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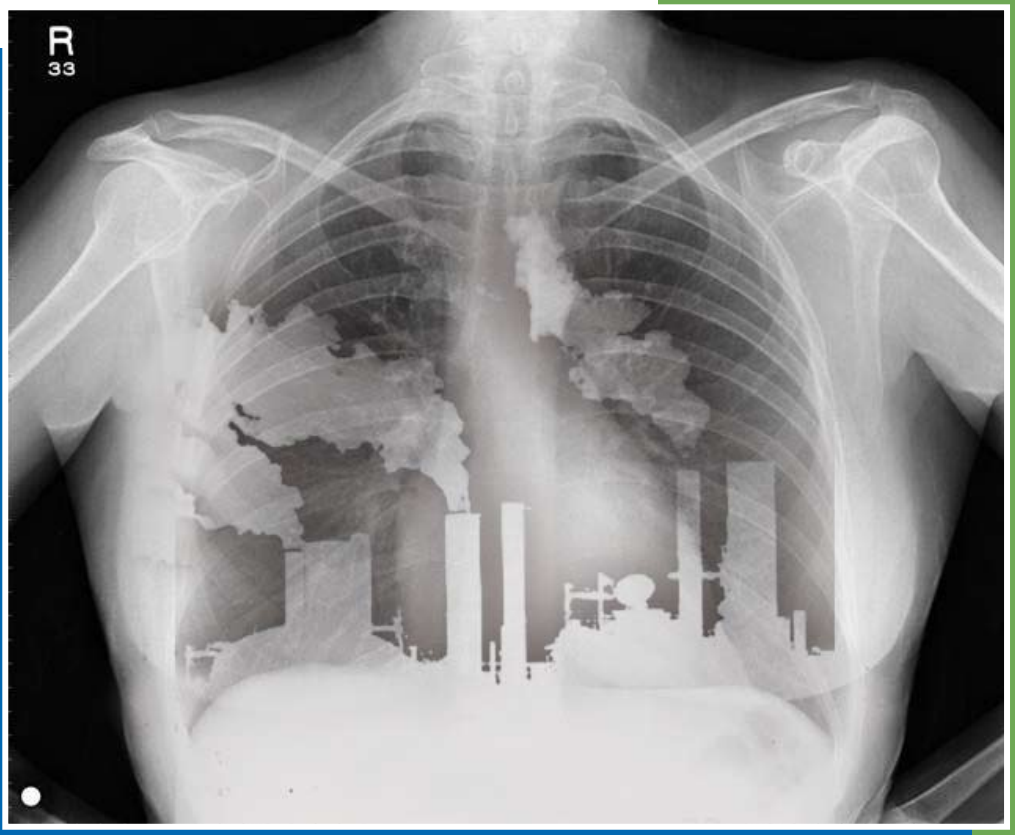

POLLUTION IN PEOPLE

A Study of Toxic Chemicals in Oregonians

NOVEMBER 2007

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Collaborative for Health and Environment, Oregon Chapter

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The Oregon Collaborative on Health and the Environment (CHE-OR) is an active network of organizations and individuals who share the basic goal of improving human health by reducing exposure to toxins in our bodies and the environment. CHE-OR moves the environmental health movement forward in Oregon by furthering productive debate and cooperative efforts, fostering productive action on human environmental health issues, and disseminating the best scientific information about these concerns. CHE-OR is a regional working group of the national Collaborative on Health and the Environment, which consists of over 2800 individual and organizational partners in 43 countries and 48 states.

The Oregon Environmental Council safeguards what Oregonians love about Oregon – clean air and water, an unpolluted landscape and healthy food produced by local farmers. For nearly 40 years we've been a champion for solutions to protect the health of every Oregonian and the health of the place we call home. We work to create innovative change on three levels: we help individuals live green; we help businesses, farmers and health providers thrive with sustainable practices; and we help elected officials create practical policy. Our vision for Oregon includes solving global warming, protecting kids from toxins, cleaning up our rivers, building sustainable economies, and ensuring healthy food and local farms.

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The CHE-OR Research and Media Workgroup consists of: Pamela Brody-Heine (Principal, Eco Stewardship Strategies), Cheyenne Chapman, JD, LLM (Chemicals Policy Program Director, Oregon Center for Environmental Health), Molly Chidsey (Pollution Prevention Specialist, Multnomah County), Stephanie Farquhar, PhD (Associate Professor, School of Community Health, Portland State University), Renee Hackenmiller-Paradis, PhD, MPH (Program Director, Oregon Environmental Council), Sara Leverette (Outreach Program Director, Oregon Environmental Council), Catherine Thomsen, MPH (Project Lead, California Breast Cancer Research Program), Maye Thompson, PhD, RN, (Oregon Nurses Association), and Sara Wright, MPH (Environmental Health Program Director, Oregon Physicians for Social Responsibility). We are particularly grateful to Maye Thompson, PhD, RN for coordinating sample collection and shipment.

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The conclusions and recommendations in this report are those of the author and sponsoring organizations (Oregon Environmental Council and CHE-OR) and do not necessarily reflect the views and opinions of the project funders, Portland State University, advisors, reviewers, or participants. The author and sponsors accept all responsibility for any errors or omissions in this work.

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EXECUTIVE SUMMARY

Oregonians are polluted with many hazardous industrial chemicals according to a new study conducted by the Oregon Environmental Council (OEC) and the Oregon Collaborative for Health and the Environment (CHE-OR). In 2007, ten Oregon women and men volunteered to have their bodies tested in a study of chemical pollution in people. These Oregonians represent a diverse group of people from rural and urban areas throughout the state. Unfortunately, one thing they probably share with all Oregonians is the unwelcome presence of toxic chemicals in their bodies.

KEY FINDINGS:

1. Toxic chemicals from consumer products, food, and industrial pollution contaminate our bodies. Each person tested in this study had at least nine and as many as 16 toxic chemicals in his or her body. Of the 29 chemicals tested, a total of 19 were detected in the ten volunteers, including six perfluorinated chemicals (PFCs) six phthalates, mercury, four organophosphate pesticide metabolites, bisphenol A, and polychlorinated biphenyls (PCBs). While some of these toxic chemicals come from contaminated soil, air, and water, many of the pollutants also come from food, everyday household dust, and from direct contact with such everyday products as personal care items, plastic products, consumer electronics, and stain-resistant furniture.

2. The toxic chemicals in our bodies are cause for concern because they can lead to health problems. The latest scientific research provides increasing evidence that toxic chemicals harm the health of adults, children, and developing fetuses. Children and fetuses are of particular concern because chemical exposures at critical points in child development can cause irreversible, often subtle, damage. Although no children or pregnant women were included in our study, it is reasonable to assume that their bodies are exposed to the same chemicals most of us are exposed to.

- Every participant was contaminated with phthalates, endocrine disrupting chemicals found in a variety of everyday consumer products. Recent scientific studies in humans have linked low-level phthalate exposure to reduced sperm count, feminization of male genitals, and premature delivery. Study participant Jeff VonAllmen, a Portland-area firefighter, had levels of the phthalate DEHP that were more than 16 times the national median.

- Although PCBs were banned in the 1970s, they were detected in the blood of all ten participants, including one born in the early 1980s. PCBs from everyday exposures have been associated with learning deficits.

- Every participant had mercury in his or her blood. While none of the participants had mercury exposures above the Environmental Protection Agency's "safe" level, all but one participant had blood mercury levels higher than the national median. Mercury is a potent neurotoxin that is of particular concern for young children and the developing fetus.

- PFOA, a chemical of the PFC class used in the manufacture of Teflon®, is a likely human carcinogen and was detected in every participant.

- The hormone-disrupting chemical bisphenol A was found in 80% of the participants. Don Sampson and Linda Hornbuckle had bisphenol A levels that were higher than 90% of people that have been tested in national biomonitoring studies. Studies on laboratory animals have shown that at very low doses bisphenol A can lead to a number of adverse health effects including reduced sperm count, impaired immune system functioning, and increases in prostate tumor proliferation.

3. State and federal regulations have failed to prevent the use of harmful chemicals in consumer products and in manufacturing and production processes. Current federal law does not require testing for harmful effects to humans or the environment before chemicals are allowed to be used in products or for manufacturing. Once chemicals are in use it is extremely difficult for the EPA to restrict them, because they must balance costs incurred to manufacturers with the impacts to human health and the environment. At the state level, Oregon lacks the regulatory structure needed to prevent toxic chemicals from polluting our consumer products, household goods, and people.

Recognizing that the safety system for industrial chemicals is broken and that Oregonians accumulate a body burden of toxic chemicals associated with negative health impacts, the Oregon Environmental Council and CHE-OR strongly recommend that our government develop and adopt comprehensive policies to ensure that only the safest chemicals are used in consumer products and in manufacturing and production processes. These policies need to fill the existing safety, data, and information gaps left by inadequate federal chemical laws. Specifically, we call for the following actions to be taken:

- Require that complete information on chemical ingredients and their toxicity be provided for all products
- Categorize chemicals into levels of concern; manage these chemicals based on hazards; and substitute chemicals of highest concern with safer alternatives
- Establish policies, practices, and incentives that move Oregon toward safer alternatives
- Ensure that workers and impacted communities are protected
- Provide adequate funding and enforcement

These policies will not be implemented overnight, but it is critical that we begin reform now. In the short-term, OEC and CHE-OR call on state agencies to utilize safer products for institutional operations (e.g. cleaning products). In the 2009 legislative session, we will call on our leaders to enact policies that require the disclosure of ingredients in consumer products and to establish a framework to remove the most toxic chemicals from these and other products. It is time for Oregon to begin establishing common-sense chemicals policies to ensure a healthy future for all Oregonians.

THE PEOPLE

Dr. Alan Bates, 62, lives in Ashland. Dr. Bates has been a physician for 30 years and currently practices family medicine in Southern Oregon. In addition to practicing medicine, he is also a Democratic state senator representing the Medford-Ashland area. He has served in the Oregon Legislature since 2001, first as a two-term representative and currently as a senator. In his spare time, Alan enjoys skiing, fly-fishing, and playing basketball.

Alan had the highest level of three types of phthalates and the second highest total phthalates. He had the highest mercury level in the group, but doesn't typically consume large amounts of fish. Dr. Bates had the lowest PCB levels and no pesticides were detected in his body.

Vicki Berger, 58, is a Republican state representative from District 20 which includes Salem, Monmouth and Independence. Vicki is a lifelong resident of Salem where she has worked, owned and operated a business, and raised three children with her husband. She enjoys playing golf and racquetball. After seeing her results, Vicki was both pleased that some of the chemicals were detected at low levels, but also worried that some of the chemicals were detected at levels above national medians. She would like to know how she was exposed.

Vicki's levels of both mercury and bisphenol A were above the national median. She had the lowest total PFC level and one of the lowest total phthalate levels.

Cathy Bloome, 36, lives in Portland. She is married with two young children. She is an occupational therapist and ergonomics consultant who works with business offices and industrial sites to assess for safety hazards. She enjoys getting outside to hike, camp, canoe, and run. Cathy's main motivation to participate in this study was to help educate the general public about toxic chemicals, especially around choices that can be made during pregnancy and while nursing. When she was pregnant with her first child, she wasn't aware of the potential health hazards in some consumer products. With her second child, Cathy knew of the dangers of phthalates and bisphenol A and made the choice to avoid them when possible.

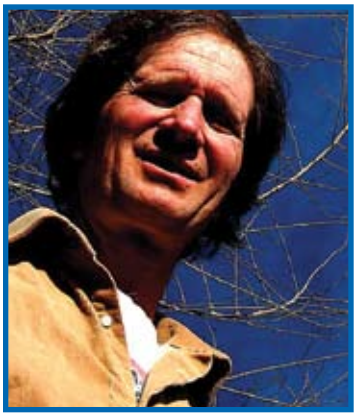
Cathy had the fewest number of chemicals detected in her body. She was one of two participants with no detectable bisphenol A, and her total phthalate level was less than half that of the second lowest participant.

Donalda Dodson, 65, is a native Oregonian who lives in Salem. She is the Interim Executive Director of the Oregon Child Development Coalition. Donalda has served on the Oregon Environmental Quality Commission since August 2005. Previously, Donalda served as Administrator of the Department of Human Services Office of Family Health and as Manager of the Maternal/Child Health Program at the Marion County Health Department. In her spare time, Donalda enjoys reading and spending time with her grandchildren.

Donalda had the highest level of PFOS, a chemical found in Scotchgard® and other stain-preventing chemicals. She also had the third highest total phthalate level. The rest of her results were low to medium compared to the other participants.

Linda Hornbuckle, 52, has lived in Portland her entire life. Linda is a professional singer who started singing at the age of six in the Grace & Truth Pentecostal Church in Portland, where her father Bishop H. Hornbuckle pastored. She has toured and recorded with national recording artists including Quarterflash, Nu-Shooz, Dan Reed, and Gino Vinelli. Her hobbies include walking and hanging out with her dogs.

At more than four times the national average, Linda had the highest level of bisphenol A in her body compared to the other participants. The amount of mercury detected in her body was more than two times the national average and the third highest in the group.



Doug Phillips, 53, is the founder and president of Metolius Climbing Company in Bend. He has lived in Oregon most of his life and currently resides in Camp Sherman. In addition to climbing, Doug enjoys a large number of activities including skiing, sailing, hiking, swimming, and woodworking. After reviewing his results, Doug commented that while the test results didn't really surprise him, he was a little concerned that his pesticide level was so much higher than the national average. He eats organic lettuce and tomatoes, but not necessarily organic apples (which are known to have a high pesticide load). He was interested to know which fruits and vegetables generally have higher/lower pesticide loads.

Doug was one of three participants who had detectable levels of organophosphate pesticides in their bodies. Both his mercury and phthalate levels were higher than the group median. He had no detectable bisphenol A in his body, and his PCB levels were among the lowest in the group.

Danya Rumore, 22, was on the 2006-2007 cross country and track team at Oregon State University. She graduated in 2007 with a degree in Environmental Science-Resource Economics and, as a recipient of a Fulbright fellowship, she will be studying Environmental Management at the University of Auckland, New Zealand in 2008. Danya aspires to work in the area of natural resource management with the ultimate goal of developing sustainable social and environmental policy. Born in Chico, California and raised in Sandpoint, Idaho, Danya has two older siblings and enjoys a variety of outdoor sports, gardening, art, piano, reading, writing and traveling.

Danya had the highest level of PCBs, two of the PFCs, and one of the phthalates. Her PCB level was more than three times the national median of PCB exposure.

Don Sampson, 46, lives in Pendleton. He is the Executive Director of the Confederated Tribes of the Umatilla Indian Reservation located in northeastern Oregon, a position he has held since June of 2003. The Confederated Tribes of the Umatilla Indian Reservation is the government of the Cayuse, Umatilla and Walla Walla Tribes— a confederation formed by treaty in 1855. Don's hobbies include snowboarding, gardening, playing basketball, and practicing martial arts.

Don had bisphenol A levels that were higher than 90% of people that have been tested in national biomonitoring studies. He also had the highest total PFCs as compared to the other participants. Don had the second lowest total phthalate level and no organophosphate pesticides were detected in his body.

Doug Stamm, 54, was born and raised in Portland. He has been the Chief Executive Officer of Meyer Memorial Trust since 2002. Meyer Memorial Trust, created by the late Fred G. Meyer, is the largest private, independent foundation in Oregon. In his free time, Doug enjoys time with family, exercising, sampling red wines and observing sports and politics of all kinds.

Doug had the highest level of PFOA and organophosphate pesticides as compared to the other Oregon participants and was the second highest in PCBs. Of the 29 chemicals that were tested in this study, 16 were detected in Doug, the greatest number of chemicals found in any individual.

Jeff VonAllmen, 47, has been a Portland-area firefighter for over 27 years. He was born in Portland and has lived in the area his entire life. In his free time, Jeff enjoys selling things on eBay, playing golf, and traveling with his wife.

While most of Jeff's test results were low to medium compared to the other participants, his total phthalate level was almost double the next highest participant, putting him in the top 25% nationally for phthalate exposure.

INTRODUCTION

Since the mid 1900s, the global production and use of chemicals have increased substantially. It is estimated that in the United States alone 42 billion pounds of chemicals are produced or imported each day.[1] Scientific studies have found two things: 1) many of these chemicals pose a grave danger to human health and 2) these chemicals can be found in every corner of every country—in the land, the air, the water, wildlife, people's blood, and women's breast milk. Despite these findings, current laws regulating chemicals are insufficient and endanger the health of all Americans, with particular threats to the health of our children (see sidebar Young Children and Fetuses at Greatest Risk).

