Environmental Health Education: A Fort Worth, Texas, Case Study

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Abstract
This paper describes an environmental education project done by an American newspaper. It involved a series of articles based on data from samples for a number of chemicals found in the blood of residents living in an around Fort Worth, Texas, USA. These included two brominated flame retardants, PBDEs, hexabromocyclododecane (HBCD), and concentrations of four perfluorinated compounds (PFCs): perfluorooctanoic acid (PFOA), perfluorooctane sulfonate (PFOS), perfluorooctanesulfonic acid (PFOSA), and perfluorononanoic acid (PFNA). HBCD had previously not been reported in blood of American residents. The *Fort Worth Star-Telegram* newspaper undertook the project in an effort to educate readers as to some types of chemicals and their levels in the general population of Tarrant County, Texas. The project culminated with the publication of a series of articles on blood levels of selected chemical families with a discussion of these compounds and the reactions of those tested.

Introduction
Concerns have been growing in the public for years about widespread exposure of polybrominated diphenyl ethers (PBDEs) and perfluorochemicals (PFCs) found in a wide array of common household products, ranging from carpets to seat cushions to non-stick cookware. Previous studies have found US human milk PBDE levels to be the highest in the world, approximately 10-30 fold higher than reported in Europe(1). Similar high blood PBDE values from blood collected in 2003 were seen when compared to that collected in 1973 but far lower levels in dioxins, dibenzofurans and PCBs were detected in the 2003 specimens (2). Other studies reported high levels of PBDEs in US household vacuum sweepings and in wipings from office computers and computer monitors (3). Other studies have found levels of PFCs in American residents to be higher than any place in the world, and that prolonged use of PFCs in a wide variety of applications, such as paper and packing products, stain-resistant textiles and cleaners may be a major source of human exposure to these compounds.(4) In April 2006, the *Fort Worth Star-Telegram* embarked on an environmental health education project designed to inform persons living in and around Fort Worth and Tarrant County of the levels of these and other toxic man-made chemicals in their bodies. The project was expensive, costing about $23,000. The paper undertook the project because of increasing public debate over whether these chemicals found in many common household products are in people and making them sick. PBDEs are thought to contribute to nervous system alterations, reproductive and developmental disruption, endocrine disruption (5) and cancer (at high doses) (6). The paper examined the levels of various toxic chemicals in the blood samples of 12 Tarrant County residents, ranging in age from 10 to 64. The goal was to use the 12 study participants to put a face on the evolving and extremely complex topic of toxic chemicals now being found in Americans. We analyzed dioxins: 2.3.7.8-Tetra-CDD, 1.2.3.7.8-Penta-CDD, 1.2.3.4.7.8-Hexa-CDD, 1.2.3.6.7.8-Hexa-CDD, 1.2.3.7.8.9-Hexa-CDD, 1.2.3.4.6.7.8-Hepta-CDD, OCDD; dibenzofurans: 2.3.7.8-Tetra-CDF, 1.2.3.7.8-Penta-CDF, 2.3.4.7.8-Penta-CDF, 1.2.3.4.7.8-Hexa-CDF, 1.2.3.6.7.8-Hexa-CDF, 1.2.3.7.8.9-Hexa-CDF, 2.3.4.6.7.8-Hexa-CDF, 1.2.3.4.6.7.8-Hepta-CDF, 1.2.3.4.7.8.9-Hepta-CDF, OCDF; dioxin like PCBs: 3,3',4,4'-TCB (77), 3,4,4',5-TCB (81), 3,3',4,4',5-PeCB (126), 3,3',4,4',5,5'-HxCB (169), 2,3,3',4,4'-PeCB (105), 2,3,4,4',5-PeCB (114), 2,3',4,4',5-PeCB (118), 2',3,4,4',5-PeCB (123), 2,3,3',4,4',5-HxCB (156), 2,3,3',4,4',5'-HxCB (157), 2,3',4,4',5,5'-HxCB (167), 2,3,3',4,4',5,5'-HpCB (189); marker PCBs: PCB # 28, PCB # 52, PCB # 101, PCB # 138, PCB # 153, PCB # 180; PBDEs: BDE # 17, BDE # 28, BDE # 47, BDE # 66, BDE # 71, BDE # 77, BDE # 85, BDE # 99, BDE # 100, BDE # 119, BDE # 138, BDE # 153, BDE # 154, BDE # 183, BDE # 209; perfluorinated compounds: PFOA, PFOSA, PFNA, PFOS; pesticides and others: β-HCH, α-HCH, γ-HCH, δ-HCH, o,p-DDT, p,p'-DDT, o,p-DDD, p,p'-DDD, o,p-DDE, p,p'-DDE, pentachlorobenzene, hexachlorobenzene, heptachlor, cis heptachlorepoxid, trans

