

"Pollution Gets Personal: Tracking Toxic Chemicals in Our Bodies"

Lecture by Jane Houlihan, MS

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Introduction:

This evening's topic, "The Human Body Burden of Synthetic Toxic Chemicals" is a relatively new and really important area of research with fascinating health and public policy implications, so I'm really looking forward to this presentation and discussion. Briefly, as we hear about this, I wanted to give you a sense that at OEC we've been working to reduce exposures to certain toxic chemicals here in Oregon, especially ones dangerous to children, particularly things like mercury, pesticides and diesel pollution. And again, our effectiveness is greatly enhanced when we work with health providers and health professionals, those in this room.

I'm going to introduce Dr. Joan Rothlein who will introduce Jane Houlihan. Dr. Rothlein is also going to share with you briefly some results of local studies on pesticide exposures to give us a sense of what's going on here in the NW before we talk about the bigger picture. Dr. Rothlein is an environmental toxicologist at the Center for Research on Occupational and Environmental Toxicology, also known as CROET, which is at Oregon Health and Science University. She studied biochemistry and neurochemistry at the University of California in Santa Barbara and Yale University School of Medicine in the Departments of Pharmacology and Neurobiology. Dr. Rothlein has been working in Oregon in chemical and health surveillance among workers and the general public, and has recently focused her work on bio-monitoring in epidemiological studies involving hazardous exposures, primarily pesticides and endocrine disruptors.

Dr. Rothlein:

I'm going to speak for about 5 or 10 minutes about some research that we've been doing for the last 5 years up at CROET and OHSU that is focused on pesticide exposure among migrant workers and other workers in agriculture, both looking at exposures and potential health effects from low level chronic exposures. I'm just going to present 4 slides. This first slide is a summary of organo-phosphate that has been measured in the carpet dust of farm workers and growers (farm owners) in 1998 and 1999, as well as measuring the levels of pesticides in carpet dust of non-agricultural homes, both coastal areas as well as in Portland.

The reason that we're doing this study is that we wanted to assess pesticide exposures in families, in the children, and determine whether there are any health effects due to those low-level exposures. The numbers in 1998 look lower than the numbers in 1999 primarily because we sampled late in the season, around September to October whereas in 1999 we sampled in the middle of the summer. And you can see that there are pesticides in the dust of the carpets in their homes. The level of pesticides in the homes of the growers is

lower than the level of pesticides detected in the farm-worker homes, but these numbers are still much higher than those detected in non-agricultural homes.

The pesticides that we're looking at are a special category called organophosphates. Right now in Oregon there are six organophosphates that are currently used both in agricultural and in non-agricultural settings. When those organophosphates are metabolized, they are metabolized in one of several metabolites. When we measure those metabolites in urine samples of the participants, we are actually looking at a total load, or a total exposure from multiple routes of exposure. It could be from dermal exposure, ingestion, drinking water, or food. What I'm going to focus on right now is the level of DMTP that we've detected in urine samples of farm workers, children, and control families. I want to add one thing – two of these six organophosphates, Azinphos Methyl and Phosmot, are products that are used currently in the orchards in Oregon, primarily on pears and apples.

So we know we've been measuring levels of pesticides in their homes. The question is whether there is actually an exposure among those individuals living there, both the adults and the children. This is a summary slide, several years of research, of levels of DMTP measured in their urine – families of growers, farm workers and their children – compared to national numbers of non-exposed groups. Our guest speaker is going to be talking I think in part about the NHANES study, but this is a national study that was done in 1999-2000 of US citizens around the US, a non-exposed population, of what are body burdens of these organophosphate metabolites are. First of all, I want to show you that in Portland, levels in adults and children are comparable to the levels that we see in the national study, but as you can see, among the farm workers and growers, the numbers are much larger – the concentration of metabolites in the urine is much larger than you would see in an unexposed population. The levels among the farm workers are higher than those among the growers. But in this situation the children were a little bit lower than that of the adults.

The next phase of the study that we've been working on is to look at whether there are actually any health effects associated with these low level chronic exposures to organophosphates. We want to look at whether there is a correlation between the organophosphate exposure in the home and the metabolite level in the urine, but we also want to look at whether there is any correlation between the metabolite level in the urine and possible health effects. And the health effects that we are looking at are neurobehavioral. Before I show you the last slide, I also want to indicate that the level of DMTP in the urine is down between 10 and 50 ng/ml. Although these levels up here are elevated compared to controls, they are significantly lower than what you would see in a non-fatal poisoning situation involving a child who is accidentally poisoned by an organophosphate and is symptomatic and is hospitalized. The levels might be up at around 10,000 ng/ml compared to 50. So there's a huge difference, and we're looking at really very, very low levels compared to what you would see in a poisoning situation, but there still might be health effects associated with those low level exposures.

This is a part of the study that is in progress. We're looking at neurobehavioral effects, both among adults and among children. We're using a battery of tests that measures both attention, memory, response time, higher cognitive learning, and we develop kind of a summary score of the various tests that they are taking and we compare populations. What we're finding among female workers is that, if we compare Hispanic female workers in agriculture versus Hispanic female workers that are not working in agriculture, those that are working in agriculture do not perform as well on these neurobehavioral exams compared to those that are not working in agriculture. We do not see any effect right now among male workers, but we're in the process of this research. We are also conducting research like this among children, both ages 4-6 and 7-9. The tests that we use are computerized, they're in Spanish, and the children have been able to complete the tests, and we are now working on analyzing that data. Right now we don't see any consistent pattern or trend in the responses or the performance on those neurobehavioral exams between children of agricultural workers and children of non-agricultural families.

So I'm going to stop right there. That's a quick snapshot of our work. And now I have the pleasure of introducing our guest speaker. Ms. Houlihan directs research operations at the Environmental Working Group (EWG) in Washington D.C, focusing on human health and environmental exposures, with an emphasis on risks to infants and young children. Her areas of specialty at EWG include the human body, the burden of toxic chemicals and health implications from exposures to toxics in drinking water, food, cosmetics and other common consumer products. With others, she has authored over 20 major studies on potential health impacts of industrial chemicals, some leading to important policy changes. Ms. Houlihan serves as an expert for the environmental and public health community on national television, and in national print media. She has appeared on such shows as 20/20, Network Nightly News and Morning Shows, and the News Hour with Jim Leher, and in such publications as the New York Times and the Wash Post. Prior to joining EWG, she spent ten years in practice as an environmental engineer, studying pollution at superfund sites, and designing remedies to protect the environmental and human health. Thank you.