The primary federal law regulating chemicals is the 1976 Toxic Substances Control Act, or TSCA. Of the 81,600 chemicals registered in the United States, 62,000 were already in production in 1979 when TSCA was implemented. These "existing" chemical substances, as they are classified under TSCA, are assumed to be safe unless the Environmental Protection Agency (EPA) can demonstrate that they present an unreasonable risk to human health or the environment. Additionally, the EPA must weigh risk against the economic costs of banning, limiting, or phasing out a chemical. Unfortunately, because of the limited capacity to study the toxicity, health effects, and hazards of these existing chemicals, it is difficult for the EPA to demonstrate a risk to human health or the environment. As of 2005, the EPA has performed internal reviews of only an estimated 2% of the 62,000 TSCA pre-1979 chemicals.[2]

Today, most people assume that the chemicals, materials and products in their homes, workplaces and schools are safe. This is not necessarily the case.

Chemicals are all around us—in the air we breathe, the water we drink, the food we eat, and the products that are in our homes, schools, and workplaces. While some of these substances are likely to be safe, evidence is building that an alarming number of widely used chemicals pose a threat to our health and environment. Scientific research is revealing that everyday exposures to these common chemicals can contribute to the development of cancers, learning disabilities, Parkinson's disease, endometriosis, birth defects, infertility, and other health problems.

Of particular concern to humans and the environment are chemicals that bioaccumulate, chemicals that are persistent, and highly toxic chemicals including carcinogens, mutagens, reproductive toxicants, and hormone-mimicking chemicals.

Bioaccumulation is the process through which a chemical concentrates in an organism. Chemicals that bioaccumulate can also biomagnify, which means that the concentration of the chemical increases as it moves up the food chain. Because humans are at the top of the food chain, these chemicals can have significant negative impacts on our health. Chemicals that bioaccumulate are usually concentrated and stored in an organism's adipose (fat) tissue and organs.

Persistent chemicals are substances that do not break down quickly, staying in and negatively impacting the environment for decades, if not longer. Data from countless studies show persistent toxic chemicals in places they should never be, including human breast milk, the umbilical cords of newborn babies, whales, eagles, and peregrine falcons, to name a few.[3] Even for chemicals that do breakdown within the environment, their sometimes ubiquitous presence in everyday products and foods means we are continually exposed to them.

Carcinogens are chemicals that cause cancer. A mutagen is a chemical that changes genetic information. As many mutations are known to cause cancer, mutagens are also a type of carcinogen.

Reproductive toxicants can interfere with sexual functioning or reproductive ability from puberty through adulthood. Toxicants that target the female reproductive system can cause a wide variety of adverse effects on sexual behavior, onset of puberty, fertility, gestation time, pregnancy outcome, lactation, and menopause onset. Toxicants that target the male reproductive system can affect sperm count or shape, alter sexual behavior, and decrease fertility.

Hormone-mimicking chemicals can interfere with a number of developmental and physiological processes, because our bodies have trouble distinguishing them from natural compounds such as estrogen. Hormone mimickers frequently interfere with sexual development, sperm counts, and reproductive functioning.

For the *Pollution in People* study, ten Oregonians from across the state volunteered to be tested for toxic chemicals encountered in their everyday lives. The results represent the first-ever report of 19 toxic pollutants found in Oregonians. By releasing these findings, the Oregon Environmental Council and the Oregon Collaborative for Health and the Environment seek to elevate public discussion about unwanted pollution in Oregonians and to promote actions to fix our broken chemical safety system.

The Oregon *Pollution in People* study focuses on six groups of chemicals that have been linked to harmful effects:

PHTHALATES: plasticizing chemicals used widely in personal care products, certain plastic toys and food containers, medical devices, and vinyl (PVC) products such as flooring, shower curtains, and wall coverings. The greatest concern for toxicity is when women of childbearing age and young children are exposed, as human studies have shown negative effects on reproductive development, including the feminization of male genitals.

MERCURY: a heavy metal which enters the environment through multiple routes—including natural geological sources, coal-fired power plants, cement manufacturing plants, abandoned mines, and consumer products—and can transform into methylmercury. Methylmercury, the most common form of mercury to which people are exposed, is a potent neurotoxin that interferes with brain development.

PERFLUORINATED CHEMICALS (PFCs): a group of chemicals used as surfactants and stain protectors. The two PFCs most commonly found in the environment are known as PFOS and PFOA. They have been in use since the 1950s and build up and persist in the environment and in animals. The greatest potential health risks are cancer and liver damage.

ORGANOPHOSPHATE PESTICIDES: insecticides commonly used in agriculture and to a lesser extent in urban areas. Toxic effects may include nervous system harm, cancer, and hormone disruption.

BISPHENOL A (BPA): a chemical used to make reusable plastic water bottles and baby bottles, the linings in metal food cans and dental sealants. Animal studies have linked BPA to reduced fertility, breast cancer, prostate cancer, and obesity. Scientific studies have shown that even low-dose exposure can have negative health impacts.

POLYCHLORINATED BIPHENYLS (PCBs): coolants and lubricants historically used in electrical equipment. The manufacture of PCBs in the United States ended in 1977, after extensive production and use. PCBs bioaccumulate and persist in the food chain and in our bodies and have been linked to cancer, disrupted immune and reproductive systems, and negative effects on nervous system development.

These chemicals were chosen because they are ubiquitous and are increasingly recognized as potential threats to our health. Some are also known to be persistent in the environment and to bioaccumulate in the food chain. In some cases these chemicals have been shown to have adverse health effects at extremely low levels, levels below current government safety guidelines, especially when exposure occurs at crucial stages in human growth (see sidebar New Paradigm: The Dose Is Not All that Makes the Poison). For example, we know that low-level exposures to lead and mercury harm the developing brain, and can lead to lowered IQs and learning and behavior problems.[4]

How might exposure to other, less well-studied chemicals be harming our health?

Sources of exposure vary with our individual daily routines and activities. Exposure pathways for individuals are difficult to establish because of the lack of information about product content. Our participants provided us with information about possible sources of exposure, including food consumption and product use, to help hypothesize about exposure routes.

Understanding the effects toxic chemicals might have on our health is a difficult task. Many factors influence whether or not exposure to toxic chemicals will lead to health problems including:

- Type and nature of the chemical;
- When in a person's lifetime the exposure occurs;
- How often the exposure occurs;
- How long the exposure happens;
- Amount of the chemical exposure;
- An individual's genetic makeup and physical condition;
- A person's health and nutrition;
- An individual's access to health care; and
- A person's socio-economic status.

Therefore, the results of this study cannot be used to predict how an individual's health will be affected by the chemicals present in his or her body.

While we cannot make conclusions about how these chemicals are impacting the health of all Oregonians, we can place the results for our participants in the context of other national and regional biomonitoring studies such as the Centers for Disease Control

and Prevention's Third National Report on Human Exposure to Environmental Chemicals; similar small studies in Washington, Maine, California, and Canada; and six studies conducted by the Environmental Working Group.[5] All of these studies shed light on chemical exposure levels in individuals and foster compelling questions about their health impacts.

It is important to note that this report provides a window into the chemical exposure levels of ten Oregonians, but, because of our small sample size the results are not statistically significant (see sidebar) and conclusions about Oregonians in general should be made cautiously.

The ten Oregonians tested join participants from the United States and Canada who have already been tested for the presence of toxic chemicals in their bodies.[6] These volunteers have paved the way for understanding our relationship with the chemicals to which we are regularly exposed, often without our knowledge or consent. By comparing the levels found in Oregonians to other, similar populations, we can begin to track our exposure to toxic chemicals. This information empowers us to demand safer alternatives.

The findings presented in this report make it apparent that we need to take action now, erring on the side of caution, for our health and the health of our children and future generations. Our history of widespread harm caused by toxic substances such as lead, PCBs, and mercury reminds us that we need to act on early warnings. When science reveals a connection between exposure to these chemicals and developmental disabilities or chronic disease, our concern should be turned into action. When there is a plausible concern about serious environmental health hazards, precautionary action should be taken to prevent exposure and possible harm.

ABOUT THIS REPORT

All of the protocols for this project were approved by the Portland State University Office of Research Compliance and Institutional Review Board, with oversight of methodology and data collection provided by Dr. Stephanie Farquhar. Samples of blood and urine were analyzed by the following three accredited laboratories that specialize in highly sensitive chemical analysis: AXYS Analytical Services in Victoria, British Columbia; Brooks Rand Labs in Seattle, Washington; and Pacific Toxicology in Los Angeles, California. For some chemicals the laboratories analyzed the samples for the parent compound; for others, such as phthalates, the analysis was for metabolites (breakdown products). The laboratories reported the results in varying units of measurement. For ease of understanding, we have converted the results in most cases to parts per billion (ppb). See the Materials and Methods section at the end of this report for further details.

The next section of this report discusses the overall findings. This is followed by detailed information on each group of chemicals found in the ten Oregonians. The "Conclusions and Recommendations" section identifies actions that governments, businesses, and individuals can take to reduce exposures to toxic chemicals.

THIS IS NOT A CONTROLLED RESEARCH STUDY Because of the number of people tested, the study results cannot be used to draw statistical conclusions about chemical exposures for certain represented groups, or the Oregon population as a whole. The data presented in this report provide a snapshot of the levels of some chemicals in a small, diverse, cross-section of Oregonians. The only statistically-based compilation of measurements is the National Report on Human Exposure to Environmental Chemicals conducted by the U.S. Centers of Disease Control and Prevention. The National Report on Human Exposure to Environmental Chemicals does not test for all the chemicals assessed in our project.

Young Children and Fetuses at Greatest Risk. Children and fetuses are not simply little adults. They are uniquely vulnerable to health damage from toxic chemicals for many reasons.

1. Their organs and physiological processes are still developing. Small exposures can disrupt critical cellular processes, disrupting the development of organs and systems during childhood and causing long-term, irreversible damage.

2. Pound per pound, children drink, eat, and breathe more than adults.

3. Normal childhood activities including hand-to-mouth behavior and crawling around on the floor increase the risk of exposure to certain chemicals.

These and other factors put children and fetuses at greater risk than adults of harm from environmental exposures. Rates of certain kinds of cancer, developmental disabilities, asthma and allergies—all of which have suspected environmental links—are on the rise in children. Our children's health and environment are at risk of being impaired because of our failure to protect them from common toxic chemicals

New Paradigm: The Dose Is Not All that Makes the Poison. A common argument against concerns about chemical exposures is that the presence of minute amounts of chemicals in our bodies is not necessarily harmful. However, a number of peer-reviewed studies in scientific journals have found that common chemicals impact health at lower levels than previously believed.[7] For example, lead, a known neurotoxin, damages babies' brains at very low levels—levels much lower than previously considered safe.

One critical finding is that the timing of exposure can be as important as the amount of the exposure. For example, animal tests show that a single dose of certain pesticides on a critical day of development can cause permanent hyperactivity and changes in brain chemistry.[8] Scientific studies report that many chemicals mimic natural hormones that act in the body at extremely low levels to regulate development, reproduction, immune function, and many other biological systems.

DISCUSSION OF PROJECT FINDINGS

This study reveals that Oregonian's bodies are polluted through repeated, regular exposure to many toxic chemicals. The Oregonians we tested have all six classes of chemicals in their bodies, including mercury, phthalates, PCBs, PFCs, organophospahte pesticides, and bisphenol A. We found an astonishing 19 of the 29 toxic chemicals tested for. The average body burden was 12 toxic chemicals. Table 2 in the appendix shows these results.

The chemicals we tested for pose potentially serious health threats to all Oregonians, and many, such as PCBs and mercury, are persistent (slow to degrade) and bioaccumulate (build up in the food chain).

Many of the chemicals we found in the bodies of our study participants are found in everyday consumer products, including plastic water bottles, toys, cosmetics and personal care products, furniture, carpeting, cookware and clothing. They are found in common materials such as plastics, coatings, and adhesives. Oregonians are exposed to these chemicals when using and disposing of these products, ingesting household dust, breathing indoor air pollution, eating contaminated foods, and drinking contaminated water.

The detection of 19 mostly unregulated and potentially toxic chemicals in average Oregonians shows that the safety system for industrial chemicals is broken and needs to be fixed. Current laws and practices do not prevent routine exposure to hazardous chemicals in our daily lives.

For detailed results of all chemicals measured in each participant, see the tables in the appendix at the end of this report. Table 1 identifies the 29 chemicals tested for. These chemicals fall into six chemical groups: phthalates, mercury, PFCs, pesticides, bisphenol A, and PCBs. All six groups of chemicals tested for were detected in Oregonians, although not every chemical was found in every participant. Three of the participants tested had detectable levels of all six chemical groups in their bodies.

Table 2 reports all of the chemical testing results for each individual participant. It also indicates which chemcials were not detected and the lowest level measurable (i.e., the limit of detection). Table 3 summarizes the results for the group and compares them to similar results from the national biomonitoring program or similar body burden studies.

The sections of the report that follow provide more details on each group of chemicals, including how we are exposed, known health impacts, policy changes needed to reduce our exposures, and suggestions for personal actions that individuals can take to reduce exposures to these toxic chemicals.

PHTHALATES

Six of the seven phthalate metabolites were detected in nearly every Oregonian we tested. The levels of four of the six phthalates detected in the participants were higher than the national average. For one phthalate, the median participant value was higher than 75% of all Americans tested. Phthalates are added to thousands of personal care products and soft polyvinyl chloride (PVC) plastic used in everything from shower curtains and packaging to inflatable toys and IV bags in hospitals. Phthalates are hormone-disrupting chemicals that threaten reproductive health.

MERCURY

All ten Oregon participants had measurable levels of mercury in their bodies. Mercury levels for all but one participant were higher than the national median level of mercury. The methylmercury levels measured in blood most likely resulted from consumption of mercury-contaminated fish, such as canned tuna and tuna sushi. Methylmercury is a potent neurotoxin that interferes with brain development.

PFCs

All ten Oregon participants had perfluorinated chemicals (PFCs) in their blood. Of the 13 PFCs tested, six were found. PFOS and PFOA were detected in every participant. These persistent chemicals are ubiquitous in the environment. PFCs are used as stain-and water-resistant coatings on furniture, clothing, and carpets; grease-resistant coatings in fast-food packaging; non-stick coatings for cookware; and other Teflon® products including Gore-Tex. The greatest potential health risks are cancer and liver damage.

PESTICIDES

Three of the ten Oregonians tested positive for organophosphate pesticides in their bodies. Of the six organophosphate pesticide metabolites we tested, we found four in the participants. One of the most likely sources for pesticides exposure is from the food we eat. Organophosphate pesticides are known to be harmful to the nervous system and are associated with poor memory and damaged motor skills.

BISPHENOL A

Eight of the ten Oregonians tested had detectable levels of bisphenol A in their bodies. Six had urine levels of bisphenol A that were higher than the national median levels. Two participants had levels of bisphenol A that were in the top 10% nationally. BPA is a plastic building block chemical used to make polycarbonate plastics used in baby bottles, reusable water bottles, and many other products. Bisphenol A mimics the actions of naturally occurring estrogen, but also has other mechanisms of action. Animal tests show that exposure to very low doses may adversely affect reproduction, sexual development, and other biological systems.

PCBs

All ten of the Oregon participants were found to have PCBs in their blood. While the median concentration of PCBs was lower than the national median, the highest PCB concentration was more than three times the national median. Our society continues to suffer from the toxic legacy of PCBs more than 30 years after they were banned in the United States. PCBs enter the environment and accumulate in water. For most people, food is the most significant source of exposure. PCBs are considered probable carcinogens and prenatal exposures have been linked to impaired brain development.

CHAPTER 1

PHTHALATES

Phthalates (pronounced THAL-ates) are a versatile class of about 25 chemicals widely used in consumer products to soften plastics, carry fragrances, and act as solvents and fixatives. The majority of phthalate use, approximately 90%, is to make PVC (vinyl) products softer and more flexible. PVC, the second most commonly used plastic worldwide, is found in toys, car interiors, medical devices like IV bags and tubing, vinyl flooring, vinyl wallpaper, and vinyl shower curtains.[9] Phthalates are also present in personal care products, detergents and soaps, pesticides, and some clear food wrap.[10] In cosmetics and personal care products, phthalates are used to disperse fragrances, stabilize the cosmetic on the skin, and provide flexible hold in nail polish and hair care products.

