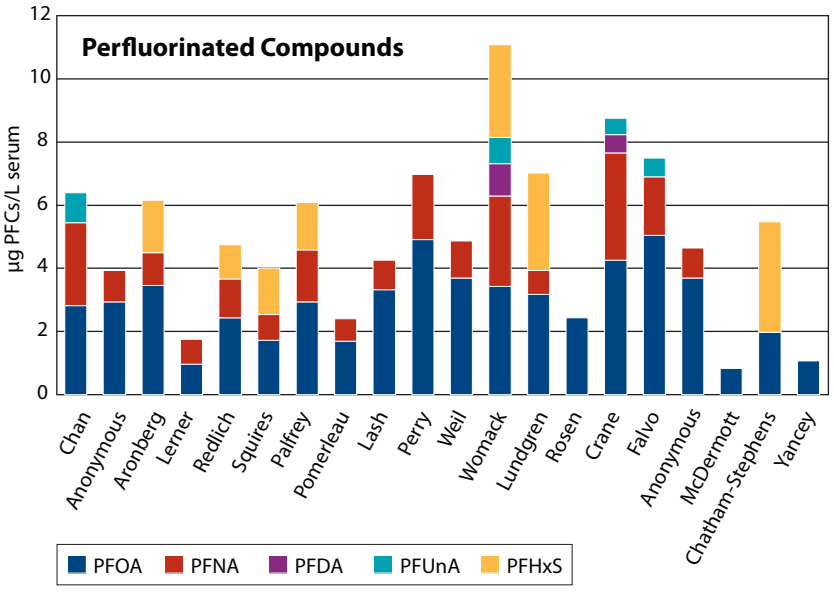
Perfluorononanoic Acid (PFNA):
Sixteen participants had PFNA in their bodies. Our median, 1.105 µg/L, was slightly above CDC's median of 1.0.

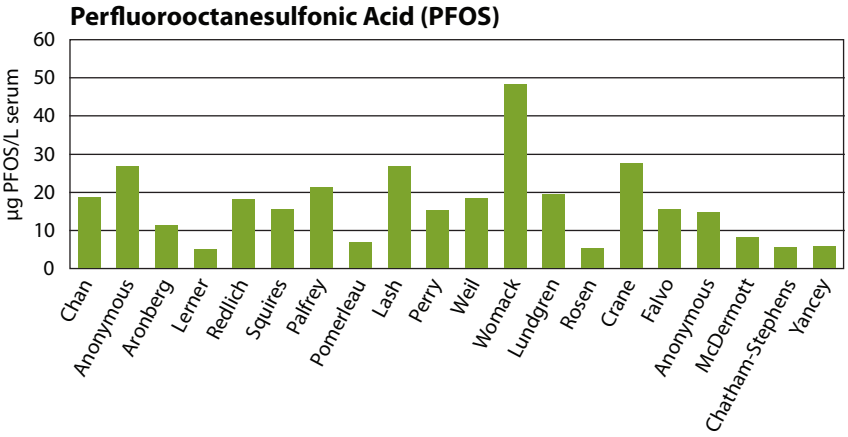
Perfluorooctanesulfonate (PFOS):
All participants had PFOS in their bodies. Our median of 15.55 µg/L was below CDC's median of 21.1 µg/L. These values are still significantly higher than the amounts detected of other PFCs, despite PFOS having been phased out by Dow Chemical.

Perfluorodecanoic acid (PFDA):
Two participants had PFDA in their bodies, at values of 0.58 and 1.02 µg/L. CDC reported no data for this chemical.

Perfluoroundecanoic Acid (PFUnA):
Four participants had PFUnA in their bodies, with values ranging from 0.52 – 0.94 µg/L. CDC reported no data for this chemical.

Perfluorohexansulfonate (PFHxS):
Seven participants had PFHxS in their bodies. Our median, 1.65, is slightly below CDC's median of 1.9 µg/L.



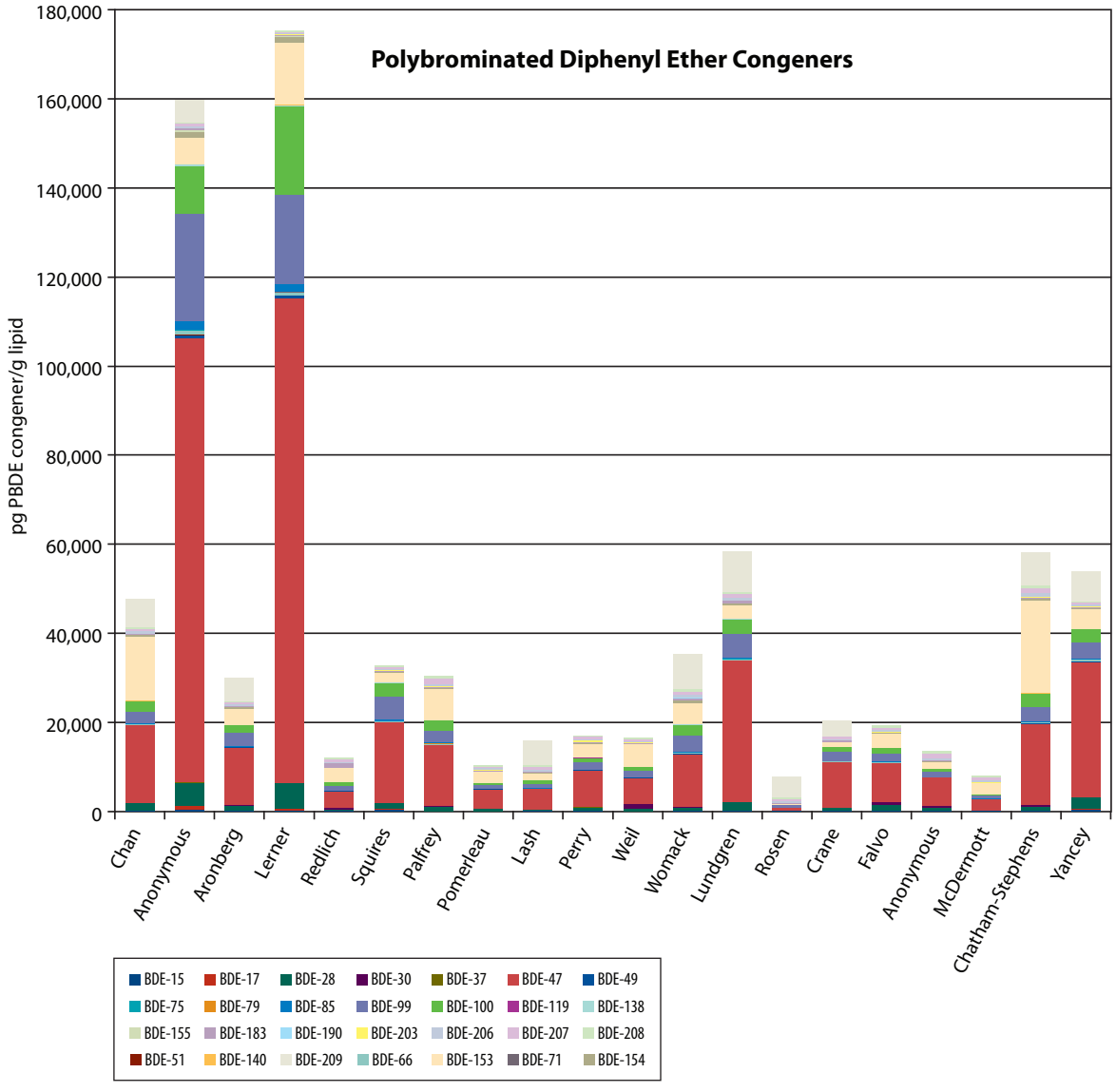


POLYBROMINATED DIPHENYL ETHERS (PBDES)

All of our participants had PBDEs in their bodies, including congeners that correlate with exposure to commercial mixtures of pentaBDE and octaBDE. PentaBDE congeners found in all participants include the tetraBDE 47, pentaBDEs 99, 100, and hexaBDEs 153 and 154. OctaBDE congeners found in all participants include heptaBDE 183, octaBDE 203 and nonaBDEs 206, 207, and 208. NonaBDEs are also part of the decaBDE commercial mixture, and break-down products of decaBDE.