Jane Houlihan-

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It's a real pleasure to be here tonight. As Laura and Joan said, the topic for tonight is the human body burden. And specifically what I want to talk about in that arena is what we call the "emerging revolution" in our understanding of the intersection between pollution and disease, and how body burden data can really enrich that understanding.

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For decades scientists have measured pollution in water, air, land and food, and finally we're measuring pollution in people. That's what we call the body burden – the industrial chemicals within the human body. So we are each of us carrying in our bodies at any

given time hundreds of industrial contaminants, pesticides, and other pollutants. These chemicals are the consequence of our lifelong exposures to contaminants in water, air, food and to chemicals in consumer products. We inhale them, we ingest them, we absorb them through our skin, and until really very recently we've had very little understanding of the health implications of these exposures.

I want to do three main things tonight as I speak. First of all, I want to tell you about a body burden study we conducted jointly with Mt. Sinai School of Medicine and Commonweal in California. Some of you might be a little bit familiar with that study. I really want to dig into the data and give you a sense of how rich body burden data is and the spectrum of findings and links that it can provide. The second thing I want to do is describe some of what we know about the intersection between pollution and human health and human diseases. And then lastly I want to highlight some recent examples where body burden data has been able to cut through stymied policies and bad science and really move public health protections forward in important ways.

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First of all: Our study in conjunction with Mt. Sinai School of Medicine and Commonweal. We tested nine people from five states for 210 industrial chemicals, pesticides and other pollutants. The study protocol was approved by Mt. Sinai's institutional review board and was published in the Journal and Public Health Reports, and I think you have a copy of that piece in your materials tonight. We spent two years designing the study, gaining approval from the IRB¹ and recruiting subjects. And just to give you a scope of the costs, for each study participant the lab costs alone ran \$5000 for the study. In the end, each of our nine participants gave thirteen vials of blood and they each gave a 24-hour urine sample, and these were sent to two major national laboratories for testing.

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Who we tested is shown across the top here. And I'll use this template, this pseudo-periodic table later on to tell you about the test results. But these are the nine people we tested – more about them later as well – but it was a convenient sample of nine people. None work with chemicals on the job and all of these people lead healthy lives. And here's what we tested for.

1) First of all we tested for 73 PCBs. PCBs are industrial chemicals used as electrical insulators, banned in the 1970s, but they are very persistent in the environment, they build up in the food chain, they persist in the environment for long periods of time. We are exposed mainly through fatty meat and dairy products and fish.

2) We found 48 phalates of 73.

3) We also tested for 17 dioxins and furans. These are industrial pollutants. They stem from incinerations, from the production of PVC plastics.

4) We found 15 of 17 dioxins and furans in the nine people we tested.

¹ IRB – Institutional Review Board

5) We tested for five metals and found four – arsenic, mercury, cadmium and lead. These stem from a huge variety of consumer products and other sources – mining pollution, consumer products like lead paint, arsenic treated wood decks and play sets are common sources of metals in our lives.

6) We tested for nine organophosphate pesticides and metabolites. We found seven. Organophosphate pesticides are used to kill insects, and they are very commonly used in the home and on foods.

7) We tested also for a big class of chemicals: semi-volatile and volatile organic chemicals. We tested for 77 in that family. And these are used in a huge range of consumer products, everything from cosmetics to paint to gasoline. It runs the gamut of a lot of things that are in our cupboards and shelves.

8) We tested for six phalates, and we found six. These are industrial plasticizers also used in a huge range of products. Plastics as you can imagine, also cosmetics. Anything requiring softening or flexibility takes advantage of the properties of phalates that also end up in our bodies.

9) We also tested for 23 organochlorine pesticides and metabolites and found ten. Many of these chemicals have been banned for a long time in the US, but they are very persistent in the environment. They build up in the food chain and end up in our bodies.

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And here's what we found: Of the 210 chemicals we tested, we found 167 industrial compounds, pollutants and other chemicals in the blood and urine of the nine people who were tested. We found an average of 91 chemicals in each person. And in each person, as you would guess, we found many chemicals that are linked to common health harms. I'll say more about that later.

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I just want to give you a sense for the variety of chemicals found in each person. These are the test results for Lucy Wallezky. What is highlighted here is what we found in Lucy Wallezky's blood and urine samples. She's a 61-year-old psychiatrist from New York who participated in this study. First of all we found two metals, we found 15 dioxins and furans – the full suite, and we found a number of PCB congeners. We also found a suite of semi-volatile and volatile organic compounds in Lucy's samples. Phalates, Organophosphate pesticides and organochlorine pesticides are shown also shown here. So, we found a huge range of chemicals in Lucy's samples, including 42 carcinogens.

David Smaltz is a 49 year old researcher from Berkeley, and his samples contained 106 chemicals. He had more chemicals than any of the other test participants, and unusually high levels of Durzban.

Charla Pattant is a 59-year-old organizer from Bolinas, California. And Charla's samples contained 105 contaminants. She was the only participant whose samples contained the pesticide Myrex.

Lexi Rose was a volunteer. She lives in California and Montana. Her samples contain 86 contaminants, including the full sweep of dioxins and furans that we found in the test participants.

Michael Lerner is a 60-year-old educator from Bolinas. In Michael's samples we found 101 contaminants, and he had elevated concentrations of both arsenic and mercury above what one would consider a reference dose.

Andrea Martin, from Sausalito California, was 56 years old when we released this study. Her samples contained 95 contaminants, high levels of mercury. Andrea passed away last year after a long battle with cancer. Many of you know her as the founder of the Breast Cancer Fund. This study is dedicated to Andrea, and Andrea did have an opportunity to speak to the press in a really compelling way about this study. Her samples contained 59 carcinogens.

Charlotte Brody is a 55-year-old organizer from Roundhill, Virginia. Her samples contained 85 contaminants including Durzban, or the organophosphate Chloropropofrost, which is a pesticide that she has long tried to avoid.

Mony Harden is a 35-year-old lawyer from New Orleans. Her samples contained 75 contaminants. She was the only person with detectable levels of pentachlorophenol. She had the fewest contaminants, the lowest overall levels of dioxins and furans, which is consistent with the idea that those chemicals build up in the body over time.

Bill Moyers is a 69-year-old TV producer from New Jersey. His samples contained 84 contaminants. He the highest overall levels of dioxins and furans, also consistent with the theory that these contaminants build up over time. He was the oldest in our cohort of nine.

So you see that there are complex mixtures in each of these people that we tested. And it's the case that under nearly every environmental law, safety standards are set as if we're exposed to only one chemical at a time, and that's clearly not the case. This data shows pretty powerfully that that's not a good assumption. One of the primary questions that comes out of this study is, are the complex mixtures of chemicals in these people's bodies harming their health? Have they seen health impacts from these chemicals, or will they in the future? And the answer to that is not one that we necessarily want to hear, but it's normally science doesn't yet hold the answer to that question. We don't know. We don't have the data to definitively link health problems in these individuals with this snapshot of body-burden data, just an instant in these peoples' lives and their exposures day to day.