Phthalates are widely detected in human blood and urine samples. According to the Centers for Disease Control (CDC), phthalates are found in Americans of all ages, sizes, and races. The latest exposure study from the CDC indicates that women are slightly more exposed than men, and younger children (ages 6-11) are more exposed than older children (ages 12-19 or 20).[11] In 2006, the EPA issued a draft risk assessment that proposed a reference dose (RfD), or safe oral exposure level, of 0.3 milligrams per kilogram of body weight per day (mg/kg-day), which is weaker than the current agency standard of 0.1 mg/kg-day.[12]

Exposure to phthalates occurs through direct use of products containing these chemicals, consumption of foods wrapped in products containing these chemicals, and inhalation of air contaminated with these chemicals.[13] For example, children are exposed to di-(2 ethyl hexyl) phthalate (DEHP) because they put vinyl toys in their mouths. DEHP has also been shown to leach into blood from medical tubing and devices. A 2005 study found that babies in neonatal intensive care units using phthalate-containing medical products had levels of phthalates seven times higher than babies in a hospital not using phthalate-containing products.[14] Di-n-butyl phthalate (DBP) and diethyl phthalate (DEP) are used in cosmetic products

where the exposure can occur through inhalation, absorption through the skin, and oral ingestion. Animal studies have demonstrated that different phthalates have different toxicities depending on the route and timing of exposure.[15]

PHTHALATES IN OREGONIANS

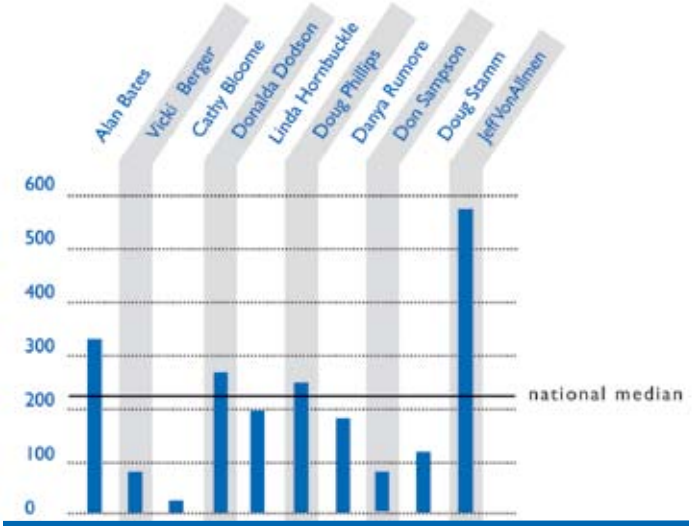
Three of the phthalate metabolites were detected in all ten Oregonians, and seven participants tested positive for six of the seven forms (see Table 2 in the appendix for complete results). Phthalates do not build up in the human body (or bioaccumulate) so internal levels may fluctuate throughout the day reflecting only recent exposure. We tested for seven phthalate metabolites, which vary in their toxicity and use.* Using national numbers reported in the CDC study, we were able to compare the levels in our participants with levels found in a large number of people nationwide.[16] For three of the phthalate metabolites, we found levels higher than the median levels detected in the CDC study.

Figure 1 shows the total phthalate load of each of the Oregon study participants. Four people had total phthalate levels that exceeded the national median for the same seven phthalate compounds. Since different phthalates have different toxicity, a higher sum may not correlate with a higher toxicity.[17] The data in Figure 1 are creatinine-corrected. That means that the results are adjusted for how well a person's kidneys work and are not biased by differences in fluid intake or kidney function.

Both Jeff VonAllmen and Alan Bates had total phthalate levels in the top 25% nationally for phthalate exposure. Jeff's exposure, with a total phthalate level of 585.7 ppb, was more than three times the group median levels. It is of note that Cathy Bloome, who had the lowest total phthalate level at 31.74 ppb, has made the conscious choice to eliminate many phthalate-containing products from her home including vinyl shower curtains and other plastic products. Figure 2 shows our participants' exposure to the phthalate known as DEHP, which is widely used in consumer products like clothing and shower curtains, and is among the most toxic phthalate, even at relatively low levels of exposure. Median levels among our participants for the three DEHP metabolites (MEHP, MEOHP, and MEHHP) were 4.32, 25.52, and 24.53 ppb; median levels in the CDC study were lower, at 3.89, 11.2, and 16.6 ppb.[18]

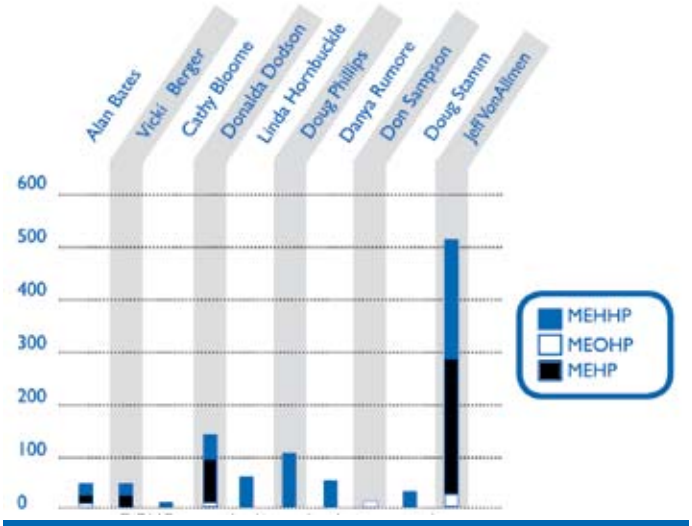
For one DEHP metabolite, MEOHP, the median Oregon value was higher than 75% of all Americans tested. DEHP is widely used in PVC products such as medical IV bags and tubes, auto interiors, diaper covers, shower curtains, and other consumer items. The Pollution in People participant at the top of the list for DEHP metabolites is firefighter Jeff VonAllmen. Jeff's overall DEHP metabolite levels (526.24 ppb) were more than three times those of any other participant and higher than 95% of all Americans tested in a recent CDC study.[19] While we cannot make any definitive conclusions based on a single exposure assessment, it is possible that Jeff's high DEHP metabolite level is due to an occupational exposure. Jeff responded to an electrical fire three days prior to his testing. Electrical wire and cable is normally sheathed in DEHP containing PVC, which may be released when burned.[20]

FIGURE 1: Phthalates in 10 Oregonians



Phthalate monoester levels, measured in urine and creatine corrected

FIGURE 2: Levels of DEHP Metabolites in 10 Oregonians



Three breakdown products of the phthalate DEHP were measured in urine and creatinine-corrected: MEHP, MEOHP, and MEHHP.

* We tested for seven phthalate monoesters, which are breakdown products of five phthalate diesters used in products.

HEALTH EFFECTS OF PHTHALATES

Phthalates are hormone-disrupting chemicals that threaten reproductive health in humans. Scientists have suspected for years that exposure to phthalates can lead to health problems in humans. In laboratory animals, fetal exposure to phthalates causes significant developmental toxicity, especially of the male reproductive system. Effects in male animals include small testes, hypospadias (abnormal urinary openings), and undescended testes.[21] In adult animals, phthalates damage the reproductive organs, adrenal glands, liver, and kidneys.[22] These effects occur at exposure levels higher than those expected for people today; however some of the most highly exposed people have phthalate levels that exceed reference doses (thought to be safe) based on animal tests.

In humans, phthalates cross the placenta and reach the growing fetus. In utero exposure to phthalate metabolites is associated with marked changes in the reproductive systems of baby boys. A landmark 2005 study found that baby boys whose mothers had higher levels of phthalates in their urine were more likely to have altered genital development, smaller average penis size, and a higher frequency of undescended testicles.[23] Phthalate metabolite levels in urine associated with these health effects were not extreme, but rather were typical for about one-quarter of all U.S. women.[24]

These effects are consistent with a "phthalate syndrome" observed in male rodents with phthalate-induced feminized traits. The study authors and some researchers think that phthalates that have these effects, such as DEHP and DBP, act by reducing levels of testosterone and important growth factors in males. In adult males, phthalate exposure has been linked to lower sperm counts, reduced sperm motility, and damaged sperm.[25] Phthalate exposure has also been linked with a number of other adverse health effects. These include: reduced female fertility, liver and kidney damage, and asthma.[26]

Animal research and one recent human study show that prenatal exposure to DBP disrupts development of the male reproductive system in ways that may increase the risk of testicular cancer.[27] Cancer studies also suggest cause for concern among females. The phthalate DBP promotes the growth of breast cancer cells in culture and has been shown to decrease the sensitivity of these cancer cells to chemotherapy drugs.[28]

POLICY CHANGES NEEDED

Phthalates provide an example of why we need comprehensive safer chemicals policies to close the gaps in our current system. We need to encourage the development and substitution of safer alternatives and ensure that businesses and individuals have information about all of the ingredients in the products they use. Given the widespread human exposure to phthalates and the known reproductive harm associated with common exposure levels, government and industry must take action to eliminate the use of phthalates in PVC plastics and personal care products.

In 1999, the European Union took the responsible step of restricting the use of three phthalates used in plastic toys that can be placed in children's mouths, and followed this in 2005 by banning six phthalates in toys. In addition, the European Union also prohibited the use of some phthalates in cosmetics in 2003. Mexico, Japan, and Canada also have limited the use of some phthalates.

In the United States, phthalates remain essentially unregulated. While cosmetic and medical uses of phthalates are regulated by the Food and Drug Administration (FDA), the FDA has not taken steps to eliminate phthalates from these products, citing a lack of compelling evidence that phthalates pose a safety risk.[29] The FDA has urged medical providers to switch to phthalate-free products and they do regulate plastic containers and materials that come into contact with food.

At the state level, bills to prohibit the use of phthalates in toys and child care products have been introduced in New York and recently passed in California. In 2007, the City and County of San Francisco adopted an ordinance to restrict the use of phthalates in children's products. These policies offer models for action at the state and local level.

In 2007, the Oregon Legislature passed a joint memorial urging the U.S. Congress to require accurate labeling of all ingredients, with a particular focus on phthalates in cosmetics, personal care products, and toys and to enact federal laws to ensure that the chemicals in these products are tested, reviewed, and approved as safe for humans. This resolution sets the stage for the passage of state-level policies to address phthalates in coming legislative sessions.

In contrast to the relative inaction from government regulatory agencies, a large number of hospitals, consumer product companies, and government purchasers have taken steps to replace phthalate-containing products with safer alternatives. Kaiser Permanente has pledged to reduce PVC, and thus phthalates, wherever possible in new construction and has also worked with vendors to develop phthalate-free carpeting and wall coverings. The cosmetic companies Revlon and L'Oreal and other major companies are phasing phthalates out of nail polish. Three hundred companies, including The Body Shop and Burt's Bees, have pledged to eliminate phthalates in response to requests from the Campaign for Safe Cosmetics.

REDUCING YOUR EXPOSURE TO PHTHALATES

Products containing phthalates are ubiquitous in our society, but you can reduce your and your family's exposure to phthalates by avoiding PVC and purchasing products from companies that have eliminated phthalates. When you can, try to choose metal, glass, ceramic, wooden, or other natural non-PVC products.

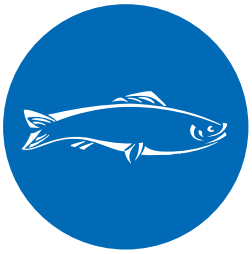
Avoid plastics with recycling code #3. Look at the recycling symbol on products when you purchase plastic products. Plastics marked with the #3 symbol contain PVC.

Use PVC-free food storage. Buy plastic wrap and bags made from polyethylene, such as GLAD®. For food storage, use glass containers or plastic containers marked with recycling codes other than the #3. If you do use plastic containers, do not heat or microwave food in them.

Choose phthalate-free toys. Toymakers Early Start, Brio, Chicco, Evenflo, Gerber, Lego and Sassy have pledged to stop using phthalates. Look for toys made from polypropylene or polyethylene or avoid plastic toys altogether.

Purchase phthalate-free beauty products. Avoid nail polish, perfumes, colognes, and other scented products that are labeled as containing phthalates. Many scented products simply list "fragrance" as an ingredient, which often incorporates a number of different chemicals including phthalates. Avoid these products, or do additional research. For more information on phthalate-free cosmetics and personal care products, visit the National Campaign for Safe Cosmetics (www.safecosmetics.org) and the Environmental Working Group (www.ewg.org), which maintains a database on cosmetic products, their ingredients, and toxicity.

For additional information on PVC-free products for the home, office and building materials, check out the resources available at: *www.preventharm.org/take.buyg.shtml#pvc*.



CHAPTER 2

MERCURY

Mercury is a naturally occurring element that has no nutritional value and is a potent neurotoxin. This means that it interferes with the way nerve cells function. Mercury's dangers have been established for centuries—noted by both the ancient Romans and Incas. Despite this, mercury is used in, and is a byproduct of, many industrial processes and consumer products.

In Oregon, the major sources of industrial mercury are mercury-added products (such as thermostats, thermometers and fluorescent lamps), point sources (such as power plants that burn coal, commercial and industrial boilers, steel mills, and cement kilns), and abandoned mercury and gold mines. Additional sources of mercury in Oregon include laboratories, dental offices, health care facilities, global emissions, and erosion of native soils. The total amount of mercury released from human sources to air, water, and land in Oregon is estimated at approximately 4,500 pounds annually.[30] Oregon's two largest source of mercury emissions are the coal-fired power plant at Boardman, emitting an estimated 165 lbs a year, and the Ash Grove cement kiln in the Eastern Oregon town of Durkee, emitting an estimated 2,500 lbs of mercury a year.[31] In 2004, the Ash Grove Cement plant was the third largest source of airborne mercury in the nation.[32]

Once released mercury circulates in the atmosphere and deposits on land and water. Mercury entering water can be transformed into methylmercury, a highly toxic form of mercury that bioaccumulates in the muscle tissue of fish and biomagnifies in animals that eat fish. When a substance biomagnifies its concentration increases as it moves through the food chain. This study tested for the presence of methylmercury. The most common way people are exposed to mercury is by eating fish containing methylmercury.[33] Just one gram of mercury (the amount in just two typical thermometers) can make the fish in a 20-acre lake unsafe to eat.

The EPA and the FDA have jointly determined a reference dose for mercury of 0.1 µg/kg body weight per day, which corresponds to a blood mercury level of 5.8 ppb for women of childbearing age, pregnant and nursing women, and

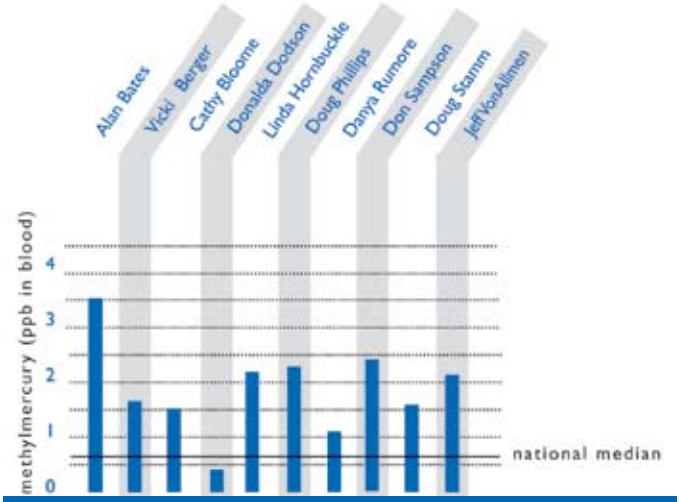
children under the age of fifteen. The EPA reference dose is defined as the amount of mercury a person, including sensitive subpopulations, can be exposed to on a daily basis over a lifetime without appreciable risk of effects. Currently men over age 16 and women over age 49 have no mercury exposure level guidelines. These guidelines are needed in order to be able to determine safe levels of mercury exposure for these populations. While mercury is naturally excreted, it can take months to leave the body after exposure. In addition, most people are regularly exposed to mercury in the environment and food.