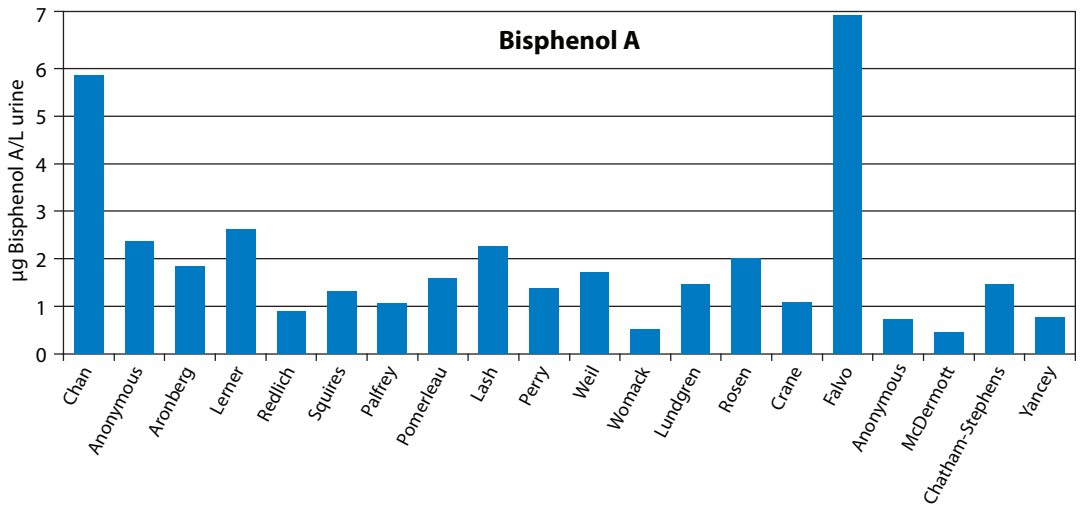
In total, each of our 20 participants had 12 specific PBDEs in their bodies, with total PBDE congeners ranging from a low of 13 (Mary Rosen) to a high of 24 (Jimmy Womack).

For six of the seven congeners for which published CDC data is available, our project's median was below CDC's 50th percentile. The exception was pentaBDE 99, which was not detected in CDC's 50th percentile, while our project's median was 2365 pg/g lipid weight. Our project maximum, 24,400 pg/g was below CDC's 95th percentile.

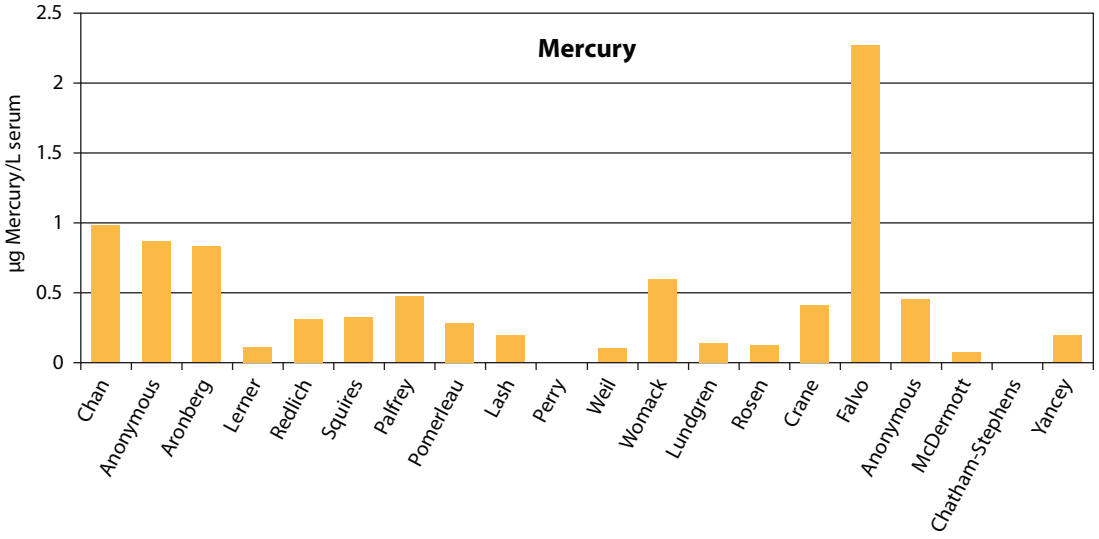


BISPHENOL A & MERCURY

We detected BPA in all 20 of our participants. CDC detected BPA in 93% of the most recent sample.

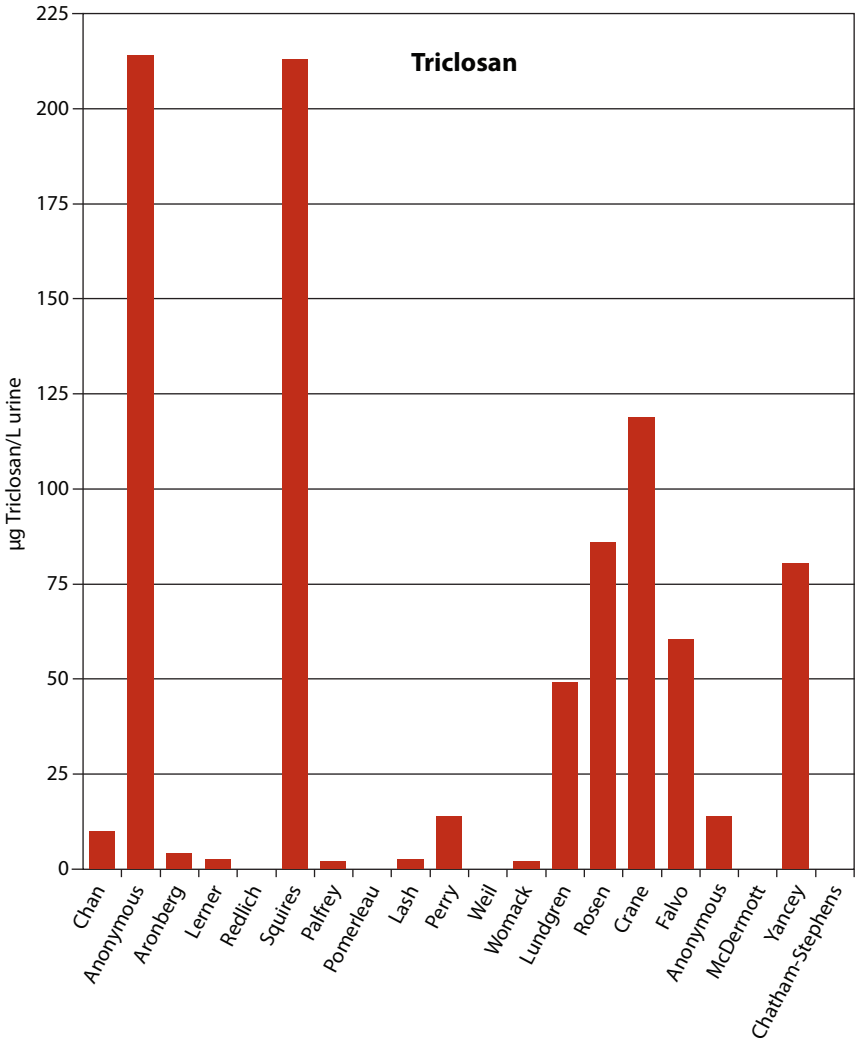


Eighteen of our 20 participants had detectible levels of mercury in their blood.