We know that toxicity of chemicals depends on the timing of the dose. We know it depends on the susceptibility of the individual, including genetic differences. And we've really captures only a piece of the puzzle here, not capturing timing, not capturing genetic differences. But, that said, population based studies and a lot of other evidence tells us

that some of these chemicals are harming health at levels that are in the general population – I'll talk more about that later – and that, in fact, toxic effects do not require high doses.

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So, let's look first at the broad kinds of harms that are associated with the chemicals we found in this study. And you'll see here at the top of this slide the broad kinds of health harms or target organs or systems that are associated with the chemicals that we found. Now, as I click here, I am highlighting only on this slide the chemicals in Charlotte Brody's samples that are linked to brain and nervous system damage – 56 chemicals in Charlottes' samples linked to that same spectrum of health harms. 48 chemicals toxic to the reproductive system, 45 linked to cancer, 47 that harm the immune systems. Here's Michael Lerner. His samples contain 72 chemicals toxic to the brain and nervous system, 68 chemicals toxic to the cardio-vascular system and the blood. And while any one of these chemicals might not be present in a harmful amount, we know that combinations of chemicals can have additive effects. And again, in setting safety standards, most often the government assumes that we are exposed to one chemical at a time, and this body burden data shows pretty powerfully that that is not in fact the case. We are exposed to complex mixtures of many chemicals that are linked to common health harms.

Now one of the main things to remember when we're looking at body burden data is that in fact toxic effects do not require high doses. And I want to present you with three lines of evidence that support that idea – the idea that exposure levels in the general population are in fact very likely impacting health in significant ways.

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Let's look first at patterns in human disease. I want to pull out some statistics on cancer first. Lifetime cancer now stands at 1 in 2 for men and 1 in 3 for women. Between 1992 and 1999 we saw an increased incidence for breast, thyroid, kidney, liver, skin and some forms of leukemia. In the 25 years between 1975 and 1999 we saw childhood cancer increase by 26%, led by brain and other nervous system cancers and acute lymphocytic leukemia. Testicular cancer in recent years has risen by 60%. Childhood brain cancer is up 50%, childhood leukemia is up 62%. The risk of breast cancer for women now stands at 1 in 8 and it's doubling every two generations. Testicular cancer, the risk is doubling every 1 and a half generations. It's now the most common cancer among young men. In our 9 subjects we found 76 carcinogens. We found an average of 53 carcinogens in each person we tested.

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I'm going to move to nervous system disorders – neurodevelopmental problems. The incidence of autism and autism spectrum disorders appears to be increasing, maybe 10-fold estimated in the last 10 years. Some studies now put the incidence of autism at about one in every 200 children. Also we're increasingly seeing scientists turn to environmental factors to explain the etiology of parkinsons and other diseases of aging. In our study we found 94 chemicals toxic to the nervous system. We found an average of 62 neurotoxins in each person we tested.

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Reproductive effects: declining sperm count, hypospadias, undescended testicles, testicular cancer, early puberty – all of these have been reported to be increasing in incidence in recent years. In our study we found 77 chemicals toxic to the reproductive system, and an average of 55 in each of the nine that we tested.

So, it is the case that increasingly, scientists are turning to the human body burden to help explain patterns of human disease like these. Why are we seeing these increases? And also to explain the current burden of disease, whether or not diseases or other conditions are on the increase.

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Here's the second line of evidence that shows us that toxic effects do not in fact require high doses and that levels in the general population, levels of industrial chemicals may in fact be harming human health. And this evidence comes from population-based studies. We all know that there are hundreds of studies in the peer-reviewed literature that link chemicals to health harms at levels in the general population. These are chemicals where some of the strongest evidence exists – things like PCBs, dioxins, DDT, lead, mercury, urban air pollution and many other chemicals that do have very strong evidence in peer reviewed literature.

I just will pull out two examples from this. Many of you are probably familiar with some of the literature on PCBs, but it's shown in a number of studies that exposures in the womb to PCBs from a mother's consumption of PCB contaminated fish causes deficits in IQ later in life for that child, and that mercury for instance is related to a similar spectrum of effects – that a mother's consumption of mercury contaminated seafood during pregnancy leads to what is now believed to be permanent damage of that child's brain. Two weeks ago scientists from Harvard's school of public health released their latest study in a series.....

.....measure organ weight,.

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First of all, bisphenol A. According to EPA the lowest dose that causes effects is 5 mg of Bis A per kg of bodyweight per day. Well now low dose studies are showing reproductive effects, sperm count, prostate effects, early puberty effects at levels 2500 times lower than the current regulatory safe level.

Atrazine: ?? drinking water standard. Pollutes drinking water for millions of people across the Midwest. It's the most commonly used herbicide in the country. The allowable level in drinking water is 3 ppb. We estimate that 10 million people are drinking finished?? tap water from the sink polluted with Atrazine. Tyrone Hayes at Berkeley is now seeing amphibian deformities at levels 30 times lower than what's allowed in drinking water. He's seeing amphibians exposed at that level developing multiple ovaries and testes in the same organism – in the same animal.

Methoxychlor Pesticide: The no effects dose, according to EPA is 5 mg of meth per kg of bodyweight per day. Low dose studies – laboratory studies – are now finding prostate damage at levels 100 times lower than that, so low dose studies do provide much stronger evidence than high dose regulatory studies that the levels of exposures in the general population can in fact impact health.

As many of you know, doctors aren't trained necessarily to think about pollution or environmental causes when they're presented with diseases from people that come into their office. But one of the things that this science says is that it does make a lot of sense to be cognizant of potential environmental links. Jane Hightower, for instance, San Francisco physicians, had a number of patients presenting similar symptoms, tested them for mercury and found really high levels across a number of her patients linked back to seafood exposures – swordfish, tuna and other seafood. So, there's an increasing number of health care practitioners that are using body burden science in their science. It's growing.

I'm moving into the third area of my talk now, which is to tell you some great positive examples of how body burden data has really cut through bad science and made a difference in terms of public health impacts, but before I do that I want to set you up with really what the reality is for where we are in terms of regulation. I want to do that by talking about the pervasive sources of exposure that we're faced with for these chemicals in our body, and I want to talk about how regulation has tried to deal with that, and then segway into some of the ways that body burden data has really cut through some of those problems.

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First of all, sources of exposure – there are 75,000 approved for use by the Environmental Protection Agency, and the agency approved 7 new industrial chemicals every day – every day of the year.