MERCURY IN OREGONIANS

Oregonians are most directly exposed to mercury by eating contaminated fish. Oregon has 12 fish advisories due to mercury contamination covering 435 miles of waterway, including the entire main stem of the Willamette River.[34]

Methylmercury was detected in the blood of all ten Oregonians we tested. Methylmercury is a particularly toxic form of mercury as it specifically targets the central nervous system. Figure 3 shows that a wide range of mercury was detected in the participants, from 0.37 to 3.5 ppb, with a median of 1.83 ppb. Mercury levels for all but one Oregonian tested were higher than the national median of 0.70 ppb.[35]

FIGURE 3



Methylmercury levels measured in blood. The horizontal line depicts the national median value of 0.70 ppb. *

At 3.5 ppb, Alan Bates had the highest methylmercury level in our group. High blood methylmercury levels are often thought to correlate with fish-rich diets, but Alan did not report consuming the highest levels of fish among the participants, although he does eat fish occasionally (once a week). While it is difficult to know what accounts for Alan's high methylmercury level, without a more in-depth evaluation of his exposures and habits, it is likely that the fish he does consume is contaminated with high levels of mercury. His results demonstrate that while fish consumption can be a significant source of mercury contamination for Oregonians, the exposure also depends on where the fish came from and the type of fish you consume.

HEALTH EFFECTS OF MERCURY

Many adverse health effects are associated with the accumulation of mercury in the body. They vary depending on the amount of mercury one is exposed to, time of exposure, chemical form of the mercury, and age of the subject.

Methylmercury, the most common form of mercury to which people are exposed, is a very potent neurotoxin that interferes with brain development. Once in the brain it interferes with nerve cell differentiation and cell division by binding DNA and RNA. Methylmercury can cause nerve cell death and scarring in selected areas of the brain.[36] In the case of methylmercury poisoning, numbness is the first sign of damage to the nervous system.[37] Other symptoms that may follow a higher dose of methylmercury poisoning are stumbling or clumsy gait and generalized weakness. Higher doses of methylmercury poisoning may lead to speech difficulties, loss of vision and hearing, tremor, and finally, coma and death.[38]

Young children and fetuses are more sensitive to methylmercury than adults.[39] Mercury in the mother's body passes to the fetus and may accumulate there. It can also pass to a nursing infant through breast milk. Children exposed to methylmercury in utero show irreversible damage to their central nervous systems: numbness and tingling around mouth, fingers and toes; a clumsy stumbling gait; difficulties swallowing and speaking; general weakness and fatigue; vision and hearing loss; spasticity and tremor; and seizures. Methylmercury interferes with cell division and migration of cells in the developing brain.[40] Prenatal mercury exposure has also recently been implicated in preterm birth.[41] According to the CDC, 8% of U.S. women of childbearing age have enough mercury in their blood to pose a threat of neurological damage to the fetus.[42]

Chronic exposure to methylmercury in adults may also produce cardiovascular problems,[43] though studies have not yet determined a reference dose for the level of exposure that might trigger these effects. There is some evidence that methylmercury may function as a hormone disruptor and may play a role in diseases such as breast cancer.[44]

* Methylmercury results have been compared to total mercury in CDC biomonitoring. Total blood mercury concentrations are predominantly from methylmercury. Our testing was specifically for methylmercury.

POLICY CHANGES NEEDED

Regulation of mercury is particularly difficult because it readily moves between media; from release into the air and deposition in land and water, to bioaccumulation in animals and people. In addition, mercury is produced as an unintentional byproduct of mining and other industrial processes, so we are continually producing more of it. One emerging problem involves how to capture and store excess mercury. Also, absent regulations, excess mercury in the United States can be sold on the international market. Subsequently, mercury sold abroad can eventually be released by production facilities back into the air and recontaminate Oregon's environment and people. At the federal level, the Mercury Market Minimization Act is being proposed to help reduce the amount of mercury circulating in the global marketplace.

Many states have acted to limit mercury exposure, use, and production. A number of states have implemented broad mercury reduction efforts, such as Connecticut (phase out all anthropogenic discharge of mercury), Massachusetts (requires manufacturers to collect mercury containing products), and California (controlling mercury throughout its lifecycle). Other states including Oregon, Maine, New Hampshire, Illinois, Indiana and Washington have focused on eliminating mercury-added products. Maryland is focusing on getting mercury out of schools, and Michigan has focused on getting mercury out of hospitals. Several local jurisdictions around the country also have adopted restrictions on sales of products containing mercury.

Eliminate the use and sale of mercury-containing products. Oregon has begun to address the problem of mercury releases through the Mercury Reduction Act of 2001 which has phased out use and sale of certain mercury-containing products such as fever thermometers, auto switches and novelty products. Although mercury-containing thermostats can still be sold under this legislation, they cannot be installed by contractors.

Reduce mercury emissions from power plants. Oregon has adopted a Utility Mercury Rule that limits mercury emissions for new plants and mandates installation of mercury control technology for Oregon's only existing coal-fired power plant. The rule requires that the power plant achieve a 90% reduction in mercury emissions by 2012. If the 90% reduction is not technologically achievable, the coal-fired power plant must install continuous mercury monitoring equipment by 2008 and develop a mercury reduction plan. In the long-term, coal burning should be replaced with conservation and cleaner energy production.

Reduce mercury emissions from manufacturing facilities. Oregon Department of Environmental Quality (DEQ), in partnership with the Ash Grove Cement plant and local community and environmental organizations, are working on a plan to reduce mercury emission through the installation of control equipment. The mercury reduction effort is a voluntary effort specific only to Ash Grove as it is the only cement manufacturing plant in Oregon. To avoid excessive mercury pollution, the state should require that all facility retrofits and every new facility constructed in Oregon use the best available technology.

Health care facilities, including hospitals and dental offices, should phase out mercury containing products in favor of safer alternatives. For several years, the Oregon Dental Association, local governments, and Oregon DEQ have been promoting voluntary environmental best management practices to reduce mercury contamination from dental amalgam in dental offices. In 2007, the Oregon Legislature passed a requirement regulating dentist disposal practices of amalgam fillings that contain between 40 and 50% mercury. If no protective measures are taken, mercury from amalgams ends up in air after being incinerated with medical waste, or in water if disposed of down the drain. This legislation requires installation of amalgam separators in all dentist offices, which can remove over 90% of all the mercury if installed properly. While this legislation is a step in the right direction, further action is needed to encourage health care facilities to eliminate the use of mercury in health care practices to ensure that no mercury enters the environment from dental and medical offices.

The Oregon Center for Environmental Health's "Health Care Without Harm" campaign is working to eliminate mercury in hospitals by promoting safer alternatives. In 2006 Kaiser Permanente Northwest Region, Legacy Heath System, and Providence St. Vincent Medical Center received the "Making Medicine Mercury-Free" Award from the Hospitals for a Healthy Environment for virtually eliminating mercury devices from their facilities and discontinuing the purchase of new mercury-containing devices. Also in 2006 Oregon Health & Science University, Providence Newberg Hospital and Providence St. Vincent Medical Center were recipients of the Partners for Change Award from the Hospitals for a Healthy Environment for the significant progress they have made toward eliminating mercury from their facilities.

Expand and develop programs to safely collect and recycle mercury-containing products. In the past few years, Oregon DEQ has implemented, funded, and co-sponsored a number of programs to collect and safely manage mercury thermostats, thermometers, fluorescent light tubes, and auto switches. These programs need to be expanded and continually evaluated to ensure that mercury-containing products are safely collected and recycled. The increasing use of energy-efficient compact fluorescent light bulbs (CFLs) necessitates the quick implementation of an effective recycling program to avoid the accumulation of mercury from CFLs in our solid waste management systems.*

* It is important to note that although CFLs do contain small quantities of mercury, they are far more energy efficient than incandescent lights. CFLs significantly reduce the amount of mercury released into the environment because they reduce the amount of energy generated by coal-fired power plants, the main source of mercury in the United States.

Develop scientifically based regional fish-consumption guidelines. The amount of fish eaten varies geographically and among different populations. Data demonstrate that some populations in Oregon consume more fish than the current EPA reference dose.[45] Oregon DEQ—in partnership with the EPA, the Confederated Tribes of the Umatilla Indian Reservation and other community members—is in the process of reviewing Oregon fish consumption rates to determine appropriate fish consumption guidelines. Oregon needs to adopt appropriate, regional guidelines for fish consumption that protect populations at risk from eating contaminated seafood and fish from local and commercial sources.

REDUCING YOUR EXPOSURE TO MERCURY

Avoid fish high in mercury. Fish species that are known to be high in mercury are long-lived, large predators. Examples include king mackerel, tilefish, swordfish, orange roughy, and marlin. Limit consumption of tuna, especially steaks and canned 'white' albacore. In a recent study, 100% of tested canned tuna contained methylmercury.[46] The range of contamination was wide, but a pregnant or nursing woman could only eat one can of the most contaminated tuna every 98 days without risking damage to her baby. Lower-mercury choices include wild salmon, sardines, anchovies, Atlantic herring, Dungeness crab, Pacific cod, Alaskan black cod, farmed striped bass, tilapia, farmed catfish, clams, mussels, and Pacific oysters.

You can find additional guidance on fish choices at the following websites:

- Oregon Department of Human Services, An Expectant Mother's Guide to Eating Fish in Oregon at *www.oregon.gov/DHS/ph/envtox/docs/mothersguide.pdf;*
- Environmental Defense, Oceans Alive: Best and Worst Seafood at *www.oceansalive.org/eat.cfm;* and
- Environmental Working Group, Mercury in Seafood (includes Tuna Calculator) at *www.ewg.org/issues/mercury/index.php*

Exercise caution when consuming sport-caught fish. If you eat fish caught in local rivers and streams, check the Oregon Department of Human Service's fish advisories for specific guidance on Oregon water bodies or coastal waters. Almost 20% of Oregon's waterways are under fish advisories due to contamination from persistent bioaccumulative pollutants, including mercury. These advisories include fish in the Cottage Grove Reservoir near Eugene, fish in the Coast Fork and entire main stem of the Willamette River and fish throughout eastern Oregon. Fish and shellfish consumption advisories are available at *http://oregon.gov/DHS/ph/envtox/fishconsumption.shtml.*

Avoid purchasing and using consumer products that contain mercury. The most common household items that may contain mercury include thermostats, barometers, manometers and thermometers.* Buy digital or mechanical thermostats and digital or alcohol-based thermometers, all of which are free of mercury. Encourage local businesses to carry mercury-free items whenever possible and to offer recycling for mercury-containing products in their stores.

Make sure your medicines are free of mercury. Some home remedies, including some Hispanic folk remedies ("grieta") and Ayurvedic herbal preparations and immunizations can contain mercury. Look at ingredient lists, talk to your doctor, and avoid folk remedies and other medicines that contain mercury.

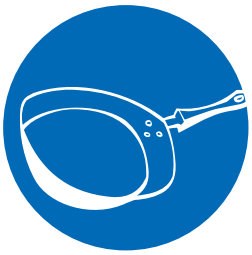
Dispose of mercury-containing products responsibly. Keep mercury out of landfills and incinerators by recycling batteries and mercury-containing wall-mounted thermostats. Exchange mercury-containing thermometers. Recycle compact fluorescent lightbulbs (CFLs) appropriately. While compact fluorescent light bulbs do contain a small amount of mercury, they reduce overall mercury emissions because they are far more efficient than incandescent bulbs and reduce the amount of coal burned to power our homes.

Choose green energy. A primary source of mercury in the environment is pollution from coal-fired power plants. Although Oregon only has one coal power plant, one-third of our electricity is generated by coal-fired power plants located here and in nearby states. By choosing your power utility's green energy option, you can help reduce mercury and other air pollutants across the West.

Ask your elected officials to take action on mercury reduction policies. Lobby your elected officials to strengthen regulations on industrial releases of mercury and to fund clean-up of Oregon's abandoned mines which continue to leak mercury.

FISH ARE AN EXCELLENT SOURCE OF NUTRIENTS, including protein, omega-3 fatty acids, and vitamin D. We encourage people to continue eating fish following the Oregon Department of Human Services fish-consumption precautions. Limiting mercury intake from fish is especially important for young children and women who are pregnant, nursing, or of child-bearing age.

* In 2002, the sale of mercury-containing fever thermometers was banned in Oregon. Mercury-containing fever thermometers are still available for purchase in other states.



CHAPTER 3: PFCs

In 1935 Dupont adopted a new advertising slogan, "Better Things for Better Living . . . Through Chemistry," which heralded a new age of chemical invention and production. One of the best-known products introduced by Dupont in the 1950s is Teflon®, a non-stick coating for cookware, made with a chemical of remarkable persistence known as perfluorooctanoic acid (PFOA). Around the same time, another well-known chemical company, 3M, introduced the popular product Scotchgard®, a water and grease repellant for clothing and textiles that relies on a similar chemical known as perfluorooctane sulfonate (PFOS). PFOA and PFOS are part of a family of PFC chemicals that are used in protective coatings of all sorts—paper wraps, containers for food, fire-fighting foams, pesticides, textiles including clothing, upholstery, carpets, and personal care products.

While it had been known since the 1960s that PFCs build up in the bodies of workers at Teflon® and Scotchgard® production facilities, by 2000 scientists had found PFCs almost everywhere – in soil, water, sediment, animals, food, people, and even newborn babies. These chemicals are extremely persistent. Even if production were to end today, levels of the breakdown product PFOA would continue to increase in the environment for many years to come. 3M has disclosed that "perfluorinated compounds are extremely resistant to biodegradation."[47]

PFOA is particularly resistant to the breakdown process. It has been found not to degrade in the environment at all, even when boiled in nitric acid for a hour.[48] Once in a human body, PFCs remain in the body for many years. The half-life (time required for half the amount of a chemical to be eliminated from the body) of PFOA in our bodies is estimated to be more than four years,[49] and the half life of PFOS in our bodies is estimated to be over eight years.[50] When other PFCs break down they turn into the non-biodegradable PFOA, adding to the environmental burden of these chemicals.

PFCs are detectable in the blood of most humans and animals worldwide. Studies done by 3M have found PFOA and 14 other PFCs in the bodies of the general population, especially in children.[51] A 2001 3M study found PFOA in 96% of children tested in 23 states and the District of Columbia.[52] Researchers at Johns Hopkins University found PFOA in 100% and PFOS in 99% of 297 serum samples collected in 2004 and 2005 from umbilical cords of newborn babies.[53]

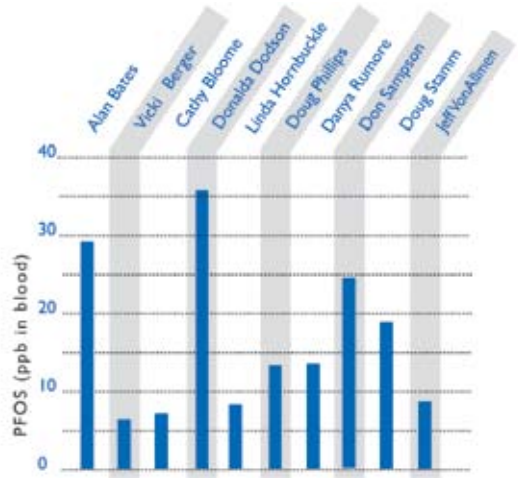
It is believed that we are most likely exposed to PFCs through contaminated water and food, including fish,[54] and by breathing contaminated air.[55] When Teflon® pans are heated to high temperatures, such as during cooking or when discarded products are burned in incinerators, toxic PFC-containing gases are produced. Grease-resistant food packaging and paper products, such as microwave popcorn bags and pizza boxes, also contain PFCs. PFCs build up in our bloodstream and liver, umbilical cord blood, and breast milk.

PFCs IN OREGONIANS

All ten of the Oregon participants were found to have PFCs in their blood. We found six different perfluorinated chemicals of the 13 PFCs that we tested. PFOS and PFOA were detected in every participant. See Table 2 in the appendix for the complete results.

PFOS, which was detected in all ten Oregonians, was the highest PFC for every participant. PFOS levels in our participants ranged from 5.77 ppb to 35.4 ppb, with a median value of 13.55 ppb (see Figure 4). This is lower than the mean estimate for PFOS from a CDC study of more than 900 people tested in 2001 and 2002.[56] This could reflect a decline in PFOS exposure since production and its use in Scotchgard ceased in 2001. See Table 3 in the appendix for comparisons. Three of our participants—Don Sampson, Donalda Dodson and Alan Bates—with PFOS levels at 24.6, 35.4, and 29.6 ppb respectively, were within the national mean estimate of 23.4 to 40.2 ppb.

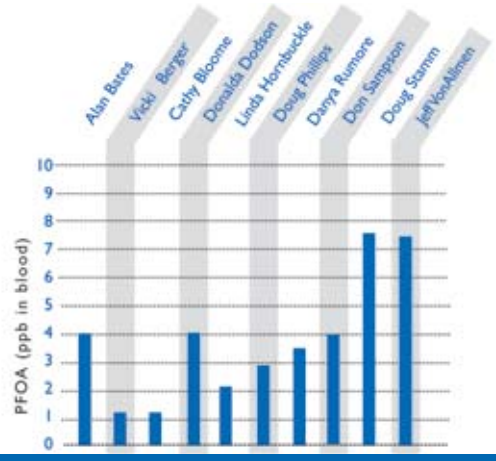
FIGURE 4



Levels of PFOS measured in participant blood serum.