TRICLOSAN

Fifteen of our participants had triclosan in their bodies, which mirrors CDC's finding that 74.6% of 2003-2004 samples contained triclosan. Our project median of 31.5 µg/L was roughly three times higher than CDC's 9.2, though our study maximum was below CDC's 95th percentile.



CONCLUSIONS

THE RESULTS OF OUR PROJECT DEMONstrate that health care professionals are exposed—through the workplace or in their personal lives—to a wide range of chemicals known or suspected to cause health problems. This is consistent with the Center for Disease Control's *National Report on Biomonitoring*.

Connections between Diseases with Increasing Incidence and Synthetic Chemicals in Commerce

Apparent correlations between increased incidence of certain diseases and the increased reliance on industrial chemicals have motivated much of the effort to remove toxic chemicals from commerce. These diseases include reproductive dysfunction (in many forms), learning and developmental/neurological harm, metabolic syndrome and cancer.

Reproductive Dysfunction—Recent research indicates adverse changes in human reproductive health and fecundity, such as increasing incidence of testicular and breast cancers, decreased semen quality, cryptorchidism, hypospadias and polycystic ovaries. Studies indicate that some synthetic chemicals have the potential to disrupt the endocrine system and could be partially responsible for this decline in health. The chemicals for which we tested are among the synthetic hormones, organochlorine pesticides, phthalates and metals identified as having had this potential.[30,31]

Developmental/Neurological Effects—The developing brain is a target organ for neurotoxicity in the fetus through many stages of pregnancy as well as during infancy and early childhood. Autism, attention deficit hyperactivity disorder (ADHD), dyslexia, mental retardation, lowered IQ and other disorders of learning and behavior are highly prevalent among American children. The incidence of learning and developmental disabilities (LDDs) appears to be rising, affecting between five and 15 percent of all children under the age of 18 in the United States, or more than 12 million children under 18.[32] In general, disabilities have increased significantly over the past four decades.[33]

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The Scientific Consensus Statement on Environmental Agents Associated with Developmental Disorders, signed by 56 scientists, researchers, and health professionals, concluded that accumulating scientific evidence demonstrates environmental contaminants are an important cause of learning and developmental disabilities.[34] The proportion of LDDs that can be attributed to environmental contaminants such as industrial chemicals in an issue of profound human, scientific and public policy significance. Existing animal and human data suggest that a greater proportion is environmentally influenced than has yet been generally realized or than can be demonstrated with scientific certainty.

Metabolic Syndrome—According to the International Diabetes Foundation, metabolic syndrome is a cluster of the most dangerous heart attack risk factors, including diabetes and prediabetes, abdominal obesity, high cholesterol and high blood pressure (also known as the "Western Disease Cluster"). An estimated 20–25% of the world's adult population has metabolic syndrome and is twice as likely to die from and three

times as likely to have a heart attack or stroke compared with people without the syndrome.[35] Bisphenol A has been specifically associated with metabolic syndrome.[36,37]

Cancer—Long cancer latency periods make it difficult to study contributors to cancer incidence. The general causation categories are genetic and environmental influences, including exposure to industrial chemicals. Carcinogenic industrial chemicals and environmental contaminants can be encountered in the home, work place or community. Twin and sibling studies indicate that environmental factors are more important than genetic factors for virtually all cancers. Immigration studies indicate that for many cancers, risk is established early in life.[38]

About Occupational Safety and Health Failures

Despite federal and state occupational safety and health laws and regulations, corporate and institutional policies, and union contract provisions for ensuring workplace health and safety, workers are exposed to toxic chemicals at levels much higher than the general population. This disparity is due to permissible exposure levels (PELs) for workers that are routinely orders of magnitude higher than what is lawful for the general population.[39]

Occupational Safety and Health Administration (OSHA) regulations are overly reliant on material safety data sheets (MSDS), which are often incomplete and inaccurate, do not contain information about environmental effects or chemical reactions, focus on acute rather than chronic or latent health effects, and are often written in scientific language by the chemical producer and not reviewed by a third party. In general, OSHA takes 10 years to promulgate new standards and during that time many toxicants continue to be used. For example, despite 15 years of research on glutaraldehyde (Cidex), a known asthmagen used in hospitals as a sanitizer and disinfectant, no exposure limit has been established.[41]

A FAILED ATTEMPT

A classic example of why EPA has all but given up on banning chemicals under TSCA is their failed attempt to ban asbestos, a proven health hazard. In 1989, after ten years of research, public meetings and regulatory impact analyses, EPA issued a rule to prohibit the manufacture, importation, processing and distribution of asbestos. The asbestos industry challenged the EPA, and the court all but eliminated the EPA's ability to use TSCA to restrict problem chemicals. The court found that the EPA had not used the least burdensome (to industry) regulation to minimize risk, had not demonstrated a reasonable basis for action, and had not sufficiently balanced the benefits against the costs (to industry). This decision chilled any further efforts by EPA to use its authority to restrict chemical production or use.[40]

About Our Chemical Management System

The chief US law intended to manage chemicals is the Toxic Substances Control Act (TSCA). Passed in 1978, this law has managed to ban only five chemicals or classes of chemicals (PCBs, chlorofluorocarbons, dioxin, asbestos, and hexavalent chromium), and none since 1990. Roughly 62,000 chemicals were 'grandfathered' in without safety data requirements. Another approximately 20,000 have been introduced into commerce since, without being proven safe. Under TSCA, the rules the EPA must follow in order to ban a chemical are so burdensome, it is nearly impossible to meet them. This law has never been modernized despite advancing technology that has produced safer alternatives to some chemicals and scientific studies showing bioaccumulation and linking certain chemicals to illness.

PROBLEMS UNDER TSCA INCLUDE:

- TSCA places the burden of proof on EPA to demonstrate that a chemical poses a risk to human health or the environment before EPA can regulate it.
- TSCA does not require companies to develop information on new chemicals' effects on human health and the environment.
- Companies do not have to develop information on the health or environmental impacts of chemicals already in commerce.
- EPA has moved toward voluntary programs to gather information from chemical companies, but data collection has been slow and does not provide EPA enough information to identify and control chemical risks.
- TSCA provides EPA with differing authorities for controlling risks, depending on whether the risks are posed by new or existing chemicals. For existing chemicals, EPA may regulate a chemical only if it finds that it presents or will present an "unreasonable risk."

Photo: © iStockphoto.com

- TSCA requires EPA to choose the regulatory action that is "least burdensome." EPA has found it nearly impossible to promulgate rules under this standard.
- TSCA prevents disclosure of information claimed by chemical companies as confidential business information.

A reformed Toxic Substances Control Act (TSCA) would serve as the backbone of a sound and comprehensive chemicals regulatory policy that protects public health and the environment, while restoring consumer confidence in U.S. goods in both the domestic and world market.

EFFECTIVE TSCA REFORM SHOULD:[42]

- **Take immediate action on the most dangerous chemicals**—Persistent, bioaccumulative toxic chemicals should be phased out of commerce. Our exposure to other toxic chemicals with known serious health effects should be reduced. Green chemistry research should be expanded, and safer chemicals favored over those with known health hazards.
- **Hold industry responsible for the safety of their chemicals and products**—Companies that make and use chemicals should be required to provide full information on the impact of all their chemicals on health and the environment. The public, workers, and businesses should have access to information about the safety of chemicals.
- **Use the best science to protect all people and vulnerable groups**—Chemicals in commerce should meet a standard of safety for all people, including children, pregnant women, and workers. The extra burden of toxic chemical exposure on people of color, low-income, and indigenous communities must be reduced and more studies done to detect chemicals in our bodies.