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There are 5000 chemicals used in cosmetics, according to a voluntary reporting system database maintained by the food and drug administration. There are 3200 chemicals added to food, approved as indirect or direct food additives. There are 1010 chemicals in 11700 consumer products in a database cobbled together by EPA from air monitoring, from consumer products and ingredients labels, and there are 500 active ingredients in pesticides approved by the environmental protection agency.

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Pollution is a big source of exposure – background pollution in our environment. In 1998, US industries reported manufacturing 6.5 trillion pounds of 9000 different chemicals. In the year 2000, industries released 7.1 billion pounds of 650 industrial chemicals to air and water – these were reported to EPA's toxics release inventory program.

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Wastewater is another source of exposure for us. In 1999-2000 as USGS (US Geological Service) survey of 139 rivers and streams in 30 states found 95 components of treated human sewage, including steroids, DEET insect repellants, antibiotics, and persistent breakdown products of cigarettes and detergents, and they also found caffeine. These chemicals are not regulated in drinking water by and large, and drinking water treatment plants are not designed to remove these chemicals, and they're not being tested at the tap. This is really an emerging field of study, and it has its own acronym now that many of you probably now – it's PPCPs, Pharmaceuticals and Personal Care Products. So you'll see a lot more of this in the future. It's also known as "from the toilet to the tap."

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So, one thing that we did as we looked at the whole spectrum of how we can be exposed to industrial chemicals, we just set out to define some of the possibilities of where the chemicals came from in the nine people that we tested. So we scoured ten standard industry and government handbooks, including the ingredients list for 11700 products from the database that EPA had compiled, and what we learned was that the chemicals in the nine people that we tested potentially came from 100s of types of consumer products, including household cleaners, cosmetics, gasoline and paint. Here are just some of our findings for the potential sources of exposure – the chemicals we found in the nine people tested are used in 183 types of consumer products, including brake fluid, paint, pesticides, flame retardants. They are made by 164 past or current manufacturers including Shell, Union Carbide, Exxon, Dow, Monsanto and more. And they're linked to 64 chemical functions, including plasticizers, froth flotation agents, and defoaming agents.

(no slide)

So, one thing we've done on our website – this is just a frame shot from our website – is list down the line the possibilities for exposures for how people are exposed, in terms of products, brand and trade names, and manufacturers. For instance for Davis Spaltz, some of the things in David's samples are used in food packaging, furniture refinishing, gasoline, hairspray – I don't think Davis is using hairspray – hand cleaners and insecticides. Brand and trade names: Eversol 210, Phenchlor, Fly Fighter, Fortress, Lordan, Liquid Nails. And manufacturers: you can see a Sarco, Dow, the Crystal Chemical, many names that we've all heard of. The bottom line is, these really are industrial chemicals and they really are ending up in our bodies.

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So, how does the regulatory system deal with this pervasive exposure and the multiplicity of exposures we face every day? Well, the answer is that it really doesn't. Here are the traditional assumptions that regulators make when they are assessing risk and setting safety standards. Now there are exceptions to these rules, but this is kind of the standard thing that happens in these regulatory agencies. First of all, these risk assessments assume that we are exposed to one chemical at a time. That's not true. The risk assessments assume that we are all healthy adult males, we weigh 70 kg, we live 70 years. That's also not always true. These risk assessments assume that in utero exposures don't matter. They are looking at adult exposures only. This is obviously not appropriate, in utero

exposures sometimes matter most of all – it’s a really sensitive time for chemical exposures. Risk assessments also traditionally assume that high dose studies capture all potential effects, so it’s often the case that regulatory high dose studies form the basis for risk assessment, and what we know now is that low dose studies define a much fuller spectrum of health impacts than the limited high dose studies conducted for regulatory science.

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Regulatory failures in terms of testing: First of all, polling shows that Americans generally think that companies are required to test their products for safety before they’re put on the market, and that in fact is not the case. Under the toxic substances control act (TSCA), our national law that regulates most industrial chemicals, a chemical company is under no legal obligation at all to understand how its products might impact health. More than 63000 chemicals were granted blanket approval for use when TSCA was passed in 1976, and TSCA carries no requirement for upfront safety testing for new chemicals. These facts come from a study done by the general accounting office that looked at some of the limitations of TSCA when some in congress were contemplating reform that hasn’t happened yet. First of all, companies have been ?? with fewer than half of all applications to manufacture new chemicals. The government approves 80% of these applications with no restrictions and with no request for additional tests. 8 of 10 new chemicals win approval in less than three weeks. By statute EPA has 90 days to review a new chemical. If that chemical comes in with no tests – and submission of tests is a voluntary thing for the company – if that chemical comes in with no test EPA uses computer models to estimate if the chemical might be toxic to humans, and it’s on the basis of those computer models that the chemical is approved for use.

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One thing we know is that some chemicals are well studied, and when we ask the question – why do some chemicals finally get well studied since there is no regulatory system to force that, and here’s the answer: Chemicals really are only intensively studied after some normally accidental discovery has been made – after it’s been learned that they definitely harm human health, after it’s been learned that they, for instance, contaminated the biosphere. This first chemical at the top is benzene- what we’ve done here is an accounting of how many studies we find for benzene’s health effects in PubMed, which is the National Institutes of Health’s massive compendium of peer reviewed literature on health and environmental toxins. So, benzene carries in that PubMed database 11,000 peer-reviewed studies. Really these studies came up because it was discovered in the 1960s that benzene is linked to leukemia, and widespread exposures through consumer products continue. So benzene is probably the best studied chemical in terms of human health impacts. Triazine herbicides came in second with 7400 studies. These have been in use since Elvis invented the hula hoop – is the year that they’re tagged back to, but I forget what year that was – but in the 1980s it was discovered that Atrazine and other triazines widely contaminate drinking water supplies across the Midwest. There was also discovered in the 1980s that they’re linked to certain kinds of cancer in some animal studies. So, although these pesticides continue in widespread use, they’re really getting a great deal of study right now. PCBs – 7000 studies in the peer reviewed literature, and of

course these were banned in the 1970s after it was discovered that they have contaminated the biosphere, that they are linked to cancer. And then down the list we see ozone, DDT, dioxin, Bisphenol A, all these chemicals linked to pretty major problems, have all seen quite a number of studies in peer-reviewed literature.