PFOA levels in our participants ranged from 1.25 ppb to 7.64 ppb, with a median of 3.22 ppb (see Figure 5). This median PFOA level is below the national average range of 3.97 ppb to 6.98 ppb. While these levels are lower than our participants' levels of PFOS, PFOA levels may well be on the rise as other PFCs continue to break down into PFOA. One participant, Doug Stamm, had a PFOA median level that was not only higher than the national average range, but also more than twice the Oregon median. While we do not know the source of Doug's exposure to PFOA, it is used in Teflon® and is a breakdown product of stain- and grease-proof coatings found in microwave popcorn bags and pizza box liners.

FIGURE 5



Levels of PFOA measured in participant blood serum.

PFNA, another PFC detected in eight of the participants, was detected in Danya Rumore, Doug Stamm, Donalda Dodson, and Alan Bates at levels above the median estimate reported in the CDC's national study. See Table 2 in the appendix for complete results.

HEALTH EFFECTS OF PFC EXPOSURE

Since the 1950s significant amounts of PFCs have been produced, used and disposed of without any regulation, oversight, or testing for environmental or health effects. Only recently have these chemicals come under scrutiny, and there are few studies addressing the potential health effects of PFC exposure in people. However, animal studies show that PFOA and PFOS damage the liver and other organs, cause immune disruption, endocrine effects, reproductive harm, and developmental defects.[57] PFOA also causes liver, pancreatic, testicular, and mammary gland tumors in laboratory animals.[58] Research on men with occupational exposure

to PFCs found an increased risk of death due to bladder cancer for those exposed to PFOS[59] and higher cancer deaths, with possible links to prostate and testicular cancer for men, with occupational exposures to PFOA.[60] In response to these studies and others, in January 2006 the EPA upgraded PFOA to a likely human carcinogen.[61]

Recent research has demonstrated a statistically significant link between higher levels of PFOA and PFOS in cord blood and decreased birth weight and head circumference.[62] In addition, this same study found a correlation between PFC levels and the scores babies earned on the ponderal index, which measures fetal body mass and can serve as a rough approximation of nutritional status. Higher PFOS and PFOA cord blood levels were correlated with a lower ponderal index. Other studies have suggested that low birth weight may be a risk factor for obesity, diabetes, and cardiovascular disease later in life.[63]

POLICY CHANGES NEEDED

Even though PFCs permeate our water, soil, and food, until very recently there were no limitations of PFC emissions or disposal under the Clean Air Act, the Clean Water Act, the Safe Drinking Water Act, or the Resource Conservation and Recovery Act. Similarly the FDA has no authority to assure safe levels of PFCs in food or personal care products. The only bulwark against PFCs (and tens of thousands of other chemicals produced since the 1950s that were grandfathered in under TSCA) is regulatory action by the EPA that first requires them to prove that the chemicals are harmful. Since chemical producers are not required to provide health effects information to the EPA or the public about the chemicals, proving them harmful has been a difficult task.

In 2001, after intense media attention and pressure from the EPA, the 3M Company stopped production of PFOS-containing products and reformulated their Scotchgard® product to minimize the release of PFCs into the environment. Unfortunately, non-U.S. producers continue to manufacture PFOS. In 2006 the EPA signed a voluntary agreement with DuPont, 3M, and six other chemical companies to reduce PFOA use and emissions by 95% by 2010, with complete phase out by 2015. PFOA and related chemicals are still used to manufacture Teflon® and Gore-Tex®.

While these actions are important, they will not fully protect public health and the environment from PFCs. Further steps are necessary to eliminate the toxic threat of PFCs to our environment and consumer products and to guard against similarly persistent and potentially dangerous chemicals that are yet to be introduced.

Phase out the use of all persistent PFCs. Many concerned people and organizations around the world have called for the phase-out of PFCs. Sweden has proposed that PFOS be banned globally under the Stockholm Convention on Persistent Organic Pollutants and, along with Britain, has applied to the European Commission for a national ban on the substance. Oregon should review PFCs and take action to phase out persistent or potentially persistent PFCs.

Support research on the health impacts of PFC exposure. While there is some research on the health impacts of PFC exposures, additional information is needed. Under our current system of chemical regulation, until there is proof of harm, the EPA has no authority to set standards and regulations pertaining to PFCs.

Establish maximum allowable limits for PFCs in drinking water. In response to concerns over the health effects of PFCs, West Virginia established a water 'screening level' of 150 ppb maximum allowed for PFOA. In February 2007, New Jersey moved to adopt a limit of 0.4 ppb of PFOA in drinking water. There is currently no federal limit for PFOA in drinking water. Oregon should follow the lead of New Jersey and establish a similar limit for PFOA in water.

REDUCING YOUR EXPOSURE TO PFCS

To reduce personal exposure, avoid purchasing or at least minimize use of products containing PFCs. Consider the following tips:

Reduce greasy packaged foods and fast foods in your diet. Not only is the nutritional quality of these foods questionable, but the packaging for greasy foods such as microwave popcorn, French fries, and pizza are often treated with PFOA-laden grease-resistant coatings.

Avoid stain-resistant furniture and carpets. Choose furniture and carpets that aren't marked "stain-resistant." Decline treatments and ask for products that have not been pretreated with products such as Stainmaster®.

Avoid Teflon® and other non-stick cookware. If you do choose to use non-stick cookware, do not overheat or burn them. PFCs are released when the cookware reaches 450°F.[64] Discard products when the non-stick coatings show signs of deterioration.

Choose alternatives to clothing with Teflon® labels or otherwise known to be treated for water or stain-resistance. Many of the treated outerwear and gear are coated with PFCs.

Read the labels of your personal care products. Avoid personal care products made with Teflon® or polytetrafluoroethylene (PTFE), a Teflon-like PFC. PFCs can be found in shaving cream, dental floss, and a variety of cosmetics, including nail polish, facial moisturizers, and eye makeup.

CHAPTER 4: PESTICIDES

Pesticides are created and used to kill weeds or pests. Unfortunately, their harmful health effects do not always end with the pests or weeds they eliminate. In fact, a growing body of research has associated some pesticide exposure with serious health effects. A number of the pesticides currently on the market are known to be carcinogenic, mutagenic or toxic to the nervous system, development or reproduction. Health effects of a variety of pesticides range from irritation of skin and eyes, to nervous system damage, to cancer.

This study tested for the presence of organophosphate pesticide breakdown products in the urine of ten Oregonians. About 70% of insecticides (pesticides that kill insects) used in the United States are organophosphate pesticides. Approximately 80 million pounds of organophosphate pesticides are used annually in the United States, with 75% of their use in agriculture as one way to prevent pest damage to crops.[65] Organophosphate pesticides are chemically similar to chemical warfare agents originally produced during World War II and work by interfering with the nervous system of insects, as well as humans, other mammals, birds, and fish. Organophosphate pesticides inhibit cholinesterase, an enzyme that breaks down acetylcholine. Acetylcholine is a neurotransmitter that allows nerves to function properly. Inhibition of cholinesterase by organophosphate pesticides leads to the accumulation of acetylcholine, interfering with proper nerve function.

People are commonly exposed to low levels of pesticides through fruit and vegetable consumption, contacting pesticide-contaminated surfaces and dust, and breathing air near pesticide applications (both indoors and outdoors). Pesticides are found in our lawns, gardens, parks, workplaces, schools, homes, in the food we eat, the water we drink, and the air we breathe. Although most of us are exposed to pesticides, two groups are of particular concern—farmers and farm workers —because of their more frequent and higher levels of exposure and children because of their physiology, development and habits.

Widespread exposure to organophosphate pesticides has been documented by the CDC and scientists with studies showing that a large number of people in the U.S. have breakdown products of organophosphate pesticides in their urine.[66] These studies show that some groups, especially young children, have levels above those deemed "acceptable" by EPA. Because organophosphate pesticides generally do not persist in the environment for long periods of time and do not build up in the body fat of humans and other animals, the fact that these pesticides were found in a high percentage of test subjects indicates that most people are exposed to these chemicals on a frequent basis.

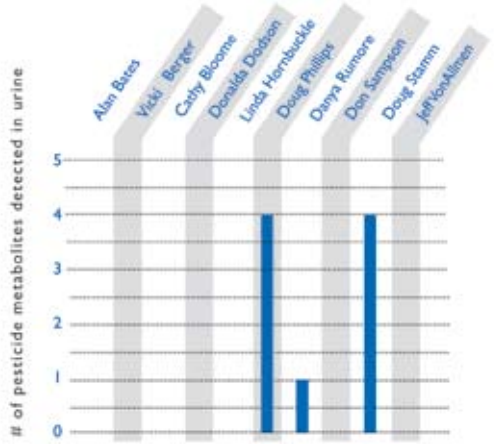
PESTICIDES IN OREGONIANS

We tested for a series of pesticide breakdown products, or metabolites, that indicate exposure to organophosphate pesticides. We found the metabolites dimethylphosphate (DMP) and dimethylthiophosphate (DMTP) in two participants, which is indicative of exposure to several organophosphate pesticides including azinphos methyl and malathion.* These insecticides are commonly used in agriculture. Malathion is also found in some home-use products. Two participants had detectable levels of diethylphosphate (DEP), suggesting they had been exposed to the organophosphates diazinon or chlorpyrifos, or other less commonly used pesticides. Two of our participants had four different pesticide metabolites: DMP, DMTP, DEP, and diethyldithiophosphate (DEDTP).

Doug Phillips had levels of DMP, DEP, and DEDTP that put him in the top 10% nationally; Doug Stamm's levels of DMP and DEP were also in the top 10%.[67] Upon learning of the pesticide levels in his body, Doug Stamm expressed confusion as to how they got there. He doesn't use pesticides on his lawn, and he tries to eat organic produce as much as possible. He was disappointed that his personal effort to keep his body free of pesticides has not been enough. Organophosphates do not persist in the body, so these levels reflect recent exposures.

Figure 6 shows our participants' exposures to organophosphates. The chart shows the number of metabolites of these pesticides detected out of a total of five tested.

FIGURE 6



The number of organophosphate pesticide metabolites detected in participant urine.

HEALTH EFFECTS OF ORGANOPHOSPHATE PESTICIDES

Organophosphate pesticides can cause short-term adverse health effects from acute exposures as well as adverse health effects as a result of chronic, low-level, persistent exposures. Health effects from acute organophosphate pesticide exposure include irritation of the nose, throat, and skin causing burning, stinging and itching as well as rashes and blisters. Nausea, dizziness and diarrhea are also common.[68] People with asthma may have very severe reactions to some pesticides, particularly pyrethrin/pyrethroids, organophosphate and carbamate pesticides. In many cases, symptoms of pesticide poisoning mimic symptoms of colds or the flu. Since pesticide-related illnesses appear similar or identical to other illnesses, pesticide poisonings may be frequently misdiagnosed and under-reported. Immediate symptoms may not be severe enough to prompt an individual to seek medical attention, or a doctor might not even think to ask about pesticide exposure.

Health effects from chronic exposure to organophosphate pesticides include memory and attention deficits, as well as increased depression, anxiety and irritability.[69] Recent studies in U.S. populations with no obvious symptoms of acute pesticide exposures have linked higher levels of chronic exposure to organophosphate insecticides in utero with reduced birth weight, head circumference, and gestational length in infants.[70] In addition, there is emerging evidence that chronic low-level exposure to these chemicals may adversely effect both psycho-

* DMTP, DMP, and DEP are "non-specific" metabolites of organophosphate pesticides, meaning they may result from exposure to more than one pesticide.

motor and mental development in more highly exposed infants.[71] Pediatric asthma,[72] cancer,[73] and birth defects[74] are also a focus of concern, but the data linking such outcomes with exposure are limited. Since the health effects of chronic organophosphate pesticide exposures may not appear for weeks, months, or even years after exposure, it is often difficult to link health impacts to specific exposures.[75]

Scientific studies in farm worker populations indicate that developmental exposure to organophosphate pesticides is a real threat to the health of people. A 2005 study of children born to farm workers in California's Salinas Valley found that infants with the greatest exposure to organophosphate pesticides had more abnormal reflexes.[76] Studies on this same population have also demonstrated that mothers with higher exposures are at increased risk for preterm birth.[77] Researchers in Oregon found that adults with greater exposures to organophosphate pesticides scored lower in tests of attention span and motor function.[78]

POLICY CHANGES NEEDED

Current federal regulations need to make protecting public health a priority. Although the EPA requires manufacturers to test pesticides for harmful effects, current regulations do not prevent the use of pesticides that have been associated with cancer or other harmful health impacts. The current federal pesticide law—the Federal Insecticide, Fungicide, and Rodenticide Act—protects a pesticide's uses unless the chemical poses an "unreasonable risk to man or the environment, taking into account the economic, social, and environmental costs and benefits of the use of any pesticide." So, as long as it is perceived that the economic benefit to using a particular pesticide outweighs the health risks, the law will allow for its use. There are problems with this approach. First, many pesticides have not been fully evaluated as to their human or environmental health impacts. Second, this cost-benefit analysis does not take into account the fact that there are often safer alternatives to achieving the end goal—reducing weeds and pests—that have fewer or no negative health impacts. In deciding whether a specific pesticide should be allowed, the analysis should also take into account whether there is a safer alternative.

Support and implement Integrated Pest Management at all Oregon schools, childcares, and public parks. Safer pest management strategies, such as Integrated Pest Management (IPM), use alternatives to chemical-intensive practices. IPM is a systems approach to pest management based on an understanding of pest ecology. It begins with steps to accurately diagnose the nature and source of pest problems, and then relies on a range of preventive tactics and biological controls to keep pest populations within acceptable limits. Reduced-risk pesticides are used if other tactics have not been effective, as a last resort, and with care to minimize risks.

IPM is not a new approach to pest management and is being used by school districts and park systems throughout the country. Schools and parks can significantly decrease and ultimately eliminate their use of hazardous pesticides while successfully and cost-effectively managing pest problems in school buildings and on school and park grounds. IPM is a program of prevention, monitoring, and control that offers the opportunity to eliminate or drastically reduce hazardous pesticide use. IPM is intended to establish a program that utilizes cultural, mechanical, biological, and other non-toxic practices, in combination with least hazardous chemicals as a last resort.

Require full disclosure of all product ingredients on pesticide labels. Nearly every one of the over 20,000 pesticide products in the United States contains ingredients that are called "inert." "Inerts," sometimes comprising up to 99.9% of a pesticide product, are used to make these products more potent or easier to use. The name does not mean they are biologically, chemically, or toxicologically inert. In fact, many inerts threaten human and environmental health.[79] Yet, right now, inert ingredients are not required to be listed on pesticide labels. This means we don't know the chemicals we are being exposed to and are unable to find out.

Support and fund pesticide stewardship programs. In 1999 Oregon DEQ implemented a Pesticide Stewardship Partnership (PSP) to identify problems and improve water quality associated with pesticide use. The PSP approach encourages and supports voluntary changes that can result in measurable environmental improvements. In the past four years, pilot projects in the Columbia Gorge have shown substantial improvements in water quality associated with measurable changes in pesticide management.[80] Continuing funding of this innovative, collaborative program can provide an effective alternative to traditional regulatory approaches.

Support the continuation of Oregon's Pesticide Use Reporting System (PURS). PURS provides information on all pesticide use in the state. It requires businesses to report annual pesticide use while personal home use is evaluated through surveys. The goal of the program is to collect information that will lead to a better understanding of pesticide use in Oregon and its effect on public and environmental health. The statute authorizing PURS is set to expire December 2009.

REDUCING YOUR EXPOSURE TO PESTICIDES

Although some exposure to pesticides is difficult to avoid, you can significantly reduce pesticides in your diet and your surroundings with a few simple steps.

Buy organic or sustainably produced. Produce which is certified Organic, Food Alliance, or Salmon-Safe may cost more, but buying

sustainably produced, in-season food from your local market is usually the best assurance of reduced pesticides or pesticide-free produce. Also, be aware that smaller growers may not have obtained organic or sustainability certification because of costs or other reasons, so talking to and getting to know your farmer is a wonderful way to learn if they are pesticide-free. Recent research has shown that organic diets significantly lower children's exposure to pesticides.[81] Ask your grocer to start carrying organic or sustainably produced food if it doesn't already.