RECOMMENDATIONS

ARMED WITH THE AWARENESS THAT THE chemical management system currently in place neither protects our right to know nor ensures product safety, we can now empower ourselves to demand product information and to use that information to become discerning consumers. In a few minutes, from your home, you can drive markets toward safer materials and processes. Read the labels; browse company websites; make use of toll-free numbers; ask questions and get answers. As you reclaim your right to be safe and free from toxic trespass, you will be educating product company employees and shifting decision-making about how highly corporations prioritize product safety.

Reduce Your Exposure

Below are some measures each of us can take in our personal and professional lives to reduce our exposure, but it is important to note that this list is incomplete. Moreover, although we can take steps to limit our exposure, it is impossible under the current regulatory system to eliminate it. We cannot shop, eat, or exercise our way out of this problem. Only a major shift in the way chemicals are managed will achieve the necessary systemic change.

Bisphenol A is transferred from thermographic printer paper to our hands, can leach from epoxy resin can linings and polycarbonate bottles into foods and beverages. Polycarbonate plastic containers are labeled #7 and "PC". Avoid heating food in polycarbonate. Substitute non-polycarbonate plastic or glass bottles for cans and prepare fresh, frozen or dried food. Some dental sealants, composite fillings, or orthodontic appliances are made with BPA. Ask your dentist or orthodontist not to use products containing BPA.

Mercury is globally available due to air dispersion from cement kilns, incinerators and coal burning power plants, allowing it to move up the food chain, into fish, and into humans. Mercury is in all fish. The highest and most dangerous mercury levels are in larger sharks, swordfish, mackerel, tuna, and tilefish. Replace them with shrimp, pollock, salmon and catfish. Instead of fish, use plant sources of omega 3 fatty acids, such as canola oil, flax seeds, walnuts and pumpkin seeds.

Mercury leaches from dental amalgam. Ask your dentist to use mercury- and BPA-free composite fillings instead. Vaccinations may contain thimerosal, a form of mercury used as a preservative. Insist upon a thimerosal-free option. Other potential sources include products that contain small batteries, fluorescent bulbs, thermometers, and mercury switches, and some folk remedies and imported cosmetics such as skin lightening creams.

PBDEs are not chemically bound to products that contain them and continually spread from these products onto our hands, get into indoor dust, and are found in indoor air. PBDEs get inside our bodies through high-fat food, our hands, and inhalation/ingestion. PBDEs can be replaced with inherently flame retardant materials, design changes, or less-toxic chemicals. Ask furniture or electronics manufacturers how they achieved fire safety standards. When buying strollers, nursing pillows, car seats or other baby furniture, avoid the label: "complies with CA TB 117" (a standard that requires halogenated flame retardants). Eat lower on the food chain, choose wild fish over farm-raised, lean meat or poultry, remove fat before cooking, and broil, grill or roast instead of frying.

PFCs are found in non-stick cooking products and on water- and stain-resistant fabric and paper. Use of non-stick pans produces PFC-containing fumes which can be inhaled during use. PFCs in nonstick cookware can be replaced with cast iron, glass or enamel-lined cast iron pans. Non-stick pans are available with a ceramic surface. These are often labeled "PFOA free." PFCs have been found in fish, shellfish and drinking water, indicating dietary exposure. Avoid fast food wrappers, which can be lined with PFCs to prevent grease from soaking through packaging. Avoid treatment of clothing and furniture with stain/water-proofing, and cosmetics with "fluoro" or "perfluoro" on the ingredients label.[43]

Phthalates continually migrate from consumer products into into indoor air and are inhaled/ingested from household dust. We inhale phthalates from perfume and air fresheners, and dermally absorb fragrances when we topically apply lotions and shampoos, or through both exposure pathways from cleaners. Food is another source of exposure. Choose PVC-free building materials, household products, apparel, toys, food wrapping and packaging without #3 symbol. Find information about phthalates in adhesives, caulk, grout, and sealants at *www.householdproducts.nlm.nih.gov/*. Avoid personal care products listing "fragrance" or phthalates as ingredients. Find out more at *www.cosmeticsdatabase.com*.

Triclosan is added to a wide range of consumer products like fabrics (i.e. socks) or plastics (i.e. cutting boards, garbage bags), and marketed under the names Microban or Biofresh, to curb the growth of bacteria. It is inhaled in dust, but dermal absorption may be the major exposure pathway.[44] Ikea and The Body Shop sell only triclosan-free personal care products. Whole Foods and Trader Joe's have triclosan-free products, but no specific company policy regarding triclosan. Aveda could not find any triclosan in their products but has no specific policy.

Protect Your Patients and Yourself

Doctors and nurses can make environmental health part of patient services by providing disease prevention information to their patients, accurately and proactively recognizing the first stages of diseases of environmental origin and their causes, and making changes in the health care setting to avoid chemicals that trigger the onset of those diseases.

PBDEs are in the health care setting in mattresses, foam pads, bedding materials, furniture cushions, lamp shades, privacy curtains, draperies, window blinds, plastic housing of televisions, pulse oximeters, monitors, ventilators or IV pumps, in computers, printers, fax and copy machines and furniture at nursing stations; in microwave ovens, refrigerators, and other appliances in eating areas; and in foam packaging throughout the hospital from shipping and receiving to operating rooms. Health care institutions can reduce PBDEs by choosing inherently flame resistant products, requiring name and CAS number (chemical abstracts service registry number) of flame retardants used in products purchased, expressing a preference for products that do not contain persistent, bioaccumulative toxicants and telling vendors that they should provide only products with flame retardants that are comprehensively tested for safety.

PFCs are still commonly found in health care settings due to their stain-repellent properties. Avoid all furniture and medical furnishings (including mattresses,

Photo: © iStockphoto.com

foams, panel fabrics and other textiles) that contain PFOA. Brand names include Teflon, Stainmaster and Zonyl. Because of concerns regarding the health impact of PFOA, Scotchguard and some other stain resistant treatments are now made from a different perfluorochemical, PFBS (perfluorobutane sulfonate, or C4). All perfluorochemical related products should be avoided when possible.[45]

Phthalates, especially DEHP (di-2-ethylhexyl phthalate), is used in flexible PVC medical devices and often exposes patients. That is why the FDA recommends alternatives such as ethylene vinyl acetate (EVA), silicone, polyethylene, or polyurethane, especially when performing high risk procedures on male neonates, pregnant women carrying male fetuses, and peripubertal males. To move away from DEHP, hospitals should perform audits to identify DEHP-containing products, identify and evaluate alternatives and purchase PVC- or DEHP-free products of equivalent quality and performance. Hospitals are replacing DEHP-containing PVC with either PVC-free products or DEHP-free products (a PVC product with a non-DEHP plasticizer).

Triclosan and antimicrobial soaps do not necessarily work better than plain soap and water at preventing the spread of infections or reducing bacteria on the skin, according to the American Medical Association,[46] the Food and Drug Administration's Nonprescription Drugs Advisory Committee, and dozens of academic researchers, and may contribute to bacterial resistance.

Photo: © Jupiterimages

Mercury is used throughout health care in products including thermometers, dental amalgam, sphygmomanometers, laboratory chemicals and preservatives, cleaning agents, and electronics such as fluorescent lamps and computers. Their cumulative usage, spills, breakages and disposal make the health care sector a significant contributor of mercury exposure.