heptachlorepoxid, aldrin, dieldrin, endrin; polybrominated biphenyls: PBB #15, PBB #49, PBB #52, PBB #101, PBB #153; brominated dioxins: 2.3.7.8-TBDD, 1.2.3.7.8-PnBDD, 1.2.3.4.7.8. / 1.2.3.6.7.8-HxBDD. 1.2.3.7.8.9-HxBDD; brominated dibenzofurans: 2.3.7.8-TBDF, 1.2.3.7.8-PnBDF, 2.3.4.7.8-PnBDF, Hexa-BDF; and HBCD.

Materials and Methods

The 12 study participants were recruited by the *Fort Worth Star-Telegram* and Lone Star Screening in Euless, Texas. Lone Star labs drew 80 ml of blood from each study participant. Potential participants were eligible for inclusion criteria if:

1. They currently lived in Tarrant County.
2. They were a non-smoker.
3. They never worked at a chemical factory, power plant, or manufacturing facility.
4. They had no serious pre-existing medical condition.
5. Were $\geq$ 6 years of age and:
6. If an adult ($\geq$ 18 years of age), they agree to participate in the study and provide signed informed consent.
7. If a child $\geq$ 6 years and < 18, their guardian agrees and provides signed informed consent for their participation in the study.
8. If a child $\geq$ 7 years and < 18, they agree and give assent and their guardian provides signed informed consent.

Results and Discussion

The samples, analyzed by Eurofins-ERGO laboratory, found levels of PBDEs and PFCs in all 12 study participants at levels consistent with previous studies. Hexabromocyclododecane flame retardant levels were found to be similar in the general population in the USA and Europe, unlike PBDEs where US levels far exceed European levels (7). Summary statistics are shown in Table 1. These chemicals, in high enough amounts, in some people, as in animal studies, are thought to cause cancer, reproductive and developmental alterations, endocrine disruption such as thyroid system change, nervous system changes, and possibly other changes in health.

The series of articles made the points that residents in Tarrant County are no different from almost everyone in America in that they have at least trace amounts of very toxic, and extremely persistent, chemicals in their bodies. There is an ongoing debate over the significance of this fact. A tremendous amount of research is underway, but the general consensus among most experts is that having these toxic chemicals in our bodies is harmful because it makes us more susceptible to a host of serious health problems. Not everyone will experience health problems related to these chemicals but, on a population basis, some will. These chemicals impair the body's immune system, increasing the risk for health troubles at some point in the future. The analogy was made to a game of Russian Roulette that each of us plays unknowingly. Others correctly note that Americans are currently living longer than before, and that these chemicals have made life better for all of us in many ways. But there is very little research on the health effects of each chemical individually, and little or no research on the cumulative health effects of exposure to the entire mixture of chemicals.

A series of news stories based on the chemical blood levels, and interviews with the 12 study participants, was published on Dec. 3-5, 2006. The stories were careful in substance and tone to educate residents about the issues of toxic chemicals in humans, and were careful to explain that just because certain chemicals were measured in the study participants does not necessarily mean the health effects associated with the chemicals will occur. The stories studied in detail recent ground-breaking research on this evolving subject, and quoted extensively leading researchers and their views on the issue.