Wash your produce prior to eating. You can easily make your own produce wash using a very diluted solution of mild dishwashing detergent (1 teaspoon detergent per gallon, or 4 liters, water). For grapes, strawberries, green beans, and leafy vegetables, swirl the foods in a dilute solution of dish detergent and water at room temperature for 5 to 10 seconds, then rinse with slightly warm water. For the other fruits and vegetables, use a soft brush to scrub the food with the solution for about 5 to 10 seconds, then rinse again with slightly warm water. Another option is commercial vegetable and fruit washes, which have been formulated to remove chemical residue from produce; these are available online or at your local health food stores and some supermarkets.

Grow your own fruits and vegetables. The best way to offer your family organic or sustainably grown fruits and vegetables is to grow your own. You can grow many fruits and vegetables in flower pots or other containers right in your yard, back porch, patio, or balcony. Even a small garden can be very productive for family use. You can plant one or two different crops in your yard and encourage a neighbor to grow others—then share the harvests.

Avoid using pesticides in your home and garden. There are many non-chemical methods of pest control that are safe and effective. Pesticides such as weed killers and insecticides should be used as a last resort, if at all. Focus on preventive techniques, which are most effective in the long run. Also consider these specific recommendations:

- Many commercial ant and roach killers contain toxic pesticides. Use diatomaceous earth and other less toxic controls to rid your home of these pests.
- Use pet combs, frequent vacuuming and other non-toxic controls of fleas. Many flea collars, sprays, and dips contain dangerous pesticides.
- Limit lawn areas and grow native plants adapted to the Northwest. Information on growing native plants can be found at *http://www.metro-region.org/article.cfm?ArticleID=25309*.

Advocate for pesticide reduction in your school, childcare center, and parks. Many school districts, cities, and counties have policies to replace toxic pesticides with safer practices such as IPM. Help your community become one of them.

Choose clothing made from organic or materials. Conventionally produced cotton is responsible for 25% of the world's insecticide use.[82] Look for clothing made from organic cotton or hemp, which is easily grown with limited pesticides.

FOODS WITH HIGHEST AND LOWEST PESTICIDE RESIDUE

So what fruits and veggies are best and worst when it comes to pesticide residues? If you have a choice, try to purchase organic varieties of produce that is conventionally grown with the highest amount of pesticides.

Highest pesticide load: peaches, apples, sweet bell pepper, celery, nectarines, strawberries, cherries, lettuce, imported grapes, pears, spinach, potatoes

Lowest pesticide load: onions, avocado, frozen sweet corn, pineapples, mango, sweet frozen peas, asparagus, kiwi, bananas, cabbage, broccoli, eggplant

Adapted from *www.foodnews.org.*

CHAPTER 5: BISPHENOL A

Originally produced for use as a synthetic hormone in 1936, today bisphenol A (BPA) is manufactured in excess of six billion pounds per year. BPA is most commonly used as the building block of polycarbonate plastic for products such as some baby bottles, reusable water bottles, plastic utensils, compact discs, certain microwaveable plastic containers, and epoxy resins (coatings that line food containers). It is also an additive in a variety of consumer products including plastic toys, dyes, enamels, varnishes, flooring, adhesives, fungicides, antioxidants, dental sealants, and artificial teeth.

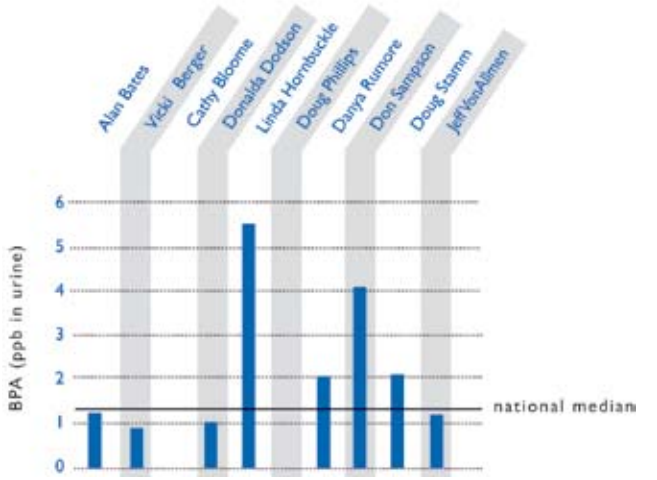
Human exposure to bisphenol A results from its use in the clear lining of metal food and drink cans, baby bottles, infant chewing toys, reusable water bottles, and from some dental sealants and composite dental fillings. Over time, bisphenol A migrates from cans into food[83] and leaches from polycarbonate plastic bottles, especially when the plastic is heated or as it ages.[84] As evidence of the chemical's "leaky" nature, BPA has been found in 40% of stream water samples surveyed by the U.S. Geological Survey.[85] Humans are exposed through ingesting contaminated food, liquids, and breast milk, and during some dental procedures.

BISPHENOL A IN OREGONIANS

We tested the urine of the Oregon participants for exposure to bisphenol A. Since BPA is not persistent in the body, the results only reflect recent exposure.

Figure 7 shows that bisphenol A was found in eight of the ten Oregonians tested, at levels ranging from 0.86 to 5.65 ppb, with a median of 1.35 ppb. This median BPA level is similar to the national average median of 1.36 ppb.[86] The data in Figure 7 are creatinine-corrected.

FIGURE 7



Bisphenol A levels, measured in urine and creatinine-corrected. The horizontal line depicts the national median BPA value of 1.36 ppb.[87]

Two participants, Don Sampson and Linda Hornbuckle, had bisphenol A levels that were higher than 90% of people that have been tested in national biomonitoring studies.[88] Linda's BPA levels, at 5.65 ppb, were four times higher than the Oregon median. We cannot explain Don or Linda's elevated level of bisphenol A based on exposure surveys. The fact that BPA is used in a multitude of products makes it difficult to determine the source of exposure.

HEALTH EFFECTS OF BISPHENOL A

Bisphenol A is a potent endocrine-disrupting chemical in lab animals at very low doses.[89] A number of animal studies have concluded that low-dose BPA exposure is associated with a variety of adverse health effects including reduced sperm count, impaired immune system functioning, increases in prostate tumor proliferation, altered prostate and uterus development, insulin resistance, alteration of brain chemistry, early puberty, and behavioral changes.[90] Very low doses of BPA have been shown to cause chromosomal aberrations, referred to as aneuploidy in mice during cell division.[91] Aneuploidy in humans is responsible for 10-20% of all birth defects.

Multiple animal studies implicate bisphenol A in many of our biggest contemporary public health problems, including diabetes and obesity, hyperactivity, and infertility. A number of studies conducted on mice show an increase in postnatal growth as a result of maternal doses of BPA between 2.4 and 500 ppb per day.[92] Accelerated postnatal growth is associated with obesity, insulin-resistant diabetes, hypertension, and heart disease. Additionally, low-level, chronic exposure to BPA causes insulin resistance in adult mice.[93] In humans, insulin resistance can lead to type II diabetes, hypertension and cardiovascular disease. A small 2005 prospective study found that higher BPA exposure is associated with recurrent miscarriages in human females.[94]

Controversy over the toxicity of bisphenol A exists between public health advocates and the plastics industry, which says there is little concern with human exposure levels. Between 1998 and 2005, 115 studies of BPA were published. None of the 11 studies funded by industry reported adverse effects at low level exposures, whereas 94 of 104 government-funded studies found statistically significant effects on animals. Adverse effects were found at levels to which many people in the U.S. are currently exposed, levels much lower than the level the EPA considers safe.[95]

POLICY CHANGES NEEDED

Current regulations need to reflect up to date scientific evidence to protect the public's health. The last EPA risk assessment for bisphenol A was based on research conducted in the 1980s and did not consider more recent evidence of low-level effects. The most recent risk assessment of BPA was based on a comprehensive review of the scientific literature conducted in 1998 by the European Union, with some selected articles added through 2001, at which time few of the current 151 low-dose BPA studies had been published. The most recent review of scientific studies shows effects from exposure to BPA at levels significantly below the current "safe exposure" level established by the U.S. based on experiments conducted prior to 1988. Growing scientific evidence on the health effects of very low doses of BPA merits a much more protective reference dose (similar to a safety standard) than currently supported by the EPA. It will be necessary to further reduce public exposure to BPA.

At the state level, bills have been introduced in New York and California to prohibit manufacture, sale or distribution of toys or child care products that contain BPA (the same bills also cover phthalates, mentioned in Chapter 1 above).

The City and County of San Francisco banned the manufacture, sale, and distribution of child care articles and toys containing bisphenol A and some phthalates for children under three years old as of December 1, 2006.[96] Under the ordinance, San Francisco manufacturers of baby bottles, pacifiers, and toys for young children must replace BPA and phthalates with the least-toxic alternatives. A similar measure was introduced in the California Legislature in 2006, but failed to pass. Similar legislation is pending in several states including Maine. All of these policy initiatives have been aggressively challenged by the chemical industry.

REDUCING YOUR EXPOSURE TO BPA

Bisphenol A has been used as an ingredient in consumer products for a long time and is difficult to avoid. In some cases, alternatives are available.[97] Consider these tips, especially if you are or may become pregnant or are choosing a product for a child:

Avoid reusable polycarbonate plastic water and baby bottles. As a general rule, avoid baby bottles labeled #7, which tend to be hard and clear, and polycarbonate reusable water bottles, which include many of the popular colored bottles like Nalgene. Leaching of bisphenol A can occur into formula, expressed breast milk, water and other liquids placed in these products. Choose polyethylene or metal bottles instead. Use glass baby bottles instead of plastic. If you prefer plastic baby bottles, choose milky or opaque colored baby bottles. Discard old or damaged bottles.

Avoid polycarbonate plastic food containers and table ware. These may be labeled 'PC' underneath a plastic code #7 in the recycling triangle on the bottom of the container. (The #7 means 'other', so you need to see the 'PC' to confirm that the plastic is polycarbonate).

You can find additional guidance on choosing plastic products, including baby bottles, food containers, and plastic utensils, at:

www.oeconline.org/kidshealth/toxics/products and

www.checnet.org/healtheHouse/pdf/plasticchart.pdf

Minimize the use of canned foods and canned drinks. Until industry reformulates the lacquer lining of metal cans (as is being done in Japan), choose fresh or frozen foods or glass containers or bottles. A recent study by Environmental Working Group found bisphenol A in more than half of 97 cans of brand name fruit, vegetables, soda, and other common canned goods.[98]

Ask your dentist for BPA-free sealants and composite fillings. Some dental resins are free from or low in BPA. Ask your dentist if they know about BPA and request the Material Safety Data Sheet for the sealants or composite fillings to look for BADGE (a chemical derivative of BPA) in the list of ingredients. Make sure your family brushes and flosses regularly to prevent the need for dental work.

CHAPTER 6
PCBs

PCBs, an abbreviation for polychlorinated biphenyls, represent a family of 209 colorless and odorless chemicals that were widely used in electrical equipment such as transformers, and capacitors. It is estimated that more than 3.4 billion pounds of PCBs were produced between 1929, when they were first introduced, and 1977, when production was prohibited in the United States, because of evidence they build up in the environment and cause harmful health effects. Although PCBs have not been used for decades in the U.S. (they were banned in the European Union in 1985 and in Russia in 1993), they still enter our bodies and the bodies of our children. The characteristics that made PCBs attractive for industrial application—stable molecular structures and flame resistance—make them difficult to get rid of. PCBs persist and circulate in the environment for decades after their release. PCBs accumulate in adipose tissue and organs in animals and people and biomagnify as they move up the food chain.

Of the billions of pounds of PCBs produced in the U.S. before 1977, about 30% has entered the environment through direct discharges into the air, land, and water. The remaining contamination results primarily from improper disposal of products containing PCBs, which continues to this day. There are numerous electrical transformers and other closed system devices still in use which contain PCBs. Products made before 1977 that may contain PCBs include fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils. Most PCBs enter the environment and accumulate in rivers, lakes, and ultimately the ocean.

PCBs biomagnify by entering the food chain in small organisms and increasing in concentration as larger fish and mammals eat the smaller organisms. Large, fatty fish like lake trout, carp, and bass have been found to contain very high concentrations of PCBs. Some fish contain such high levels that they are considered unsafe for human consumption. In Oregon, there are five fish and/or shellfish advisories due to PCBs, including the Bonneville Dam, Lower Columbia,

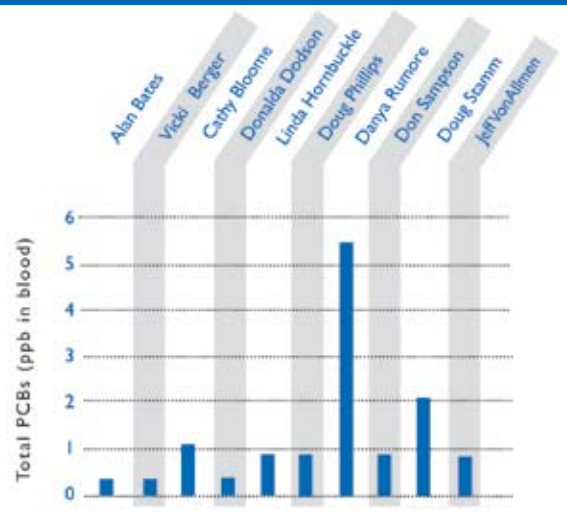
Columbia Slough, Portland Harbor, and Willamette.[99] The Oregon Department of Human Services advises that fish and shellfish in these waterways be either avoided or prepared in a way that minimize PCB exposure, such as grilling or other cooking methods that remove fat before consumption.

PCBs can be absorbed through the skin, lungs or your digestive tract. For most of us, food is the most significant source of exposure. Foods most likely to contain PCBs include milk, eggs, chicken, turkey, beef, and fish. PCBs are stored and accumulate in the body's fatty tissue. While PCB levels in most of our food have declined since 1977, three decades later we continue to ingest PCBs when we eat fish, meat, and dairy products.[100] Exposure to PCBs can also occur through occupational accidents and handling contaminated soil.

PCBs IN OREGONIANS

We tested for the level of total PCBs in the blood serum of our participants. PCBs were detected in the blood of all ten participants (Figure 8). The total PCB concentration ranged from 0.4 – 5.5 µg/L (or ppb), with a median concentration of 0.8 ppb which is similar to the total median PCB concentration detected in the Washington Pollution in People report (0.95 ppb)[101] and somewhat below the national median range of 0.9 – 1.5 ppb.[102]

FIGURE 8



Total PCBs were measured in participant blood serum.

The highest PCB concentration, at 5.5 ppb, was detected in Danya Rumore. This level is more than three times the national median of PCB exposure. Danya did not report consuming high levels of PCB-containing fish, suggesting that her PCB exposure is from either other dietary sources such as fatty meat and dairy products or from contact with electrical equipment or with certain building insulation and caulking materials.

HEALTH EFFECTS OF PCBs

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage.[103]

Research studies in both animals and exposed workers have demonstrated that PCB exposure can increase the risk of a variety of cancers such as malignant melanoma, non-Hodgkin's lymphoma, and brain, liver, biliary tract, intestinal, and lung cancers.[104] The National Toxicology Program considers several PCB mixtures to be "reasonably anticipated" human carcinogens,[105] and the EPA considers PCBs to be probable human carcinogens.[106] Additional negative health impacts associated with PCB exposure include respiratory effects, gastrointestinal damage (nausea, vomiting, abdominal pain), eye irritation, increased susceptibility to infection, and hypothyroidism.[107]

Women who consume PCBs in their diet readily pass them to their children in breast milk; infants may get 6 to 12% of their lifetime exposure to PCBs from breastfeeding alone.[108] PCB exposure in the womb or during lactation is associated with decreased IQ and impaired psychomotor development and decreased immune function.[109] However, the benefits from breast feeding outweigh any risks from exposure to PCBs in a mother's milk (see Sidebar: "Breast Feeding Is Best").