To remove mercury from the health care setting, take the "making medicine mercury-free" pledge at *www.h2e-online.org*, conduct a mercury audit, investigate and implement first the easiest mercury phaseout opportunities, such as replacing mercury with water in Miller-Abbott Tubes, replacing mercury containing bougies or esophageal dilators with silicon ones, and replacing mercury-filled blood pressure measuring devices with aneroid units. Implement a mercury-free purchasing policy, communicate the policy to suppliers and work with staff to find non-mercury alternatives, educate colleagues about mercury's effects on health and the environment; hold a mercury thermometer exchange; and discontinue sending mercury thermometers home with parents of newborns and other patients.

Be aware of the signs and symptoms of mercury exposure. If these nonspecific symptoms are present and not otherwise explained, ask your patient about past and current mercury exposures.[47,48,49]

Government and Institutional Progress

State—Due to stagnation in recent decades on federal chemical policy, some states are taking the lead and working toward state-level chemical policy reform. These policies address specific chemicals such as lead, mercury, and bisphenol A, classes of chemicals such as PBDEs and phthalates, chemicals in product sectors such as toys, electronics, cosmetics, and cleaners, or infrastructures to manage chemicals more broadly by requiring data reporting on hazard, use, and availability of safer substitutes, with the ability to regulate toxic chemicals when there are known safer substitutes.

These state-level advancements build toward federal policy reform by acting as laboratories for federal reform, creating a regulatory 'patchwork quilt' for industry compliance, and driving market leaders away from problematic chemicals, wherein companies decide that if they must comply in certain states, they may as well comply wherever their products are sold.

Federal—Since 2005, Congress has introduced TSCA reform legislation known as the Kid Safe Chemicals Act (KSCA). Parallel to KSCA's initial introduction and reintroduction, the environmental health and justice movement has crafted collectively-held TSCA reform policy elements, to improve the KSCA (2007)and protect the most vulnerable individuals and disproportionately burdened communities. Reintroduction of KSCA is expected in November 2009.

Several secondary policies that address chemicals are being considered in Congress, including those dealing with Bisphenol A in food and beverage containers, toxic chemicals in personal care products, environmental justice, and chemical plant security.

Global—There are over 150 parties to the Stockholm Convention on Persistent Organic Pollutants (not including the US), which instituted a global ban on 12 chemicals known as the 'dirty dozen.' The Council of Parties to the Convention meets annually to expand the list. At the recent fourth meeting, they expanded the list to include the PentaBDE mixture, lindane, and seven other chemicals. The Strategic Approach to International Chemicals Management (SAICM) is a policy framework to promote chemical safety around the

world. Its objective is sound management of chemicals so that, by 2020, chemicals are used and produced in ways that minimize significant adverse impacts on human health and the environment (2020 goal).[50]

Corporate—Several major corporations all along the supply chain from chemical manufacturers to retailers have environmental health policies. For example, the chemical maker Sunoco announced it will sell BPA only to companies that guarantee the chemical will not be used to make children's food and water containers. Product maker S.C. Johnson has gone beyond regulatory requirements to eliminate PVC and chlorine-bleached paperboard packaging, as well as the insecticides dichlorvos, propoxur and chlorpyrifos from their products.

Kaiser Permanente, a major medical supply purchaser, has a policy to avoid chemicals associated with cancer, reproductive problems and genetic mutation, and asks its vendors about toxicity testing of chemicals used in products.[51] Retail giant Wal-Mart's 'Chemical Intensive Products Initiative' is working with suppliers to implement a timeline for elimination of three priority chemicals of concern: propoxur and permethrin, used in insect control products; and nonyl phenol ethoxylates (NPE), an ingredient in some cleaning products.[52]

Become More Involved in Protecting Public Health?

In the Health Care Facility—Greening your facility has added health benefits for patients, speeding their recovery and preferentially distinguishing your facility from those still using products that expose patients to toxic chemicals. If your facility doesn't already have an environmentally preferable purchasing policy, there are several excellent models that address everything from IV tubing to carpeting. The Green Guide for Health Care is a best practices guide for healthy and sustainable building design, construction, and operations for the healthcare industry, and can be a helpful tool in establishing best practices.

Practice Greenhealth is the nation's leading membership and networking organization for institutions in the healthcare community that have made a commitment to sustainable, eco-friendly practices. Members include hospitals, healthcare systems, businesses and other stakeholders engaged in the greening of healthcare to improve the health of patients, staff and the environment. Hospitals for a Healthy Environment (H2E), jointly founded by American Hospital Association, the U.S. Environmental Protection Agency, Health Care Without Harm, and the American Nurses Association, is creating a national movement for environmental sustainability in health care.

It's not always possible to institute sweeping reform, so if necessary, start small. Your facility can switch to unbleached, recycled paper goods, toxic chemical-free skin lotion or green cleaning supplies, which are highly consumable products that need to frequently be replaced. Such changes can result in some quick, easy improvements you and everyone in the facility can feel good about, and can overcome any potential preconception that going green requires sacrifices.

While instituting these modest changes, ask your institutional purchaser to let you know when the next major purchase will occur, such as monitoring equipment, cubicles, waiting room furniture, etc. and offer to provide resources when the decision nears. Since most large facilities have long-term contracts with vendors, many facilities ask vendors to disclose whether their products contain chemicals identified by an authoritative government body as persistant biocumulative toxic chemicals (PBTs), carcinogens, mutigens, and reproductive toxins (CMRs), or neurological or developmental toxicants. This can alert vendors of the preference for less-toxic materials.

Another approach is to notify vendors that you will only purchase supplies or products that meet such certification programs as GreenSeal, EPEAT (Electronic Product Environmental Assessment Tool), or LEED (Leadership in Energy and Environmental Design). The best certification programs create minimum standards based on current best practices, are reevaluated frequently as technology advances, have tiered eligibility so that there are higher standards to which one can aspire, and are arrived at through a consensus process. Such widely recognized programs are useful tools that help vendors determine relative product safety, but can be inferior from a health standpoint to setting your own criteria.

In Policy Campaigns—Those of us whose political engagement does not extend beyond voting in elections tend to minimize our political influence or ability to advance policy. This creates an atmosphere in which elected officials seldom hear from their constituents, and certainly not in the absence of a crisis. Conversely, since our leaders seldom hear from us, they tend to

amplify those few contacts they do have from constituents.

Health care professionals are among the most credible and trusted professions, and almost always have more medical expertise than those elected officials. Therefore, your ability to effectively educate policy makers about the dangers posed by chemicals that are not adequately tested for safety and provide evidence that chemicals are getting into our bodies is amplified further. The closer to home you are, the more influence you have, but even your U.S. Senators and Representatives pay attention to correspondence from their constituents and ought to receive accurate health information. This is just another critical step in advocating for the health of our patients.

Several health-based organizations are becoming increasingly active in their efforts to influence environmental health policy, as they gain greater understanding of the role policy can play in disease prevention. Physicians, Nurses and Public Health Professionals can get more involved by joining Physicians for Social Responsibility in supporting the Safer Chemicals, Healthy Families Campaign. PSR is urging its over 32,000 members to declare their independence from toxic chemicals. To declare your independence and otherwise support PSR's efforts, go to *www.psr.org*.