So at the bottom I just want to pull out these chemical families that have seen hardly any study at all, and these are what I would call chemicals that have recently discovered major problems, and we'll see the studies really pick up on these in the future. First of all, perfluorinated chemicals: 178 studies in the literature. In 1999 ThreeM told EPA that they had discovered Scotchgard and other perfluorinated chemicals in the blood of the general population, and that these chemicals were linked to toxic effects in utero, to young animals at extraordinarily low doses. That was in 1999. Scotchgard was banned as a result of that. We have a new formulation now. And following out of that is an intense study at EPA on Teflon, a related chemical that has similar impacts and also has polluted what looks to be the entire human population from the tests that have been done so far. So, even though these chemicals have been in widespread use for 50 years, as of last year there were only 178 studies on their toxicity in the peer-reviewed literature. PBDEs: As of Jasn of 2003, which is when I made this graph, there were 69 studies in the peer-reviewed literature on PBDEs. And of course, in recent we now have found that PBDEs widely contaminate human breast milk and wildlife, and that they have toxicities very similar to PCBs. We're very concerned about in utero exposures.

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So here's what happens when a problem is discovered. And just to preface this by saying, PBDEs – fire retardants – have been in common use in consumer products for decades and decades and decades. So, last year scientists published 70% as many studies on PBDEs as in the last 20 years combined. We had 69 studies in the 80s and 90s. In 2003 alone we have 49 studies from 17 countries, 5 states and 36 research institutions. It's great to have these studies done on chemicals that are toxic and that pervasively pollute the human population. But what would be greater is if these studies were done up front, and the toxicities were defined before these chemicals went into widespread use.

So I want to segway now into places where body burden data really has been able to cut through some of this bad regulatory science and some of the limitations we see in the way that we deal with risk.

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First of all, Mercury in Seafood: The Centers for Disease Control and Prevention (CDC), in their major bio-monitoring program – national program – under their EnHEINs testing, defined high levels of mercury in the blood of women of childbearing age. About 8% of women have mercury levels in their blood that exceed the safe limit, or the reference dose. At the same time, I mentioned that doctor Hightower, in the Bay Area – defined high levels of mercury in her patients that who a number of symptoms that were similar to what you'd expect with mercury. These body burden data have led to requirements in CA for a seafood warning label, and they've also lead to body burden data driving a new federal advisory being hammered out by the Food and Drug Administration that will give

women more specific information on what fish they can safely eat during pregnancy and what fish they need to avoid. And that movement has really been driven by body burden science.

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This is a sticky point – is that canned tuna is a top contributor to body burdens in women. Canned tuna is about 30% of the seafood that we eat, but it's about 50% of the mercury in the diet, because it's cheap, because women try to increase their protein intake during pregnancy, because it's easy. This is from an FDA focus group in 2000 – this woman ate it every day for lunch, because it was simple and convenient.

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So canned tuna has been a sticking point at the federal level, and something that we've been advocating around for a while. We still see more progress being made on mercury and body burden. Just two weeks ago the Environmental Protection Agency came out with new estimates of how many children are born in the US every year overexposed to mercury in the womb. They doubled their estimate. What they did was shift for the first time from looking at mercury levels in a woman's blood to looking at mercury levels in the blood of the babies – your fetal cordblood measurements. Now the estimate of babies potentially exposed to risky levels of mercury above the reference dose doubled – went from 320,000 a year to 630,000 babies born every year with mercury exposures above the reference does. That's one in six babies.

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Progress made in the issue of phalates and cosmetics: Again, CDC in their major national bio-monitoring program found that phalates, first of all, pervasively pollute human blood, and they found levels in women of childbearing age that exceed the safe dose, the reference does. Some of that science has helped lead to a ban on phalates in European cosmetics, and it's also been the impetus for a number of US cosmetics compaies announcing that they're discontinuing the use of phalates in their cosmetics lines.

(25)

Teflon: This is a perflourinated chemical that I showed you on the previous graph. So the Scotchgard formulation in the same chemical family was banned basically in 2000, and now Teflon is kind of “in the frying pan” so to speak right now, in a big major safety review at the Environmental Protection Agency. And EPA has already found through their hazard assessment that the margin of exposure is uncomfortably low. So exposures in the general population with this Teflon chemical called perflouroctanoic acid, or it's also called C8, is nearly at levels that harm laboratory animals, and that's the impetus for this real priority review at EPA that is consuming a great amount of their staff.

(26)

We put together on our website all the available environmental data on Teflon and other perflourinated chemicals, and some of the things I want to point out are that now Teflon and Scotchgard chemicals have been found in the blood of all 3000 people tested. Most of this testing has been done by ThreeM.

(27)

And as I zoom in here, these stars represent places where people were tested – most of them represent a study that Three M conducted of 598 children from 23 states. 100% of those children had perflourinated chemicals in their blood.

(28,29)

I'm going to zoom into some Seattle data here – in Seattle, children weren't tested, but seniors were tested from age 65 to 95, and in that study ThreeM found 5 different perflourinated chemicals related to Scotchgard and Teflon and some of their precursor chemicals.

(30)

Not at levels as high as in children, though, and this is what I want to show – this may be hard to see. This is data from a rat study primarily. So across the bottom here, is the dose that the rat was given in the study. It ranges from 1 mg/kg/day to 10. PFOA is one of the building blocks of Teflon. It's also a building block of StainMaster, Fabric Protectors, Carpet protectors, widely used. At a dose of 1 mg/kg/day, the blood level of PFOA in the rat was about 40 ppb. At that level, scientists saw decreased growth, damage to the liver, kidneys, seminal vesicles and spleen. This yellow bar represented current PFOA levels in children's blood, the average is 5.6, ranges up to 56.1, and again, this is just 600 children tested. And what you'll notice first off in this graph is that levels in children's blood at the high end concentrations exceed levels known to harm laboratory animals, and you can understand why there is now an expedited review at the Environmental Protection Agency.

(31)

I want to talk just briefly about PBDEs in breast milk which we've all heard so much about in recent years: First of all, measurements of fire retardants in breast milk, primarily in Europe, led to a ban of some of the most toxic formulations. PBDEs target the brain of an unborn child and have toxic effects very similar to PCBs.

(no slide)

This graph, which looks beautiful here (actually doesn't show up!), is a graph that shows the exponential growth of PBDEs in breast milk in Europe, and that's really what drove the European ban. So scientists in Sweden who had archived breast milk samples back 25 years just found an explosive growth of these chemicals in breast milk. Breast milk is a great indicator fluid for contamination in the womb. It's an easy fluid to collect, and it's much simpler to collect and test in some cases than blood. And what it does is give an indication of a woman's body burden and what a child might have been exposed to in the womb – it's used as an indicator for that.

(32)

PBDEs in US breast milk now – a number of studies have come out. We released a study in October of 20 women across the US, a national study. We targeted first-time moms because they have higher body burdens than moms who have breast fed and gotten rid of

some of their body burden through the act of breast feeding. We found the highest levels ever detected in the US. We're sitting at about, on average, 30 times the levels in Europe.