Research involving animals and humans suggest that exposure to PCBs in utero is of particular concern.[110] Studies of children in the U.S., Germany, and the Netherlands have shown that those children with greater prenatal exposures (measured by levels in umbilical cord blood or the mother's blood) performed worse on tests of brain development than children with lower exposures, linking prenatal PCB exposure to brain development deficits.[111] Research on children in the Faroe Islands shows an association between increased prenatal and postnatal PCB exposure and decreased antibody production in vaccinated children.[112]

In animal studies, PCBs cause a wide variety of effects including liver and thyroid tumors; kidney, gastrointestinal, immune, urinary tract, and reproductive toxicity; altered lipid and carbohydrate metabolism; reduced fertility; and birth defects.[113] Specific birth defects include reproductive tract and skeletal abnormalities. PCBs have been shown to be endocrine disruptors in animals because they alter thyroid and adrenal hormone levels and function. PCBs have been associated with significant neurotoxicity, including decreased exploratory behavior, learning, spatial and non-spatial discrimination, auditory deficits and altered levels of brain neurotransmitters (dopamine and serotonin).[114]

POLICY CHANGES NEEDED

The continuing story of PCBs is both hopeful and disheartening. Based on scientific evidence linking PCB exposure to negative health outcomes, this chemical was banned in the U.S. 30 years ago—demonstrating that action can be taken given the right set of circumstances. Unfortunately, although the levels of PCBs have declined in most human populations, we still face levels that could be causing harm—long after regulatory action was taken.

The most recent EPA Toxic Release Inventory (TRI) for Oregon shows that PCBs are only released from hazardous waste landfills and other contained sites. There are no reported point source releases of PCBs to the air or water. Based on this, PCB contamination cannot be reduced through the use of Oregon DEQ air or water discharge permits. Oregon DEQ and EPA are addressing PCB releases from known contamination sites such as the Portland Harbor Superfund site through their cleanup program.

In addition to these cleanup efforts, there are further actions that can be taken to reduce our exposure to this toxic threat.

Establish and implement erosion control programs to minimize the release of PCBs into waterways. Since PCBs are ubiquitous in the soil, erosion control practices—in both urban and rural areas—can help to minimize releases of PCBs into our waterways.

Establish programs to collect and safely dispose of remaining PCB-containing products. Oregon needs to establish a program to identify and properly dispose of old PCB fixtures before they end up in landfills and incinerators.

REDUCING YOUR EXPOSURE TO PCBs

The greatest source of exposure to PCBs for most Oregonians is food. While you cannot completely eliminate PCBs from your diet, you can minimize your exposure, specifically:

Choose fish wisely. In Oregon, there are five fish advisories due to PCBs (Bonneville Dam, Lower Columbia, Columbia Slough, Portland Harbor, and Willamette).[115] Check with state advisories prior to eating sport-caught fish or shellfish, which are known sources of PCB exposure. Commercial fish that are high in PCBs include Atlantic or farmed salmon, bluefish, wild striped bass, white and Atlantic croker, blackback or winter flounder, summer flounder, and blue crab. Resident species in Oregon high in PCBs include northern pikeminnow, largescale sucker, smallmouth bass, and mountain whitefish.

Prepare fish to minimize PCB exposure. When preparing fish, remove the skin, trim the fat, and broil, bake, or grill the fish so that the fat drips away.

Make your meat lean and limit your consumption of dairy fat. When it comes to meat, choose lean meat cuts and cut off visible fat before cooking meat. Avoid frying meat in lard, bacon grease, or butter. For dairy products, opt for low-fat options.

BREAST FEEDING IS BEST

Despite concerns over the presence of environmental contaminants in breast milk, breastfeeding is still by far the best option for the baby's health and mother-baby bonding, when possible. Infants who do not breastfeed or do so for only a short time have more acute illness such as ear, lung, and urinary infections. Exposure to foods other than human milk in the first few months of life can increase the risk of life-long autoimmune illnesses. Without breastfeeding, infants do not receive optimal nutrition, important hormones, protective immune factors, and promoters of brain development. Formula feeding does not eliminate children's exposure to toxic chemicals and may increase exposure due to contaminants and leaching of chemicals from plastic baby bottles. According to the World Health Organization, "the accumulated data overwhelmingly support the positive health value of breastfeeding infants." For more information, see Why Breast-Feeding is Still Best for Baby, by Physicians for Social Responsibility at http://psr.igc.org/EFeasyen2pg.10.18.pdf.

CONCLUSIONS AND RECOMMENDATIONS

An alarming number of toxic chemicals are measurable in Oregonians. This study detected 19 of the 29 chemicals tested for in ten volunteers, including mercury, PCBs, six PFCs, four organophosphate pesticides, six phthalates, and bisphenol A. With the exception of pesticides and bisphenol A, both of which last in the body only a short time, every chemical class tested for was detected in all of the participants. What is particularly unsettling is that we have no clear answers as to why these chemicals were found in all of our participants or why levels of some chemicals are higher than others. Most disturbing, we know these chemicals can pose a threat to human health, but we need more information about their toxic effects on our bodies today and in the future.

Despite these uncertainties based on the findings discussed in this report and similar studies, we can make a few conclusions:

1. Toxic chemicals from consumer products, food, and industrial pollution contaminate our bodies. All six of the chemical groups tested for were detected in the bodies of the Oregon participants. Every person tested had at least nine and as many as 16 toxic chemicals in his or her body. While some of these toxic chemicals come from contaminated soil, air, and water, many of the pollutants also come from food, everyday household dust, and from direct contact with products such as personal care items, plastic products, consumer electronics, and stain-resistant furniture. This represents a partial snapshot of what chemicals might be found in all Oregonians.

2. The toxic chemicals in our bodies are cause for concern because they can lead to health problems. While more needs to be learned about the health effects of chemicals in humans, review of the latest scientific research demonstrates that there is increasing evidence that these chemicals harm the health of adults, children, and in particular, the developing fetus.

- Every participant was contaminated with phthalates, an endocrine disrupting chemical found in a variety of everyday consumer products including cosmetics, vinyl toys and vinyl flooring. Recent scientific studies in humans have linked low-level phthalate exposure to reduced sperm count, feminization of male genitals, and premature delivery.
- Every participant had mercury in his or her blood. Mercury is a potent neurotoxin that interferes with brain development.
- PFOA, the Teflon® chemical, is a likely human carcinogen and was detected in every one of our participants.
- The hormone-disrupting chemical bisphenol A was found in 80% of the participants. Studies on laboratory animals have shown that at very low doses bisphenol A can lead to a number of adverse health effects including reduced sperm count, impaired immune system functioning, and increases in prostate tumor proliferation.
- Every person tested had PCBs in his or her blood, despite a decades-old ban on the chemicals. PCBs have been shown to cause learning deficits from normal, everyday exposure.

3. State and federal regulations have failed to prevent the use of harmful chemicals in consumer products, and in manufacturing and production processes. The primary current federal law regulating chemicals is the notoriously weak Toxic Substances Control Act (TSCA). We do not have sufficient safety data for the vast majority of chemicals in use today. Under TSCA, the EPA cannot require data assessing the health and safety of a chemical prior to its use in products with which we have daily contact. If the EPA does identify risks associated with the use of a particular chemical, TSCA mandates that economic costs to industry be weighed and efforts utilized to minimize any unreasonable costs to industry. Additionally, TSCA requires certainty of harm before actions can be taken to prevent harm to the public's health. Even when the EPA has information on a chemical's potential health effects, the agency cannot share it publicly or with state agencies, because TSCA has deemed that this information is confidential business information. TSCA has not been updated for nearly 30 years—longer than any other major environmental or public health statute. At the state level, Oregon also currently lacks the regulatory structure needed to prevent toxic chemicals from polluting our consumer products, household goods, and people. As this study clearly demonstrates, this current system of chemical regulation is not working.

RECOMMENDATIONS

Oregon is known for being an environmental leader. The presence of toxic chemicals in our environment threatens to tarnish this image and endangers the health of all Oregonians, especially our children. Oregon is a key state in achieving comprehensive chemicals policy reform, which could eventually lead to stronger national standards. Oregon has been on the forefront of innovative toxic reduction policies in the past, including legislative adoption of:

- the first standards for cleaner wood stoves in the 1980s;
- the first law requiring state agencies to minimize pesticide use in the 1990s;
- the first law phasing out installation of mercury thermostats as part of the Mercury Reduction Act of 2001; and

- one of the first states to enact laws banning some toxic flame retardants in 2005.

Legislation passed in 2007 provides additional tools to reduce toxic exposures in Oregon. These policies include:

- Establishment of a Willamette basin water quality toxics monitoring program that will: (1) build a web-based tool for public access to information about water toxics data; (2) monitor the river to identify priority toxics to be reduced; and (3) develop action plans to reduce targeted toxics. The purpose of this program is to not just monitor for the presence of toxics, but to determine which pose the most significant risk to human or wildlife health.

- Senate Bill 737 requiring Oregon DEQ to develop a list of priority bioaccumulative toxics that have a documented effect on human health, wildlife, and aquatic life and to report to the Oregon Legislature by June 2010 on the sources of these toxics and the current reduction and control methods in place. Additionally, this legislation requires Oregon's 52 largest municipal wastewater treatment plants to develop plans to reduce the identified priority toxics.

- 2007-09 funding for Oregon DEQ air toxics monitors in Salem/Albany and Medford, joining the existing air toxics monitors in Portland. This budgetary package also provides funding for the development of an air toxics reduction plan for Portland.

Unfortunately, these current programs and policies are focused on monitoring or cleaning-up toxic chemicals after they are already polluting our air, water, and land. And they don't even begin to address the toxic chemicals in consumer products.

To effectively prevent pollution in Oregonians before it causes harm (instead of spending time and money to remove toxic chemicals once they are in our environment), our leaders need to enact comprehensive safer chemicals policy at the state level to ensure that only the safest chemicals are used in consumer products and manufacturing processes. These policies need to close the gaps in our broken chemical system to ensure chemical safety, provide useful data, and promote innovative technology. Together, these reforms can provide an alternative to our toxic-dependent economy through the promotion and development of safer alternatives, while at the same time creating a system to quickly remove the most serious threats from our environment. Specifically, we call for the following policies to be implemented:

REQUIRE THAT COMPLETE INFORMATION BE PROVIDED ON CHEMICAL INGREDIENTS AND THEIR TOXICITY

The burden to prove that chemicals are safe before they are allowed on the market will fall to producers and manufacturers. Chemical safety data will be made available to the public and regulators. This data must take into account impacts on vulnerable populations. Due to the size of this information management task, Oregon should support the development of an interstate clearinghouse for chemical ingredients.

CATEGORIZE CHEMICALS INTO LEVELS OF CONCERN

The public, businesses, workers and consumers will have the tools to distinguish among chemicals. A chemical categorization system will identify safer chemicals, chemicals to avoid, and chemicals that lack adequate safety data.

MANAGE CHEMICALS BASED ON HAZARDS AND SUBSTITUTE THOSE OF HIGHEST CONCERN WITH SAFER ALTERNATIVES

Oregon will use criteria to identify chemicals of concern and have the authority to restrict certain chemical uses. State agencies will have the authority to identify, collect data on, and mandate the replacement of chemicals of highest concern.

ESTABLISH POLICIES, PRACTICES, AND INCENTIVES THAT MOVE OREGON TOWARD SAFER ALTERNATIVES

- Invest in and build in-state institutional research capacity to develop safer alternatives.

- Promote least-toxic and biobased procurement policies for state, local, and municipal governments and other large institutions such as hospitals, universities, and schools

- Ensure that all communities can participate in the new green economy by creating incentives for investment

- Create tax incentives for and provide technical assistance to firms working toward safer alternatives

- Increase and direct research and economic development dollars to promote safer alternatives, particularly in key sectors ripe for alternatives

ENSURE THAT WORKERS AND IMPACTED COMMUNITIES ARE PROTECTED

Oregon will address both concerns around loss of jobs from a transition to safer chemicals and whether alternatives are indeed safer. This means incorporating policies that support a just transition to cleaner, safer jobs. Oregon will ensure that chemicals of concern to environmental justice communities are prioritized.

WHAT ACTION CAN INDIVIDUALS TAKE?

What Action Can Individuals Take? In addition to supporting chemical policy reform, Oregonians can take immediate action to protect their family's health. Oregonians can take personal action to reduce exposure to toxic chemicals by using safer products in their homes and businesses. Low-cost solutions can help reduce toxic exposure until our broken chemical safety system is fixed by policy makers; for example, eating fish low in mercury, choosing organic produce, and avoiding personal care products containing phthalates and other toxic chemicals. For specific resources to help you choose safer products and smarter practices that reduce chemical exposure, visit www.oeconline.org/kidshealth.

PROVIDE ADEQUATE FUNDING AND ENFORCEMENT

Oregon needs to create the funding and enforcement mechanisms necessary to successfully implement chemical policy reform. Despite the new policies funded in 2007, Oregon DEQ and other state agencies are severely under-funded. Resources for technical assistance and program implementation are essential to ensuring a level playing field for businesses.

These reforms will not happen over night, but it is imperative that we begin the process now to ensure a healthier environment for future generations. Making these changes will require leadership from the Governor, the Oregon Legislature, the Departments of Environmental Quality, Human Services, and Agriculture, and Oregon industry, business leaders, and local governments. It is clear from this study that it is time to take bold, innovative steps to establish a common-sense chemical regulatory system so that we can move from today's pollution in people to a system that is designed to protect the health of all Oregonians. We need to work towards a state where the health of all Oregonians is protected from, not polluted with, environmental toxins.

MATERIALS AND METHODS

All project protocols were approved by the Portland State University Office of Research Compliance and Institutional Review Board. Dr. Stephanie Farquhar, the project's Principal Investigator, provided oversight of the study methodology, data collection, laboratory testing, and data analyses.

The ten participants in this study were selected for diversity in age, geography, occupation, ethnicity, and gender. Trained research assistants met with potential subjects to review project goals and methodologies, answer questions, and complete formal consent documents. Each participant was asked to complete an exposure assessment questionnaire and provide information about their residences, occupations, diet, and potential toxic exposures.

Samples were collected in March, April, and May of 2007 using containers and procedures supplied by the analytical laboratories. A nurse collected approximately 50 milliliters of blood from each participant following all necessary safety and sample collection protocols. After clotting, serum was obtained by centrifuging tubes and pouring off or pipetting serum into storage vials. Approximately 10 milliliters of whole blood was maintained for each participant for mercury testing. Samples were processed as necessary, frozen, placed upright in appropriate containers with ice packs, and mailed via overnight courier to the analytical laboratories.

Participants provided first morning void urine samples for phthalate, bisphenol A, organophosphate pesticide, and creatinine clearance testing. Urine samples were collected in the appropriate containers and transferred to storage containers. Urine samples were refrigerated and mailed overnight to the analyzing laboratories. The analytical laboratories provided all the appropriate collection materials and shipping instructions.

All samples were coded to preserve anonymity of the participants. All samples collected were used solely for this project.

CHEMICAL ANALYSIS

Phthalate, Bisphenol A, and PFC Analysis

AXYS Analytical Services, LTD, in Victoria, British Columbia analyzed urine samples for phthalates and bisphenol A and blood serum samples for perfluorinated chemicals (PFCs). Below are the laboratory's methods in brief.

Phthalates and bisphenol A. Urine samples were analyzed for phthalate mono-esters and total BPA amounts, including both the glucuronidated and free forms of BPA by AXYS Method MLA-059, Analysis of Bisphenol A and Phthalate Metabolites in Urine by LC/MS/MS. This method allows for the combined work up of urine samples for both bisphenol A and phthalate ester metabolites. Accurately measured (approximately 1 milliliter) samples were spiked with isotopically labeled surrogate standards and incubated with an enzyme to release the mono-esters from their glucoronated form. The incubated urine was diluted with high purity water, pH adjusted, and loaded onto SPE cartridges for extraction and clean up. The SPE cartridges were eluted, and the extracts were analyzed on a high performance liquid chromatograph coupled with a triple quadruple mass spectrometer, running manufacturers MassLynx v.4.0 software.

PFCs. Serum was analyzed for PFCs by AXYS Method MLA-042, Analysis of Perfluorinated Organic Compounds (PFC) in Blood Serum by LC/MS/MS. Samples of 0.5 milliliters were spiked with 13C-labeled PFCs and extracted with formic acid. Extracts were loaded onto pre-conditioned Waters Oasis WAX SPE cartridges, which were washed and then eluted with basic methanol. The cleaned-up extracts were spiked with 13C-labeled PFC recovery standards, diluted to final volume with methanol, and analyzed by LC/MS/MS. Analysis was performed on a Micromass Quattro Ultima MS/MS coupled to a Waters 2795 HPLC equipped with a reverse-phase C18 column (7.5cm, 21 mm i.d., 3.5µm particle size). The LC/MS/MS was operated in the MRM mode at unit resolution, using Negative Ion Electrospray ionization. PFC concentrations were determined by isotope dilution or internal standard quantification against the labeled surrogates added at the beginning of the analysis.