For nurses, the Alliance of Nurses for Healthy Environments (*http://e-commons.org/anhe/*) is an on-line presence for all nurses interested in environmental health to help them understand the relationship between human health and the environment and become more involved. The American Nurses Association is also a good resource to learn more about environmental health issues facing nurses.[53] Another excellent forum for health care professionals to share information is the Collaborative on Health and the Environment.[54]

In Solving the Public Health Crisis—Burgeoning rates of learning disabilities, diabetes, obesity, and other lifelong disorders associated with toxic exposure are creating a public health crisis that we are unable to meet with existing resources, and that will only grow worse over time. A positive resolution to the current health care debate over whether and how to provide health insurance for all those in need will only partially address this problem. What is needed is a greater emphasis on the cornerstones of public health practice: health promotion and disease prevention, especially of those diseases that are associated with synthetic chemicals.

We can observe the models posed by the European Union and Canada, both of which provide more protective chemicals policies than does the US, and both of which provide universal health care. The lessons learned by observing these models may be that when governments are shouldering the responsibility and paying for health coverage of their citizens, they are less prone to allow chemical companies to expose us to chemicals that contribute to diseases. Protective chemicals policy can dramatically lessen the burden on our already overtaxed health care system. This will enable the health care professional to provide quality care to those with diseases or injuries due to causes other than toxic chemicals.

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APPENDIX 1:
METHODS & PROTOCOLS

Sampling Methodology

All project protocols were approved by the Western Institutional Review Board, Inc., Dr. Kristen Welker-Hook, Co-Principal Investigator and Dr. Richard Grady, Co-Principal Investigator and Physician-on-Record, provided oversight of the study methodology, data collection, laboratory testing, and data analyses. The 20 participants in this project were selected for their background as in health care professionals, and residence in one of our 10 target states. State Liaisons identified and communicated with potential subjects to review project goals and methodologies, and answer questions. Project Managers or Principal Investigators held calls to complete formal consent documents, including a biographical and demographic questionnaire to provide information about their residences, occupations, diet, and potential toxic exposures.

Samples were collected in between February and April 2009 using containers and procedures supplied by the analytical laboratories to ensure materials used would not cross-contaminate sample. Phlebotomists in professional collection centers drew blood samples into vacutainers. Approximately 35–50 ml of blood was collected in six vacutainers from each participant following all necessary safety and sample collection protocols. After clotting, serum was obtained by centrifuging tubes and pouring off serum into storage vials. Pipettes were not used for transferring serum into storage vials to avoid potential contamination with chemicals for which samples would be collected.

Participants were provided with the necessary materials and protocols to collect urine over a twenty-four hour period. Total volume was noted, samples were shaken, then appropriate amounts were poured off into containers specified by laboratories. Samples were processed as necessary, frozen, placed upright in appropriate containers with ice packs, and mailed via overnight courier to Axys Analytical Services, Ltd.

Data Analysis Methodologies

This project selected highly reputable, government certified laboratories to conduct our analysis. AXYS Analytical Services, Ltd. (2045 Mills Road, Sidney BC V8L 5X2, Canada) conducted analysis for phthalates, bisphenol A, triclosan, PBDEs and PFCs. They subcontracted to Brooks Rand Laboratory (3958 6th Ave. NW, Seattle, WA 98107, USA) for mercury.

Phthalates and Bisphenol A

Determination of Bisphenol A and Phthalate Metabolites in Urine by LC-MS/MS Method MLA-059

Samples are spiked with a suite of isotopically labelled surrogate standards and with 4- methylumbelliferyl glucuronide solution as an indicator for monitoring the deconjugation of glucuronidated forms of the analytes. Deconjugation is performed with β-glucuronidase enzyme at 37°C. The extraction and clean-up steps—which are the same for BPA and phthalate ester metabolites, and therefore these targets may be co-extracted from a single sub-sample of urine—are performed by SPE (solid phase extraction) on a HLB (hydrophilic- lipophilic balance) sorbent cartridge. The analytes are eluted with methanol. If needed, additional cleanup is performed using a MAX (mixed mode anion exchange) SPE cartridge and elution with methanol/formic acid/methyl tertiary butyl ether. The extract is spiked with recovery standards before proceeding to HPLC-MS/MS. Typical reporting limits are as follows: Bisphenol A: 0.25 ng/mL; phthalate ester metabolites: 1 ng/mL.

Analytes tested were: 4,4’-dihydroxy-2,2-diphenylpropane (Bisphenol A) (BPA), Monomethyl phthalate (mMP), Monoethyl phthalate (mEP), Monobutyl phthalate (MBP) (sum of mono-n-butyl and mono-iso-butyl phthalate), Monobenzyl phthalate (mBzP), Mono-2-ethylhexyl phthalate (mEHP), Mono-(2-ethyl-5-oxohexyl) phthalate (DEHP Metabolite VI) (mEOHP), Mono-(2-ethyl-5-hydroxyhexyl) phthalate (DEHP (Metabolite IX) (mEHHP).

Triclosan

Determination of Triclosan in Urine by LC-MS/MS Method MLA-067

Urine samples are spiked with β-glucuronidase enzyme (for deconjugation of possible glucuronidated forms of the target analytes) and isotopically labelled quantification standards. Samples are extracted and cleaned up using solid phase extraction (SPE) procedures. The method determines the total of the free and the glucuronidated forms of triclosan. Analyte concentrations are determined by LC/MS/MS and quantified using the isotope dilution quantification method. Typical reporting limits are 1 ng/mL on a 2 mL sample.

Polybrominated diphenyl ethers (PBDEs)

Analysis of Brominated Diphenylethers (BDE) in Blood Serum by EPA 1614

Samples are spiked with isotopically labelled BDE surrogate standards, solvent extracted and cleaned up on a series of chromatographic columns. The final extract is spiked with isotopically labelled recovery (internal) standards prior to instrumental analysis. Analytical details are documented in AXYS method MLA-033, Analytical Method for the Determination of Brominated Diphenyl Ethers (BDEs) by EPA Method 1614. Analytes tested were: BDEs No. 7, 8, 10, 11, 12, 13, 15, 17, 25, 28*, 30, 32, 33, 35, 37, 47*, 49, 51, 66, 71, 75, 77, 79, 85, 99*, 100*, 105, 116, 119, 120, 126, 128, 138, 140, 153*, 154*, 155, 166, 181, 183*, 190, 203, 206**, 207**, 208**, 209, where * means BDE congeners of “Primary Interest” as defined by EPA Method 1614 and ** means BDEs 206, 207 and 208 may be formed from BDE 209 degradation during the analysis procedure and results reported for these congeners represent maximum concentrations.

Perfluorinated Compounds

Analytical Procedure for the Analysis of Perfluorinated Organic Compounds in Blood Serum by LC-MS/MS

Sample size may be up to 0.5 mL. The sample is spiked with surrogate standards. 3 mL of 50% formic acid is added and the mixture is sonicated for 20 minutes. Cleanup is performed by solid phase extraction (SPE) using a disposable cartridge containing a weak anion exchange sorbent. The eluate is spiked with recovery standards and analyzed by LC-MS/MS. Calibration solutions are prepared in bovine serum and processed through the same SPE cleanup procedure. Typical detection limits are in the range of 0.5 – 1 ng/g for a 0.5 mL serum sample.

Mercury

Total Mercury in Serum by EPA Method 1631, Appendix

Blood samples are acid digested with heat and further oxidized with BrCl. Samples are analyzed by SnCl2 reduction, followed by gold amalgamation, thermal desorption and atomic fluorescence spectroscopy (CVAFS) using a Brooks Rand Labs Model III Analyzer. MDL = 0.04 µg/L; MRL = 0.10 µg/L.

