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TOXIC TRADE-OFF

Flame retardant risk stokes debate

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SECOND OF THREE PARTS

Charlotte Landon is meticulous about avoiding toxic chemicals.

The 59-year-old retired Fort Worth nurse has spent hours researching the issue. She can talk at length about lead in dishes manufactured in China, and she worries about whether milk contains formaldehyde -- she says she can detect the chemical aftertaste.

"I'm at the store reading all of the labels closely," she says, pretending to closely inspect an imaginary can. "Nope, not buying that."

But there's at least one group of chemicals she didn't even realize she needed to think about.

Landon has numerous chemical flame retardants in her blood, a *Star-Telegram* research project found. Those chemicals are used extensively in a host of household products and are commonly found in food and dust.

Working with a consultant from the University of Texas School of Public Health in Dallas, the *Star-Telegram* paid to have blood samples from 12 Tarrant County residents analyzed. The samples were tested for 83 toxic chemicals, including 15 of the most common flame retardants, called polybrominated diphenyl ethers, or PBDEs. The analysis found low levels of 14 of them in the study participants.

No one is sure what levels in the body might lead to health problems. But animal studies have found that the compounds can cause reproductive and neurological problems, disrupt hormonal balance and increase the risk of certain types of cancers.

Once in the body, they stay there for years.

Landon had the highest levels among the study participants, though the concentrations were consistent with results from a growing number of national studies.

"You think you purchase a product, you think it's safe, and you have no idea," Landon said. "We haven't been educated enough."

Not staying put

Nowhere are brominated chemical flame retardants more widely used than in the United States.

They're in the seat cushions of chairs in many homes, cars and airplanes. They're found in carpet padding, TV and computer wire insulation, mattress stuffing, waterproof jackets and Styrofoam.

They are put into these products for a good reason: They help prevent the spread of fires.

"It's important to always remember with flame retardants, they have a purpose," said Linda Birnbaum, a toxicologist at the federal Environmental Protection Agency and an expert on toxic chemical effects. "They're there to prevent fires, and they do that."

But the compounds don't stay in the seat cushions and computer wires. Instead, they appear to be leaching into the environment.

"They're in everything," said Ron Hites, a chemist at the School of Public and Environmental Affairs at Indiana University who has extensively researched flame retardants. "They're in people, fish, sediment, polar bears, herring gull eggs. And they're also relatively stable in the environment. They don't degrade very fast."

Scientists have found that PBDEs can pass from a woman to her baby through breast milk. One study found PBDEs in the breast milk of 47 women in Dallas and Austin.

It's also been shown that they can travel great distances through the air and water.

In January, Canadian researchers found flame retardants in the blood and fatty tissues of polar bears in the Arctic, one of the world's most desolate places. The PBDEs, according to a study published in the journal *Environmental Science and Technology*, were likely carried from the continental United States by winds and ocean currents.

The *Star-Telegram* analysis found what may be more evidence of that migration.

A flame retardant used predominantly in England and Ireland -- but never before tested for in the blood of U.S. residents -- was

found in all 12 volunteers at levels higher than the averages measured in most Europeans. That flame retardant -- hexabromocyclododecane -- is used in limited amounts in the United States.

"I'm surprised," said Larry Needham, a research chemist in the federal Centers for Disease Control and Prevention's environmental health laboratory in Atlanta.

The chemical industry, however, says that just because flame retardants are being found in people, that does not mean any harm is being done.

"I think that it is overblown," said John Kyte, North American program director for the Bromine Science and Environmental Forum, an industry trade group that represents PBDE manufacturers.

"We're evolving toward this detection-equals-danger mentality, when in science it always has been, and it still is, the dose determines the danger. And if you don't have the dose at a certain level, you don't have the danger," Kyte said. "But what we're doing is evolving to sort of a public perception that the presence of something alone equals a danger. And that's just not common sense, and it's not good science."

Still, U.S. manufacturers have voluntarily pulled two toxic PBDEs from production.

And many other companies that sell products containing brominated flame retardants have found alternatives.