(33)

Our report is called Mothers' Milk, it's available on the web if you're interested. There's another study coming out of Seattle women, next week I believe.

(34)

Here's the geographical distribution of people we tested. We did test a mom from Portland Oregon. She was on the high end of concentrations that we found – 755. We tested a Seattle mom on the very lowest end. I think our high concentration, at 1000, was a woman who is from Missouri. Seattle was I believe the second or third lowest level, but of course we have 20 people, one from each city, there's no statistical significance, but what you can see here is the huge variation in concentration – orders of magnitude – in the breast milk of these first time moms. And to me, one of the most disturbing things about findings like these is that really, government and industry have no idea what the primary routes of exposure are, why some people have such excessive levels compares to others. There's really such a lack of basic scientific understanding for how we're exposed.

(35)

This is data from Sweden, their average level in 2001. Japan, average level of 2000 down at 1 ppb. Canada, average level in 1992 and 2001 were up at 25 ppb. Here's the data from the three US studies we compiled here. Our study, the average was 58, higher probably because we targeted first time moms – other studies were in the mid range here. But we are seeing significantly higher concentrations in the US than even in other countries where these formulations had been banned.

(no slide)

And this graph was just a graph of the individual levels in women that we tested which I've already talked about.

(36)

Here's one thing to note about body burden data – it gets written about in the press. It really hits home with people. One of the powerful things about body burden data is it is so accessible and reporters want to write about it. And that really reaches a broad audience, and it has a big effect in helping the data to cut through, and really make a difference.

(37,38)

Measurements of fire retardants in breast milk in the US has led to Great Lakes Chemical Corporation, our top manufacturer, announcing that it will phase out the most harmful PBDE mixtures called Penta and Octa. So that's tremendous progress.

(39)

Emerging Body Burden data: autism – you’re going to hear a lot more about this in the years to come. There’s new evidence from body burden studies that points to specific genetic and environmental links for autism. Two recent studies – one came from a private practice in Baton Rouge, Louisiana. This physician tested mercury levels in hair for hundreds of autistic children and hundreds of controls. What she found was that autistic children had much lower levels of mercury in their hair by a factor of eight on average. And what the hypothesis is that autistic kids are not as efficiently excreting metals, so they have less of these metals in their hair than do the control children. Second study, came out of a facility in Florida that studies autistic children. Found higher levels of mercury in urine after chelation among autistic kids versus controls. Higher by a factor of 3 to 6. So again the hypothesis would be autistic children are retaining more metals in their bodies, they’re not excreting as efficiently, so when these children undergo chelation, where metals are drawn out of the body, they excrete higher levels of mercury than the control children.

This points to a whole host of possibilities. Scientists are now looking for polymorphisms in autistic children that are linked to a poor capacity to methylate these metals. There’s a lot of new science coming out of both the genetics that underlie autism as well as what the high metal retention might mean for these kids.

(40)

So, we’ve talked about body burden as if it’s this huge revolution, but really bio monitoring is a really old science. And for instance, 30 years ago, a dentist in Rochester found Scotchgard in the blood of the general population. He was doing fluoride research, and he identified an organo-flourine, and he said “Wow, that’s Scotchgard.” That was 30 years ago, and yet it wasn’t until 1999 that Three M finally gave data to EPA saying, “Yes, we’ve polluted the blood of the general population.”

Occupational medicine for a long time has relied on body burden data – to set safe limits, to find when workers have been overexposed. But here’s what’s new about the body burden data that we’re talking about now – there’s three things. First of all, we finally have methods sensitive enough to find a large array of chemicals in the general populations that have detection limits that are relevant to our exposures. Second, we’ve got a growing number of low dose animal studies from a growing number of universities, that are telling us that levels relative to the general population, low doses are in fact quite toxic in ways that high dose studies can’t predict. And then third, we’re really gaining a new understanding of how genetics and timing of exposure influence health outcomes. And with those three pieces put together, we’ve really got body burden science positioned at a point where it can really help advance public health protections.

(40 again)

So this is my final slide. This is what I think the future holds, or what I hope it holds. First of all that public health protections will be increasingly grounded in body burden science. Second, that body burden studies will increasingly be used as tools for local activists, and third, that we’ll continue to see this exploding science on the confluence of pollution and genetics and disease.

Thank you.

Question and Answer Period:

1) You said you tested for five metals but you only find four. What was the metal you didn't find?

A: We tested for Chromium but we had a really horrendously high detection limit. It happened to be a test that Pacific Toxicology could run, but we didn't find Chromium in our test subject. It was probably there, we just had a lousy detection limit.

Q: As far as environmental issues, when we decide to go and clean our houses out now, to get rid of the Teflon, do you recommend us throwing it away, because we can't really recycle it – because I'm thinking of all the chemicals that I have in my house – do I just throw them in the garbage can?

A: The chemicals that are in our blood are not the same as the chemical that is used in Teflon pans. That's a really large polymer that we probably don't absorb very well. The danger with Teflon pans is overheating them, because then that polymer breaks down and then we are exposed to the Teflon chemical that we call PFOA, or C8 that is easily absorbed into our blood. So, at temperatures that exceed 500 degrees, for instance, Teflon does begin to off-gas toxic perfluorinated chemicals. And so the trick with Teflon is not to overheat it. And, if you're concerned about the environment, it's a great idea not to support the Teflon industry because it relies on perfluorinated chemicals and produces a great deal of perfluorinated pollution in the environment. But the bigger exposure concern for perfluorinated chemicals are carpet treatments, fabric treatments and food packaging. These are the lower molecular weight chemicals that we can absorb like C8, PFOA, Teflon Scotchgard, and those are in fresh fries, bread, milk, drinking water, and a huge host of consumer products. So one way to minimize exposures to those chemicals is to forego optional stain treatments when you're buying new products, and eat fewer packaged foods – those are some practical things you can do to reduce exposures.

Q: How many of the flame retardants are coming from computer usage.

A: There's a variety of sources of fire retardants. And one is: they're used in electronics. They're also used in furniture, in polyurethane foam, carpet padding, and just a host of other consumer products. There's a huge range of ways through which we could be exposed to PBDEs, and it also includes foods, because these chemicals build up in the food chain, and fish in particular are a source of PBDEs. So from a practical perspective – a what you can do perspective – there are some companies that are starting to offer furniture that's free of PBDEs, such as IKEA, so that's one thing to look for.

Q: When you talk about food packaging, what are you referring to?