APPENDIX 2:
DETAILED RESULTS DATA

		AK	AK	CA	CA	CT	CT	MA	MA	ME	ME
	units	Chan	Anonymous	Aronberg	Lerner	Redlich	Squires	Palfrey	Pomerleau	Lash	Perry
Triclosan	µg/L	9.78	214	4.13	2.49	U	213	1.86	U	2.56	13.8
Bisphenol A	µg/L	5.86	2.36	1.85	2.63	0.895	1.3	1.07	1.58	2.27	1.39
Mercury	µg/L	0.98	0.86	0.83	0.11	0.31	0.32	0.47	0.28	0.19	U
Perfluorinated Compounds											
PFOA	µg/L	2.82	2.93	3.46	0.967	2.43	1.72	2.93	1.69	3.32	4.91
PFNA	µg/L	2.63	1	1.04	0.777	1.23	0.81	1.66	0.709	0.933	2.06
PFOS	µg/L	18.6	26.8	11.1	4.87	17.9	15.6	21.1	6.71	26.7	15
PFDA	µg/L	U	U	U	U	U	U	U	U	U	U
PFUnA	µg/L	0.937	U	U	U	U	U	U	U	U	U
PFHxS	µg/L	U	U	1.65	U	1.09	1.48	1.49	U	U	U
Phthalate Metabolites											
mMeP	µg/L	U	64.9	U	11	13.8	U	12.1	9.31	U	7.35
mEtP	µg/L	54.4	95	18.1	30.1	U	U	15.3	18.4	70.7	108
mBuP	µg/L	26.1	42.9	19	53.9	17	6.32	24.3	21.5	29.7	74.6
mBzP	µg/L	5.88	18.3	3.12	20.9	2.43	1.11	6.83	5.4	7.02	7.25
DEHP **mEHP**	µg/L	101	2.96	2.84	6.69	11	2.06	9.58	2.46	7.6	8.23
DEHP **mEOHP**	µg/L	187	19	10.7	20	21.6	4.13	30.1	18.4	18.8	39.1
DEHP **mEHHP**	µg/L	300	32.4	23.2	43.8	48.3	6.69	71.9	35.5	37.2	78
Polybromodiphenyl ethers	Tested but not detected: BDEs 7, 8, 10, 11, 12, 13, 25, 32, 33, 35, 77, 105, 116, 120, 126, 128, 166, 181										
BDE-15	pg/g lipid	242	486	208	332	93.3	456	136	181	137	335
BDE-17	pg/g lipid	116	739	87.7	487	33.8	107	91.3	35.9	31.9	43.4
BDE-28	pg/g lipid	1710	5330	947	5560	271	1300	829	453	345	633
BDE-30	pg/g lipid	u	u	331	u	406	205	219	u	u	u
BDE-37	pg/g lipid	u	55.7	u	29.2	u	u	u	u	u	46.9
BDE-47	pg/g lipid	17,300	99,600	12,700	109,000	3,840	18,000	13,600	4,290	4,710	8,200
BDE-49	pg/g lipid	169	754	156	334	44.5	127	88	47.5	33.6	74.9
BDE-51	pg/g lipid	u	88.9	u	89.4	u	u	u	u	u	u
BDE-66	pg/g lipid	132	904	143	694	49.6	179	134	40.4	34	64.2
BDE-71	pg/g lipid	u	117	u	37.7	u	u	u	u	u	u
BDE-75	pg/g lipid	u	78.1	u	139	u	u	u	u	u	u
BDE-79	pg/g lipid	u	75.5	35.5	u	u	u	245	u	u	u
BDE-85	pg/g lipid	187	1800	237	1660	81.7	505	230	70.5	76.5	121
BDE-99	pg/g lipid	2620	24200	2980	20200	1130	4940	2750	749	795	1530
BDE-100	pg/g lipid	2380	10600	1620	19700	661	3150	2270	581	869	1090
BDE-119	pg/g lipid	u	52.8	u	46.3	u	u	u	u	u	24.6
BDE-138	pg/g lipid	u	369	69	284	u	76.9	67.5	u	u	u
BDE-140	pg/g lipid	84.6	133	u	171	u	38	38.1	28.1	u	35.6
BDE-153	pg/g lipid	14500	5840	3730	13800	3210	1980	6860	2470	1590	3030
BDE-154	pg/g lipid	198	1510	222	1350	104	350	203	71.2	94.2	131
BDE-155	pg/g lipid	70.2	227	43.3	163	u	36.6	40.3	25.2	43.9	u
BDE-183	pg/g lipid	172	397	251	197	844	154	237	166	179	399
BDE-190	pg/g lipid	u	u	u	u	u	u	u	u	u	u
BDE-203	pg/g lipid	155	76.6	135	168	200	131	295	203	132	235
BDE-206	pg/g lipid	422	380	296	250	212	345	451	362	336	390
BDE-207	pg/g lipid	478	557	367	427	602	470	1020	464	739	497
BDE-208	pg/g lipid	322	322	300	205	258	326	559	241	311	185
BDE-209	pg/g lipid	6380	5190	5100	u	u	u	u	u	5440	u

MI	MI	MN	MN	NY	NY	OR	OR	WA	WA	
Weil	Womack	Lundgren	Rosen	Crane	Falvo	Chatham-Stephens	Anonymous	McDermott	Yancey	Result range
U	2.16	49.1	85.9	119	60.3	80.5	13.7	U	U	U-214
1.72	0.516	1.47	2.01	1.08	7.11	1.46	0.729	0.449	0.759	0.449-7.11
0.1	0.59	0.14	0.12	0.41	2.27	U	0.45	0.07	0.19	U-2.27
3.69	3.42	3.17	2.44	4.25	5.05	1.97	3.7	0.828	1.07	0.828-5.05
1.17	2.87	0.76	U	3.4	1.85	U	0.948	U	U	U-3.4
18.2	48.3	19.5	5.08	27.6	15.5	5.39	14.5	7.94	5.63	4.87-48.3
U	1.02	U	U	0.584	U	U	U	U	U	U-1.02
U	0.839	U	U	0.518	0.591	U	U	U	U	U-0.937
U	2.93	3.08	U	U	U	3.5	U	U	U	U-3.5
11.5	6.34	11.4	U	U	22.6	1.5	U	1.34	62.8	U-64.9
11.8	U	58.3	76	93.8	200	8.37	75	25.8	13.9	U-200
14.4	5.07	24.2	34.5	21.4	92.1	7.53	13.1	10.1	13.6	5.07-92.1
11.1	2.83	16.4	37.6	75.3	21.2	5.33	27.6	11.8	6.16	1.11-75.3
2.18	2.9	5.16	2.21	8.04	2.15	28.6	6.85	2.52	4.06	2.06-101
20.6	11.8	12.6	17.4	25.4	27.9	49.4	56.5	7.6	15.3	4.13-187
32	21.4	25.3	29.6	41.1	87.9	105	80.4	11.1	30.9	6.69-300
97.2	101	134	90.5	179	158	128	130	90.9	413	90.5-486
77.2	64.1	207	u	143	61.9	113	51.8	23.2	230	U-739
421	731	1760	91.1	634	1170	923	540	265	2640	91.1-5,560
1110	244	u	u	u	816	332	774	u	u	U-1110
u	u	u	u	u	u	u	u	u	u	U-55.7
5,740	11,800	31,700	738	10,100	8,680	18,200	6,060	2,500	30,200	738-109,000
102	121	113	u	133	135	101	66.5	33	359	U-754
u	u	31.5	u	u	u	u	u	u	34.5	U-89.4
75.5	126	257	u	103	99.7	173	58.1	25.5	243	U-904
u	u	u	u	u	u	u	u	u	u	U-117
u	u	39.3	u	u	u	u	u	u	u	U-139
u	27.8	u	u	u	28.1	41.5	u	u	u	U-245
112	308	390	u	149	187	279	107	56.9	253	U-1800
1540	3490	5240	605	2110	1790	3190	1150	595	3700	595-24,200
876	2480	3390	125	856	1140	2870	773	349	3000	125-19,700
39.9	27.6	u	u	u	68.9	142	u	u	u	U-142
u	124	105	u	31.5	55.4	74	48.9	u	u	U-369
u	68.2	51.5	u	u	23.2	95.7	u	u	43	U-171
4970	4700	3030	98	1220	3110	20900	1340	2440	4320	98-20,900
124	539	342	47.3	104	147	228	106	49	238	47.3-1,510
u	79.7	60	u	30.6	36.1	53	u	24.3	80	U-227
163	344	515	45	185	108	202	252	105	112	45-844
u	151	u	u	u	u	u	u	u	u	U-151
191	233	158	67.5	69.8	165	281	171	155	213	67.5-295
221	467	476	425	306	306	762	503	325	408	212-762
528	757	896	505	500	684	1040	966	581	555	367-1,040
257	478	488	446	160	336	689	563	283	211	160-689
u	7790	9040	4610	3430	u	7380	u	u	6640	U-9,040