IKEA, the Sweden-based home furnishings chain, has eliminated PBDEs in furniture, mattresses and carpets, and Volvo has prohibited the use of several flame retardants in its vehicles. Dell and IBM no longer use PBDEs in their computers, and Sony has committed to replace them with an alternative.

But even if all companies stopped manufacturing flame retardants today, it would be decades before they disappeared.

"The problem is that the stuff is still everywhere," said Tom Webster, an epidemiologist at the Boston University School of Public Health. "It's all over the place. It's in your home, and it's in my office. It's being thrown out into landfills. It's not like this stuff is going to go away, even though maybe we do not manufacture it anymore. So there's still a huge reservoir of exposure."

Unexpected difference

It's not uncommon for relatives living under one roof to have very different levels of flame retardants, and medical researchers don't know why.

Consider Brianna and Desiree Koehn of Arlington.

Both participated in the *Star-Telegram* study. Both are intelligent and athletic and eat a relatively healthy diet.

That's where the similarities end.

Brianna, 21, is pencil-thin and extremely careful about what she eats. Her favorite breakfast: organic eggs cooked in flaxseed oil.

Her doctor told her last year that she needed more fiber and less meat. She estimates that 80 percent of her meals are salads.

"I have to eat right, or I just get sick," she says.

Sister Desiree, 18, isn't nearly as conscientious about what she eats. She hates the vegetarian dishes her sister cooks, and she likes teasing her about it.

"I eat what I want," she says. "I never get sick."

"Not yet," Brianna says.

"I never will," Desiree shoots back, laughing.

But the levels of flame retardants measured in their blood don't seem to reflect their lifestyles.

Brianna's blood has 154 parts per billion of PBDEs.

Desiree's: 42 parts per billion.

How can two sisters less than three years apart in age and living in the same house have such different levels of flame retardants in their blood?

Brianna and Desiree Koehn don't know.

Neither does Dr. Arnold Schecter, a public-health physician at the University of Texas School of Public Health in Dallas who has led groundbreaking research on flame retardant exposures in people.

He said the disparity between the two is "kind of what we've been seeing on a population-wide basis -- big variations."

It could be due to any number of factors, such as metabolism, how long people are outside the home and where they work, he said.

What is clear is that levels of chemical flame retardants in people are rising sharply. They have been since widespread use began, in the 1970s.

Schechter led a 2005 study that analyzed archived blood samples and found that levels of PBDEs increased dramatically between 1973 and 2003.

Schechter is working with the CDC on a much broader survey of flame retardant levels in Americans, with the results expected to be released early next year.

But studies by Schechter and others have already found that brominated flame retardant levels in U.S. residents are far and away the highest recorded.

"We in America have managed to pollute ourselves with these types of flame retardants worse than anywhere in the world," Schechter said.

Food and dust

A growing body of evidence indicates that flame retardants are getting into the environment from a number of common household products.

The bigger mystery: How do they get into people?

Some obvious suspects have started to emerge.

Food is one. Schechter led a 2004 study in which researchers found flame retardants in the fatty tissues of fish, meat and dairy products being sold by three major supermarket chains in Dallas. Retardants were also measured in ice cream, eggs, milk and butter.

But the concentrations in food alone cannot explain the widespread level of flame retardants in people, Schechter and Birnbaum, the EPA toxicologist, concluded in a study published in October.

They pointed to another major source: dust.

In early 2005, Schechter found PBDEs in dust samples from computer monitors and carpets.

Other researchers like Webster, the Boston University epidemiologist, have reported similar results, pointing to a strong relationship between the levels of PBDEs in people and the levels in house and office dust.

"It could be you're breathing it in," Webster said. "It could be the dust is getting on your skin and you're absorbing it that way, or you're eating the dust by accident. You know, you don't wash your hands before eating."

Health experts fear that children are the most susceptible.

"Kids have a much higher exposure than adults because they're down in the dust a lot more," Webster said. "If you have little kids, you know how they stick everything in their mouths."