Organophosphate Pesticide and PCB Analysis

Pacific Toxicology Labs in Los Angeles, California analyzed urine samples for organophosphate pesticides and serum for PCBs. Below are the laboratory's methods, in brief.

Organophosphate pesticide metabolites. Urine samples were derivatized with a benzyltoytriazine reagent to produce benzyl derivatives of alkylphosphate metabolites. A saturated salt solution was added to the tubes and the benzyl derivatives were extracted with cyclohexane and analyzed by gas chromatography with flame photometric detection.

PCBs. Serum samples were analyzed using the Webb-McCall method in which PCBs were extracted from de-proteinized serum with 1:1 hexane/ethyl ether. PCBs were separated from by chromatography on silica gel using hexane as eluent. PCB concentrations in the eluent were determined by electron capture gas chromatographic analysis using Webb-McCall mean with percent factors and the internal standard method.

Mercury Analysis

Mercury analysis in whole blood was conducted by Brooks Rand in Seattle, Washington. Samples were analyzed using the EPA 1630 Mod. (BR-0011), *Monomethyl Mercury in Blood/Serum - Ultra-low Method*. Samples were digested in a KOH/methanol solution. The digestates were then distilled in Teflon distillation vials. Samples were then analyzed by ethylation, Tenax trap pre-concentration, gas chromatography separation, pyrolytic combustion, and atomic fluorescence spectroscopy.

Data Analysis

In order to be consistent with methods used by the CDC, for phthalates, bisphenol A, PFCs, and PCBs, medians were calculated setting non-detectable values at the detection limit divided by the square root of two. Medians were not calculated for organophosphate pesticides because of the relatively high number of participants with undetectable levels. To calculate the sum total for phthalates and PFCs, any value reported as non-detected was assigned a value of 1/2 the detection limit.

Table 1 — The Chemicals Tested in Ten Oregonians

Chemical Group Medium Tested *Units of Measurement*	Chemical Tested		Chemical Description
BPA Tested in Urine - *Results reported as nanograms per milliliter (ng/mL) or parts per billion (ppb).*	**BPA**	Bisphenol A	Monomer for polycarbonate plastic.
Phthalates Tested in Urine - *Results reported as nanograms per milliliter (ng/mL) or parts per billion (ppb).*	**MMeP**	Mono-methyl phthalate	Metabolite of DMP (dimethyl phthalate)--used in hair-care products, solid rocket propellant, insect repellants, and plastics.
	MEtP	Mono-ethyl phthalate	Metabolite of DEP (diethyl phthalate)--found in personal care products such as perfume, cologne, aftershaves, deodorants, shampoo, and hand lotion.
	MBuP	Mono-butyl phthalate	Metabolite of DBP (dibutyl phthalate)-found in personal care products such as nail polish and in pharmaceuticals.
	MBzP	Mono-benzyl phthalate	Metabolite of BzBP (benzylbutyl phthalate)--found in vinyl flooring, car-care products, personal-care products, adhesives, and sealants.
	MEHP	Mono-2-ethylhexyl phthalate	Metabolites of DEHP (di-(2-ethylhexyl) phthalate) -found in PVC products including medial products such as tubing; auto interiors; consumer products such as clothing, diaper covers, shower curtains, and furniture.
	MEOHP	Mono-(2-ethyl-5-oxohexyl) phthalate	
	MEHHP	Mono-(2-ethyl-5-hydroxyhexyl) phthalate	
Mercury Tested in Blood - *Results reported as micrograms per milliliter (µg/L) or parts per billion (ppb).*	**Methylmercury**		A highly toxic form of mercury produced by bacteria in wetland environments from mercury pollution of the air and water, which builds up to high levels in fish and wildlife.
PFCs or perfluorinated chemicals Tested in Blood - *Results reported as nanograms per milliliter (ng/mL) or parts per billion (ppb).*	**PFBA**	Perfluorobutanoic acid	PFOA is the most prominent among this group of perfluorinated carboxylic acids. It has eight carbon atoms. The related compounds in this group range from having four to twelve carbon atoms. While PFOA is being phased out of some products, all of these compounds are possible breakdown products or manufacturing intermediates of other commercial PFCs.
	PFPeA	Perfluoro-n-pentanoic acid	
	PFHxA	Perfluorohexanoic acid	
	PFHpA	Perfluoroheptanoic acid	
	PFOA	Perfluorooctanoic acid	
	PFNA	Perfluorononanoic acid	
	PFDA	Perfluorodecanoic acid	
	PFUnA	Perfluoroundecanoic acid	
	PFDoA	Perfluorododecanoic acid	
	PFBS	Perfluorobutanesulfonate	Among these perfluorinated sulfonates, PFOS was phased out of Scotchgard in 2000 and replaced with PFBS. PFHxS is still used.
	PFHxS	Perfluorohexanesulfonate	
	PFOS	Perfluorooctanesulfonate	
	PFOSA	Perfluorooctanesulfonamide	A breakdown products of PFCs, which breaks down itself into PFOS.
Organophosphate Pesticides Tested in Urine - *Results reported as micrograms per liter (µg/L) or parts per billion (ppb).*	**OP-DMP**	Dimethylphosphate	Metabolites of organophosphate pesticides.
	OP-DMTP	Dimethylthiophosphate	
	OP-DMDTP	Dimethyldithiophosphate	
	OP-DEP	Diethylphosphate	
	OP-DEDTP	Diethylthiophosphate	
	OP-DEDTP	Diethyldithiophosphate	
PCBs Tested in Blood - *Results reported as micrograms per liter (µg/L) or parts per billion (ppb).*	**PCBs**	polychlorinated biphenyls	A family of 209 colorless and odorless chemicals that were widely used in electrical equipment such as transformers, capacitors, and other electrical equipment prior to being banned in 1976.

Table 2 — Complete Results of Chemical Screening of Ten Oregonians

Chemical Class	Chemicals Tested	Alan Bates	Vicki Berger	Cathy Bloome	Donalda Dodson	Linda Hornbuckle	Doug Phillips	Danya Rumore	Don Sampson	Doug Stamm	Jeff VonAllmen
PHTHALATES in URINE *In each box: The 1st result is in ng/mL or parts per billion (ppb);* *The 2nd result is in µg/gCr-L (creatinine-corrected) or ppb.*	MMep	**<5.22** **<3.02**	**<4.38** **<2.83**	**<1.82** **<2.84**	**<3.75** **<2.95**	**<3.9** **<3.12**	**<3.2** **<3.52**	<3.39 <4.99	**<3.68** **<3.61**	**<4.68** **<4.42**	**<2.54** **<1.51**
	MEtP	**373** **215.61**	10.7 6.90	<2.5 <3.91	92.8 73.07	102 81.60	46.1 50.66	29.4 43.24	38.2 37.45	48.3 45.57	64.8 38.57
	MBuP	**67.6** 39.08	23 14.84	<1.94 <3.03	45.2 35.59	51 40.80	53.6 **58.90**	39.7 53.38	18.3 17.94	30.1 28.40	28 16.67
	MBzP	**32.6** 18.84	6.13 3.96	5.12 8.00	14.2 11.18	14.7 11.76	12.1 13.30	19.4 28.53	6.37 6.25	15.2 14.34	5.81 3.46
	MEHP	8.58 4.96	1.93 1.25	<1.00 <1.56	16.3 12.83	8.34 6.67	5.92 6.51	2.5 3.68	<1.00 <0.98	<1.00 <0.94	**50.1** **29.82**
	MEOHP	43.4 25.09	40.2 25.94	6.32 9.88	91 71.65	22.7 18.16	54.9 60.33	21 30.88	7.08 6.94	21.7 20.47	**417** **248.21**
	MEHHP	42.1 24.34	36.8 23.74	5.24 8.19	75.6 59.53	42.7 34.16	42.9 47.14	16.8 24.71	6.74 6.61	21.1 19.91	**417** **248.21**
	Total Phthalates	569.89 329.43	120.95 78.05	20.31 31.74	336.98 265.33	243.39 194.71	217.12 238.60	130.50 186.92	79.03 77.49	139.24 131.37	**983.98** **585.70**

Chemical Class	Chemicals Tested	Alan Bates	Vicki Berger	Cathy Bloome	Donalda Dodson	Linda Hornbuckle	Doug Phillips	Danya Rumore	Don Sampson	Doug Stamm	Jeff VonAllmen
MeHg in BLOOD *results shown in in µg/L or ppb*	**Methylmercury**	**3.5**	**1.62**	**1.42**	**0.37**	**2.13**	**2.18**	**1.04**	**2.4**	**1.6**	**2.06**

Chemical Class	Chemicals Tested	Alan Bates	Vicki Berger	Cathy Bloome	Donalda Dodson	Linda Hornbuckle	Doug Phillips	Danya Rumore	Don Sampson	Doug Stamm	Jeff VonAllmen
PFCs (perfluorinated compounds) in BLOOD serum *results shown in ng/mL or ppb*	PFC-PFBA	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
	PFC-PFPeA	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
	PFC-PFHxA	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
	PFC-PFHpA	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
	PFC-PFOA	4.00	1.34	1.25	4.10	2.22	2.87	3.56	3.97	**7.64**	1.71
	PFC-PFNA	1.36	<.5	0.52	1.29	0.80	1.05	**1.49**	0.99	1.13	<.5
	PFC-PFDA	<.5	<.5	<.5	<.5	<.5	<.5	**0.57**	<.5	<.5	<.5
	PFC-PFUnA	0.66	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
	PFC-PFDoA	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
	PFC-PFBS	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	PFC-PFHxS	<1.0	<1.0	1.21	<1.0	<1.0	<1.0	2.87	**19.10**	3.12	1.16
	PFC-PFOS	29.60	5.77	7.73	**35.40**	8.15	13.40	13.70	24.60	19.00	7.58
	PFC-PFOSA	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5	<.5
	Total PFCs	35.62	10.36	13.21	43.79	14.17	20.32	24.44	**50.66**	33.39	12.95

Table 2 — Complete Results of Chemical Screening of Ten Oregonians(cont.)

Chemical Class	Chemicals Tested	Alan Bates	Vicki Berger	Cathy Bloome	Donalda Dodson	Linda Hornbuckle	Doug Phillips	Danya Rumore	Don Sampson	Doug Stamm	Jeff VonAllmen
Organo phosphate Pesticides in URINE *results shown in in µg/L or ppb*	OP-DMP	<5	<5	<5	<5	<5	**29**	<5	<5	8	<5
	OP-DMTP	<5	<5	<5	<5	<5	7.6	<5	<5	**20**	<5
	OP-DMDTP	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
	OP-DEP	<5	<5	<5	<5	<5	**9**	<5	<5	**9**	<5
	OP-DETP	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
	OP-DEDTP	<10	<10	<10	<10	<10	27	25	<10	**70**	<10
	Total Pesticides	0	0	0	0	0	72.6	25	0	**107**	<5

Chemical Class	Chemicals Tested	Alan Bates	Vicki Berger	Cathy Bloome	Donalda Dodson	Linda Hornbuckle	Doug Phillips	Danya Rumore	Don Sampson	Doug Stamm	Jeff VonAllmen
BPA in URINE In each box: *The 1st result is in ng/mL* *The 2nd result is in µg/gCr-L (creatinine-corrected) or ppb.*	**BPA**	**2.33** **1.35**	**1.34** **0.86**	**<.643** **<1.00**	**1.24** **.98**	**7.06** **5.65**	**<1.09** **<1.20**	**1.32** **1.94**	**4.13** **4.05**	**2.21** **2.08**	**2.25** **1.34**

Chemical Class	Chemicals Tested	Alan Bates	Vicki Berger	Cathy Bloome	Donalda Dodson	Linda Hornbuckle	Doug Phillips	Danya Rumore	Don Sampson	Doug Stamm	Jeff VonAllmen
PCBs in BLOOD *results shown in µg/L or ppb.*	**PCBs**	**0.4**	**0.4**	**1.1**	**0.4**	**0.8**	**0.6**	**5.5**	**0.8**	**2**	**0.8**

Chemical Class	Chemicals Tested	Alan Bates	Vicki Berger	Cathy Bloome	Donalda Dodson	Linda Hornbuckle	Doug Phillips	Danya Rumore	Don Sampson	Doug Stamm	Jeff VonAllmen
Protein in URINE.	**CREATININE (g/L)**	**1.73**	**1.55**	**0.64**	**1.27**	**1.25**	**0.91**	**0.68**	**1.02**	**1.06**	**1.68**

These normal protein levels are used to adjust the measured chemicals in urine to account for dilution due to varying amounts of fluid intake per person.

Table 3 — Summary of Results of Oregon Pollution in People Study

RESULTS FROM 10 OREGON PARTICIPANTS				RESULTS FROM OTHER STUDIES			
Phthalates	**units = µg/gCr-L (creatinine corrected)**			**from federal CDC 3rd National Exposure Report n = 2,536 for MEP; n = 2,772 for all other phthalates**			
	Minimum	**Maximum**	**Median**	**Median - or 50th %tile**	**75th %tile**	**90th %tile**	**95th %tile**
MMeP	ND	ND	ND	1.33	2.62	5.00	7.97
MEtP	<3.91	215.61	44.41	147.00	388.00	975.00	1860.00
MBuP	<3.03	58.90	32.00	26.00	51.60	98.60	149.00
MBzP	3.46	28.53	11.47	13.50	26.60	55.10	90.40
MEHP	<0.94	29.82	4.32	3.89	7.94	18.20	32.80
MEOHP	6.94	248.21	25.52	11.20	21.30	45.10	87.50
MEHHP	8.19	248.21	24.53	16.60	32.30	70.80	147.00
Sum TOTAL	31.74	585.70	190.82	219.00	530.00	1268.00	2375.00

Mercury	**units = µg/L in whole blood**			**from federal CDC 3rd National Exposure Report n = 1928**			
Methylmecury	**Minimum**	**Maximum**	**Median**	**Median - or 50th %tile**	**75th %tile**	**90th %tile**	**95th %tile**
MEHg	0.37	3.5	1.84	0.70	1.70	3.00	4.60

PFCs	**units = ng/mL in blood serum**			**n=476 women & 442 men**	**n=10**	**n=12**	**n=13**
	Minimum	**Maximum**	**Median**	**National Mean (est.)**	**Washington Median**	**California Median**	**Maine Median**
PFOA	1.25	7.64	3.22	3.97 to 6.98	3.6	5.3	4.41
PFNA	<LOD	1.49	44.41	0.51 to 1.10	-	1.67	1.56
PFDA	<LOD	0.57	ND	-	-	0.43	0.55
PFUnA	<LOD	0.66	ND	-	-	0.40	0.60
PFHxS	<LOD	19.10	0.83	4.33	-	2.44	1.57
PFOS	5.77	35.40	13.55	23.4 to 40.2	21.30	25.6	14.20
Sum TOTAL	10.36	50.66	22.3795	32.2 - 52.6	24.9	35.8	25.00

Organo-phosphate pesiticides	**units = µg/gCr-L (creatinine corrected)**			**Barr et al. (2004) n = 1,949**			
	Minimum	**Maximum**	**Median**	**Median - or 50th %tile**	**75th %tile**	**90th %tile**	**95th %tile**
DMP	<LOD	31.87	-	0.74	2.80	7.90	13.00
DMTP	<LOD	18.87	-	2.70	10.00	38.00	46.00
DMDTP	<LOD	-	-	<LOD	2.30	0.43	19.00
DEP	<LOD	9.89	-	1.20	3.10	7.50	13.00
DETP	<LOD	-	-	.49	0.76	1.30	2.20
DEDTP	<LOD	66.04	-	0.08	0.20	0.47	0.87
Sum TOTAL	ND	100.94	-	ND	ND	ND	ND

Table 3 — Summary of Results of Oregon Pollution in People Study (cont.)

RESULTS FROM 10 OREGON PARTICIPANTS				RESULTS FROM OTHER STUDIES			
BPA	**units = µg/gCr-L (creatinine corrected)**			**Calafat et al (2005), n=394**			
	Minimum	**Maximum**	**Median**	**Median - or 50th %tile**	**75th %tile**	**90th %tile**	**95th %tile**
BPA	<LOD	5.65	1.35	1.36	2.58	3.88	7.95
PCBs	**units = µg/L in blood serum**			**Schreder (2006), n=10**			
	Minimum	**Maximum**	**Median**	**Median Range (est.)**	**Washington Minimum**	**Washington Maximum**	**Washington Median**
Total PCBs	0.40	5.50	0.80	0.9 - 1.5	0.20	2.30	0.95

ND = not determined
<LOD = limit of detection

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