APPENDIX 3: RESOURCES

ABOUT CHEMICALS

Environmental Health News, edited by Pete Myers, MD, provides information—from a variety of sources, including mainstream media outlets and scientific journals—about environmental health topics, including chemicals and their links to health.
www.environmentalhealthnews.org

The Endocrine Disruption Exchange, led by Theo Colburn, PhD, has compiled detailed information about chemicals linked to disrupting hormone systems. Their "Critical Windows of Development" section tracks peer-reviewed scientific evidence of endocrine disruption across the chronology of fetal development.
www.endocrinedisruption.com

The Collaborative on Health and the Environment has a number of useful resources about chemicals and health impacts, as well as consensus statements about the state of scientific evidence for various health effects, on their website.
www.healthandenvironment.org

International Chemical Secretariat, a government-funded non-profit organization based in Sweden, has compiled a "Substitute it Now" (SIN) list of chemicals that should be substituted under the European Union's REACH (Registration, Evaluation and Authorization of Chemicals) program.
www.chemsec.org/list/sin-database

The National Toxicology Program of the National Institute of Health has information about a wide variety of chemicals.
www.ntp.niehs.nih.gov

The US Environmental Protection Agency has a database of chemicals of concern called the Integrated Risk Information System (IRIS).
www.epa.gov/iris

The Agency for Toxic Substances and Disease Registry within the US Centers for Disease Control and Prevention has a wealth of information about chemicals and associated adverse health effects.
www.atsdr.cdc.gov

ABOUT BIOMONITORING

The Centers for Disease Control's **National Biomonitoring Program** tests for hundreds of chemicals in a thousands of Americans.
www.cdc.gov/biomonitoring

Environmental Working Group has conducted a number of biomonitoring studies, and this is one of their most compelling: they tested the cord blood from ten neonates for over 200 chemicals.
www.ewg.org/reports/bodyburden2/contentindex.php

The **Is It In Us? Project** tested 35 people, five in each of seven states, for PBDEs, bisphenol A and phthalates.
www.isitinus.org

ABOUT PRODUCTS

Learn about the health, environmental, and social impacts of the products in your home.
www.goodguide.com

HealthyStuff.org has a database of thousands of products that have been tested for lead, mercury and other heavy metals, as well as PVC and bromine (indicating a brominated flame retardant was used).
www.healthystuff.org

Watch a compelling on-line video about where the things in our life come from, where they end up and the ultimate impacts of our high-consumption society.
www.storyofstuff.com

Find out about the toxicity of the ingredients in your personal care products.
www.cosmeticsdatabase.com

Healthy Child, Healthy World has compiled a list of safer products to help parents buy better items for their families.
www.healthychild.org/live-healthy/shop-healthy

ABOUT HEALTH CARE

Health Care Without Harm has information about changing purchasing practices in the health care setting.
www.noharm.org/us_canada/issues/purchasing

Practice Greenhealth is a membership and networking organization for institutions in the healthcare community that have made a commitment to sustainable, eco-friendly practices.
www.practicegreenhealth.org

The Green Guide for Health Care is a best practices guide for healthy and sustainable building design, construction, and operations for the healthcare industry.
www.gghc.org

ABOUT POLICIES

The European Union has a good summary of their toxic substance control law, called REACH.
http://ec.europa.eu/environment/chemicals/reach/reach_intro.htm

Environmental Defense Fund has created an excellent synopsis of the problems with the Toxic Substance Control Act (TSCA) and what needs to be fixed.
www.edf.org/page.cfm?tagID=12814

The Lowell Center for Sustainable Production has compiled an extensive database on state-level laws and bills to address toxics.
www.sustainableproduction.org

ABOUT ADVOCACY

Physicians for Social Responsibility works to address toxics in the environment through their Confronting Toxics campaign.
www.psr.org/environment-and-health/toxics-and-health/confronting-toxics.html

Health Care Without Harm focuses its efforts on transforming the health care industry so it is no longer a source of harm. They offer many ways to make changes, large and small, within institutions.
www.noharm.org/us_canada/issues/chemicals

American Nurses Association works in part to address occupational and environmental exposures to toxics.
www.nursingworld.org/MainMenuCategories/OccupationalandEnvironmental

Alliance of Nurses for Healthy Environments brings together nurses from across the country to focus on environmental health in education of nurses, nursing practice, and policy and advocacy.
www.e-commons.org/anhe/

The Safer Chemicals, Healthy Families Coalition is a broad and diverse group of organizations working to reform and modernize TSCA.
www.saferchemicals.org

The Sate Alliance for Federal Environmental Reform (SAFER) campaign brings together advocates from 14 states that are working for local, state and federal chemicals reforms.
www.saferstates.org

Hazardous Chemicals in Health Care

A Snapshot of Chemicals in Doctors and Nurses

Bobbi Chase Wilding, MS • Kathy Curtis, LPN • Kristen Welker-Hood, ScD, MSN, RN

Physicians for Social Responsibility

PSR has a long and respected history of physician-led activism to protect the public's health. Founded in 1961 by a group of physicians concerned about the impact of nuclear proliferation, PSR shared the 1985 Nobel Peace Prize with International Physicians for the Prevention of Nuclear War for building public pressure to end the nuclear arms race. Today, PSR's members, staff, and state and local chapters network form a nationwide network of key contacts and trained medical spokespeople who can effectively target threats to global survival.

Since 1991, when PSR formally expanded its work by creating its environment and health program, PSR has addressed the issues of global warming and the toxic degradation of our environment. PSR presses for policies to curb global warming, ensure clean air, generate a sustainable energy future, minimize toxic pollution of air, food and drinking water and prevent human exposures to toxic substance.

Report Summary

Toxic chemicals are all around us. Everyday products in our homes, workplaces, schools, stores or places of worship are made from chemicals. What is the evidence that chemicals are polluting people? Through the method of biomonitoring, a technique in which blood, urine hair, semen, breast milk, or other biologic specimens are analyzed for the presence of chemicals, scientists are able to track how much and what kinds of chemicals are in people. Physicians for Social Responsibility conducted the first biomonitoring investigation of health care professionals. Chemicals selected for participant biomonitoring specifically identified because they are emerging or known chemicals of concern, are known to be used in the health care setting, and have been associated with certain diseases whose incidences are on the rise. All of the 20 participating health care professionals had at least 24 individual chemicals in their body, and two participants had a high of 39 chemicals detected. Eighteen chemicals were detected in every single participant**.** There are several measures each of us can take to reduce our exposure, but it is important to note that we cannot shop, eat, or exercise our way out of this problem. Beyond individual or professional actions to avoid exposure, the most important thing every physician, nurse or public health professional must do is advocate for change in how chemicals are managed in the U.S.