The state of Washington is so concerned about flame retardants that its Health Department has advised residents to vacuum their homes and offices frequently and wash their hands after cleaning to avoid exposure to dust laced with PBDEs.

In the *Star-Telegram* study, Lamar Calvert of Euless had some of the highest levels of flame retardants in his blood.

Calvert, 35, said he believes he was exposed while working in dusty environments as a hotel clerk. He said it also has something to do with his favorite pastime -- watching TV.

"When I have some spare time that's where I am," he said. "Lounging around the house."

A solution -- or not

Government regulators thought they'd found the solution to the problem.

In December 2004, Great Lakes Chemical Corp., now Chemtura Corp., voluntarily agreed to withdraw two of the three most widely used PBDEs.

In the first, designated penta, most molecules have five atoms of bromine each; in the second, designated octa, most molecules have eight atoms of bromine each.

Great Lakes was the only U.S. company that made them. The European Union has already banned them.

Of lesser concern was deca PBDE, which is in wide-scale use in the United States. Though deca, in which most molecules have 10 atoms of bromine each, has been found to cause cancer in laboratory rats exposed to very high levels, it is believed to be less toxic and less persistent than the other two.

But banning the two more toxic mixtures may not work out as planned.

New evidence suggests that in the body and environment, the deca PBDE degrades into the more toxic penta and octa forms.

If so, withdrawing the octa and penta forms may not help much.

The issue is "one of the big controversies in the field right now," Webster said.

Low levels of penta and octa PBDEs were found in the blood of all *Star-Telegram* study participants.

"The industry had been saying for a long time that deca was stable, it didn't break down, it didn't bioaccumulate, it didn't do anything," Webster said. "And that's all turned out to be wrong."

So what can be done?

Few dispute that some type of flame retardant is needed. And there are alternatives to the ones in widespread use today.

They include flame retardants that use chlorine instead of bromine to impede the chemical reaction that produces fire. They are already used in some plastics but are more costly.

The health and environmental effects of such flame retardants have not been studied nearly as much as the effects of PBDEs.

Kyte, the bromine trade industry official, says the deca mixture in widespread use today "is the most studied flame retardant available."

The fact that the alternatives have not been studied extensively "raises issues about their potential environmental or health impacts," he said.

"We would prefer that our product not be found in the environment," he said. "But it's got to be kept in perspective."

POLYBROMINATED DIPHENYL ETHERS

What are they? Synthetic chemicals that help prevent the spread of fire by impeding the chemical reaction that causes it. PBDEs are commonly found in polyurethane foam products, such as the padding in furniture, as well as in textiles, televisions and computers. But they can also be found in food and household dust. They have been measured in virtually every American who has been tested.

What are the possible health effects? The main concern is that PBDEs build up in the body for long periods of time. Data on how PBDEs affect humans are scarce, and no one knows what levels trigger health problems. But animal studies have shown that PBDEs harm the nervous system and alter hormonal functions and the development of reproductive organs. Industry officials say the levels in people and the environment are too low to cause problems.

SOURCES: Bromine Science and Environmental Forum, federal Agency for Toxic Substances and Disease Registry

PHASEOUT

Polybrominated diphenyl ethers used in chemical flame retardants are subject to little federal regulation. But a number of companies are still removing or committing to remove those substances from their products in favor of others that are not suspected of causing harm. Those companies include makers of furniture, electronics, automobiles and mattresses. Clean Production Action, a Spring Brook, N.Y.-based nonprofit group that seeks to eliminate the use of toxic chemicals from common products, has compiled a list of companies that have stopped using or committed to phase out brominated flame retardants. The full list is on the group's Web site, <http://safer-products.org> Among the companies:

Shaw Inc.: The world's largest carpet manufacturer is replacing all persistent toxins used in its products, including flame retardants.

Sony Corp.: The Tokyo-based electronics manufacturer has committed to replacing brominated flame retardants used in televisions and other electronic equipment.

Ford Motor Co.: The automobile giant has replaced all flame retardants in vehicle interiors, where most people would come into contact with them. So has Volvo.