A: One really common source of how perflourinated chemicals get into our blood is food packaging. So, these chemicals are used to coat things like French-fry boxes and pizza boxes because they provide grease repellency. So they're used in McDonalds French-fry boxes. Some studies from Canada show extraordinarily high levels of perflourinated chemicals actually leeching into the French-fries themselves.

Q: Is anybody developing a systematic list of recommendations and alternatives, because whenever you hear information, the next thing is, well what should I do.

A: Yeah, I think a number of groups or working on that. Some of the recommendations that we make when we release studies are just really common sense things. We get a lot of calls from people who just say, "What can I do?! I don't want these chemicals in my body. Not all of these exposures are avoidable, but there are some ways you can minimize your exposures. And those include things like just eating organic when you can – that will reduce your pesticide load, eating fewer packages/processed foods. Eat more fresh foods because you'll avoid all the chemicals that are used as food contact substances and direct food additives. Eat lower on the food chain – eat fewer fatty meat and dairy products – because many of the chemicals we're talking about do build up in the food chain and that's one of the primary reasons we're exposed. Simplify your cleaning regimen – isn't that something we all want to do? Like if we all went back to soap and water instead of the ten bottles of household cleaners we have on the shelves that we do inhale and absorb through our skin, we'll reduce our body burdens to those chemicals. So there are some really simple things we can do.

Q: I have kids in elementary school and there were some fires around last year, so the fire department said that if any place in the school was going to be covered with more than 20% flammable materials, and we were all mumbling and wondering – there was no information on the bottle. I thought I could find information myself, but I was frustrated, so I went to the principle of the school and asked her to get the info. She got the product information, but there was nothing about the contents of the product. How can you find out?

A: That a big problems – that consumers sometimes don't have the information that they need to make good choices.

Q: How can you find out?

A: You can try calling the company, and asking them. And a lot of the times when we do that, the company will give more information than what you might otherwise get. But the safe thing to assume is that it does contain brominated chemicals that you don't want to be exposed to.

Q: Is there an industry standard?

A: Well, one would assume that they're making it in the cheapest way that they can. The industry is going to shift away from penta and octa, which are what appear to be the most

toxic formulations of PBDEs, but we'll see increasing uses of deca, and of course there's now – I think today – a bunch of studies ran on Emerging Science on deca showing that its breaking down in the environment into the more toxic formulations, so we may not be really seeing a big improvement in those chemical shifts. And really one of the smartest things we could be doing is shifting to materials that are less flammable. What you don't want to do is remove fire retardants and expose people to more of a risk from fast spreading fires, so the smart solution is to change the materials so they're less flammable and we don't need these chemical additives that end up in our bodies. So you can do that at a personal level just by wearing cotton pajamas, or look for labels that don't tell you that there is a flame retardant added.

Q: A couple of related questions – I wonder if you could say anything about the 164 companies which you sites in your study – what their reaction has been from a product liability standpoint. And then what's your view on the precautionary principle as a potential tool to use in this case in the United States. It's being used in Europe – how do you see the potential for that here.

A: The chemical industry tends to speak through groups like ACSH – the American council on science and health, and groups that are industry funded that have scientific spokes-people that rebut studies showing that chemicals are harmful to human health. So a broad study like this that doesn't necessarily target a Dow chemical or a Dupont chemical doesn't really see a response from a particular company, but it does see a broad push-back from industry, what we call "industry front groups," that will attack in all the typical ways. For example: "There's no definitive link between a person's personal cancer and their personal exposures." These are things that we're all in agreement with, actually, in the end.

And the precautionary principle's been adopted in a couple of local places in the U.S. – San Francisco, and there's a push in Seattle, I know. My fear with the precautionary principle is that it's been systematically attacked by those who oppose it, and it's been equated with – the use of the precautionary principle means that there is no science. That's sort of how the people who oppose it are painting it, when that's not in fact the case, at all. So I think what you need to do, for those who favor the precautionary principle, which is most of the people that I work with, really fight against the sort of demonizing of the term, because the precautionary principle really means at its essence to take the science that you have and to use it in a very smart way. So if there's a question, err on the side of health protection. If one study says this, one study says that, err on the side that will protect health, because that's the smart thing to do. It is almost always the case that the more deeply we study chemicals, the lower and lower the safe dose falls, because there's just so little we know about chemical toxicity, really, in the big picture, so the safe dose always goes lower and lower through time.

Q: I live in a neighborhood here in Portland where we have monitored our own air quality, and we have found verified levels of a whole suite of metals, especially lead. We have a DDQ which is going to permit a foundry on the edge of the neighborhood to emit

another half ton of lead. What can we tell people about how to get lead and other heavy metals out of our body. We need to be able to offer something.

A: I mean, you'd like to work at the angle of preventing it from being emitted to the air in the first place. Lead has a half-life in the body of 30 years, so once it's in the body it's there to stay. Some things that some parents are doing are going to health care providers who will do "chelation therapy," trying to rid the body of some of these metals, and there's a lot of debate about those therapies. People who do those therapies swear by them, and then there's just a whole lot of unknowns. What does it mean to remobilize all these chemicals from the organs where they're stored and push them back out in the body? does that increase toxicity overall compared to just letting them sit where they are? I think there's a lot of debate.

Q: I'd like to say something. I grew up being healthy here in Oregon. But seven years ago I was diagnosed with mercury toxicity, my whole immune system shut down, and my doctor did have me go through chelation therapy and I'm well now.

A: Yeah, and I've heard that from people who get their fillings removed suddenly have health symptoms that disappear. But the burden shouldn't be on us to decide how to rid our bodies of chemicals when really the emphasis should be on minimizing our exposures in the first place. It puts a lot of burden on health care providers and on the individual people who are trying to make decisions about how to improve their health.

Q: Do you know of any prospective are there any body burden studies being done on ... fine and good to look at adults and their body burdens and why they get cancer. But as a pediatrician my interest is why does 1 out of 156 of my patients have autism when they know that there's some definite differences on brain groove in utero in babies, there's definitely some in utero things going on, and that directly correlates with maternal health, maternal body burden. But you don't get a diagnosis until an average age of 7, and you can't go back and look at it. You can't even ask a mom 7 years ago what chemicals were you using, what environmental >> did you have, where did you live. You can't really get that history in a meaningful way. Is anyone taking blood samples and holding them for 10 years and then seeing if there are some answers.

Dr. Rothlein: In short they are. Long term studies are being done...

Jane: And the CDC and the EnHeinz Program is testing some kids down to grade school age. But one of the factors we faced in our study was it's more difficult to draw blood from infants that the young. It's more tricky to get approval and it's much simpler to test adults.

Q: Are they doing serial blood samples to look at the effects during different parts of in utero development?