Reaction to the news series was significant. Nearly 100 people from all over the US telephoned or e-mailed the *Fort Worth Star-Telegram*. Most seemed grateful to learn that so many of these chemicals in commonly used products

were in all 12 study participants. “Is it possible to get a free test for Chemicals like the 12 in Tarrant Co. Texas?” wrote John Pace of Rexburg, Idaho, in a Dec. 3, 2006 e-mail. Others were concerned about the regulation of chemicals. “The chemicals of concern we face today were placed on the market at a time when there was no regulation whatsoever,” wrote Joel A. Tickner, an assistant professor in the Department of Community Health and Sustainability at Lowell Center for Sustainable Production School of Health and the Environment at the University of Massachusetts. “The root cause of our chemical self-slaughter is a glaring lack of government/consumer oversight on the front end of product release,” added Brian Lavelle of Spring Grove, Minnesota. Diana Kropf-Gomez, an adjunct professor at Dallas County Community College who teaches a class called "People and the Environment," wrote that she planned to use the news series “in my next class which starts in January 16th, 2007.” There were some readers who reacted with fear. Some threw out their Teflon cookware. Margaret Heglund of Seal Beach, Calif., wrote to say she was recently diagnosed with a breast tumor. “Most of my pots and pans are Teflon coated. Am I looking at the cause of my cancers and should I get rid of all these items?” Others felt the stories confirmed their worst fears. “I believe that many of the health concerns people have are in fact due to chemicals through our food supply, beauty products and off gassings of modern products such as carpeting, pesticides and food additives,” wrote Kristy Moore Hernandez, of Miami Shores, Fla., in a Dec. 4, 2006 e-mail.

References:

1) Schecter A, Pavuk M, Päpke O, Ryan JJ, Birnbaum L, Rosen R, Environ Health Perspect, 2003. 111(14):1723
2) Schecter A, Päpke O, Tung KC, Joseph J, Harris TR, Dahlgren J, J Occup Environ Med, 2005a. 47(3):199
3) Schecter A, Päpke O, Joseph JE, Tung KC, J Toxicol Environ Health A 2005b. 68(7):501-513
4) Kannan K, Corsolini S, Falandysz J, Fillmann G, Kumar KS, Loganathan B, Ali Mohd M, Olivero J, Wouwe N, Yang J, Aldous K, Environ Sci. Technol 2004. 38(7): 4489-4495.
5) Birnbaum LS, Staskal DF. Environ Health Perspectives. (2004), 112:9-17.
6) NTP. Toxicology and Carcinogenesis Studies CAS No. 1163-19-5 Research Triangle Park, NC: National Toxicology Program. 1986
7) Ryan, J.J., Wainman, B.C., Schecter, A., Moisey, J., Kosarac, I, Sun, W.F. Trends of the brominated flame retardants in human milks from North America. Short Papers from Dioxin 2006, 26th International Symposium on Persistent Organic Pollutants, Oslo, Norway, Organohalogen Compounds 68: 778-781

Table 1: Selected Fort Worth Blood values (N=12)

Chemical	Compounds	Mean	Median	Range
Dioxins Toxic Equivalents (2005) pg/g, lipid based	Dioxins and dioxin like compounds	8.29	7.62	1.13 – 18.84
Polybrominated diphenyl ether ng/g, lipid based	Total PBDEs	71.70	50.80	13.12 – 190
Perfluorinated Compounds µg/l based on whole blood	PFOA	1.98	1.00	1 - 5.7
	PFOSA	1.00	1.00	1.00
	PFNA	1.00	1.00	1.00
	PFOS	9.01	7.70	3.9 - 17
DDT pg/g based on whole blood	o, p-DDT	60	2.6	1.9 - 742
	p, p'-DDT	70	10.5	4.4 - 760
DDT metabolites pg/g based on whole blood	o, p-DDD	80	0.9	0.6 - 932
	p, p'-DDD	80	2.2	1.1 - 967
	o, p-DDE	100	50	0.8 - 711
	p, p'-DDE	650	50	148 - 1692
Hexabromo-cyclododecane ng/g, lipid based	HBCD	5.51	5.32	3.62 – 8.89