A: I haven't seen any studies that do serial blood samples. For instance, the study in the Faroe Islands that targeted about 1,000 pregnant women and their babies, did one blood

draw, fetal cord blood, mom's blood, hair analysis. But the analyses can be prohibitively expensive, so that can be one holdup to doing a big series of studies – the huge number of people in some of these studies.

Q: Well, we keep talking about mercury in tuna, and 1 in 8 women have too much mercury. But I think almost every American woman has mercury in their mouths from dental fillings. Wouldn't it be precautionary to phase out mercury amalgams altogether from women of childbearing age and children?

A: Yeah, I think it would make a lot of sense not to use mercury amalgams at all anymore. In the CDC – their next bio-monitoring round – they'll speciate mercury and really be able to look in depth at the contribution from seafood versus the contribution from fillings, so we'll know a lot more. Because it is a big question how much of the vapors that we're inhaling from our fillings end up in our blood and how is that metabolized.

Q: I'm a little confused with the information presented about the autistic children compared to non-autistic – in the hair analysis. The hypothesis was that they were not excreting it as much. So, were there some samples that measured to see if they had higher levels in their bodies?

A: That study focused only on hair samples. It would have been more powerful had they also tested blood or another internal tissue. So they were able to say, based on this, this is our theory is that these kids are not excreting mercury as readily. And then the second study, in tandem with that, gives us a fuller picture, where when they're chelating autistic kids, more mercury is being excreted. And I think we will see the study that you are alluding to in the future – there will be more and more studies on heavy metals. Blood testing, other kinds of tissue testing and testing for polymorphism.

Q: A lot of us have the perception that a lot of these chemicals get through by big business making money. I'm wondering if we're also having big businesses (i.e. the insurance agencies) paying a lot more attention to body burden that's showing that a lot of disease costs could be potentially preventable.

A: Wow, that's a great thought – we've never talked to insurance companies about this issue. You know, lead testing in kids has been around for a long time, right, and one thing we know is that HMOs are required to test kids in some states for blood lead, and in California and now Ohio both, we're finding that that testing is not being done, the HMOs are getting paid anyway, there are a lot of kids that are slipping through the cracks, so even when we try our very hardest to use that system to identify problems it doesn't always work. And I have never seen an insurance company step forward in a proactive way and talk about body burden being a disease cause, and what can we do to minimize body burdens, so that would be a tremendous step forward if that happened. That's a good idea.

Q: I was impressed to see that Bill Moyers was one of your study participants. How did you persuade him to participate and will he help in any way to publicize the results.

A: You know, he did. He was an enthusiastic participant, and did a PBS special on his test results that was really compelling. It was called Trade Secrets.

Q: What's the next step? How will this be transferred into a political solution.

A: Body burden science is exploding, so in a lot of ways it's just a ball that's going to keep rolling. We see more and more researchers at more and more institutions using body burden data to try and establish links between health and exposures. So, where is it going? It's going in a lot of different terrific directions. We're just going to keep seeing it explode.

Q: Is this administration cooperating at all?

A: I have been so pleased that CDC's funding for bio-monitoring hasn't been cut. That's been one of the highlights of my last few years. One of the big things that we need, really, to solve the problem of body burdens and the health impacts that carries with it is to reform TSCA (Toxic Substances Control Act), the big law that regulates toxic chemicals in the US, and it's such a bad law from start to finish, and it needs such an extensive rewrite, that it's been really resistant to reform. And we're not going to see that law reformed in the next year, but it is something that a lot of groups like mine work for in the big picture – it's part of a long-term goal.

Q: Isn't FIFRA just as bad?

A: Yeah, but FIFRA, at least in the food arena we have what environmentalists call the best health protection law for pesticides in food, because it requires 120 up front safety tests, it requires EPA to look at all chemical exposures in combination, chemicals that cause common health harms which they've done cumulative risk assessments from multiple chemicals now, so in this arena of pesticides in food, we have a great law with some really good, strict health protection standards. And it's sort of held up as a model for what TSCA should be like.

Q: Do you bring these tests to rural communities, like the Native American population or other populations that depend on USDA Food Programs?

A: Some programs do, and one thing that CDC found in its really large bio-monitoring program is that while we're seeing progress in lead – so lead levels in kids are dropping – that's really not happening in the urban poor. So when you do focus the tests down into particular parts of the country, geographic areas or particular sociodemographic areas, you do see big differences in the ways that people are exposed. And it makes us smarter about how to do interventions to advance public health. So now we know. We need to work harder on lead prevention programs and testing programs for that group. You know,

we tested nine people in our body burden study. If we'd had a million dollars we could have branched out to a lot more diverse communities and groups.

Q: I'm 80 years old and have three great granddaughters, and a few other problems I'd rather not discuss right now, but I have a really strong feeling that Ronald D. Lang asked a good question for our time. He said, "With the conditions of the world, is it time to ask whether 'normal' is 'sane.'" And I feel like we have such terrible political power plots in this country, that we need plot prevention or plot busters. And also, one of our friends used to be assistance secretary of health, HHS, for medical affairs, and he gave a magnificent speech to the Chamber of Commerce in Oklahoma City during health week about the fact that if we had a comprehensive health education in the United States, we could cut our medical costs in half. And there are some wonderful pilot projects, and I understand Beverly Hills has a really great one – does anybody know about it. Anyway, I just think there are a lot of things that are going on that are really good – that we need to somehow get a critical mass of radical sanity.

Q: Could you say a little bit about phalates, how we're exposed and what the effects are.

A: So, one of the things phalates do is target the male reproductive system in the womb. So in animal studies, phalates are linked to a spectrum of harms – undescended testicles, testicular cancer, hypospadias, which is a deformity of the penis. And women of childbearing age – one of the ways they're exposed is through cosmetics. We ran a testing program two years ago. We tested 72 name brand cosmetics, and we found phalates in 3/4 of them. So they're in products that we're smearing on our skin, and of course we're absorbing them and we're inhaling them – it's a huge component in nail polish as well. But you know, phalates are also common plasticizers used in a lot of other products like shower curtains. My group happens to have worked on cosmetics, so I know a lot in that arena. But it is the case that we're all exposed to phalates – and we can metabolize phalates and excrete them pretty rapidly over a period of days, so the fact that CDC found them in basically every person that they tested says that we're exposed basically every day.

Q: Do they have a different chemical name?

A: Well, phalates is a family. One of the most famous phalates is called DEHP, and a lot of the work on DEHP has been done in the health care arena because its used in plastic tubing for IVs and a number of prominent medical supply manufacturers have phased out the use of phalates because neonates are so highly exposed through those rounds. But Buetylphalate is another one – that's the most common phalate in cosmetics – Dibutyl phalate nail polish.