Dell: The Austin-based computer maker has replaced brominated flame retardants in its desktop computers and other products that use plastic.

Serta: The mattress maker has replaced brominated flame retardants in its mattresses.

Herman Miller: The furniture giant has replaced brominated flame retardants in its residential and commercial furniture.

IKEA: The Sweden-based home furnishing chain no longer sells furniture, mattresses or carpet that contains brominated flame retardants.

LAMAR CALVERT

Lamar Calvert pounds the keyboard. The tiny chapel in the middle of a modest Dallas neighborhood next to Love Field erupts in an explosion of music, loud enough to vibrate the church programs in the first few rows.

"Mag-ni-fy the Lord," Calvert belts out, lifting himself off the seat cushion as the choir members, recognizing the song, repeat the chorus in unison. Most of the 30 or so people in the chapel stand up, clap their hands and sing, "Bless-ed be, the rock."

Calvert, 35, of Euless, is passionate about music. After the New Jerusalem service, which runs two hours, he'll drive around the corner to the Greater North Park Church of God and Christ to help with its music ministry. He's not paid to do it; he just likes it.

Calvert believes that the chemicals that the *Star-Telegram* study found in his bloodstream are part of the price he pays for living and working in his community. He doesn't think there's anything he can do to avoid them. His focus is not on his health but on his music.

"This is my ministry," he says. "This is what I was called to do."

Q&A | EPA TOXICOLOGIST

Linda Birnbaum, a toxicologist at the federal Environmental Protection Agency, has been involved in research on dioxins, pesticides and many other toxic chemicals. She is an expert on polybrominated diphenyl ethers, or PBDEs, the most commonly used chemical flame retardants. She has extensively researched, mostly using animal testing, the possible health effects of flame retardants.

The following is an edited version of an interview with Birnbaum.

Many say flame retardants are ubiquitous in our environment. How widespread are they?

Very, very. It's important to always remember with flame retardants they have a purpose. They're there to prevent fires, and they do that, so that there's a real issue of what's the risk-benefit kind of ratio here. But what we're finding with these brominated flame retardants -- whose use has increased dramatically over the past 20 years -- what we're finding is that they are escaping from their products. Either at the point of making the product or during the product's lifetime or at the end of its lifetime, when it's recycled. And we're finding it throughout the world. So that we're finding many of these flame retardants in the Arctic, in totally pristine areas. In polar bears and in fish and in ice. So it's traveling.

Two forms of PBDEs have voluntarily been withdrawn, but because they're so persistent in the environment, we're still going to see them for years to come, right?

That's correct. Now there is some encouragement, like in Sweden. When they stopped using [PBDEs] in about 1990 ... levels continued to rise for a number of years. But then they appeared to have peaked and are now declining. In time, the levels will decline.

What's the main route of exposure? Food? Seat cushions? Dust? All of the above?

The answer is, we're not sure. We don't think food is the major route. We think it is a route, but not the major route. I just published a paper that if you estimate what's in food and how much food people eat and what kinds of food, it can't explain the levels we're finding in the American population. We think that dust is a major source. House dust and office dust. But how it's getting into house dust and office dust, we're not sure. If you take a piece of tissue paper and you wipe your computer screen, and it's a computer screen or a computer that was made and had these chemicals in them, and you had it analyzed, you'll find it coming out in the wipes. So these things are getting out of our consumer products. We don't understand yet, and part of it is we just don't have enough studies that have been done carefully, to understand why your dust is not as contaminated as my dust. People have tried to say, "Well how many computers or how many hair dryers or how many television sets and how many mattresses and how many sofas do you have?" And we haven't been able to come up with any kind of relationship yet. Now the state of Washington has actually gone ahead and suggested to people that in order to reduce their exposure they should vacuum frequently. Whether that's actually helpful or not, we don't really know.

There's this whole issue of chemical body burden. Some say this mixture of chemicals we carry in our bodies is probably causing adverse health effects. Some say there's no proof of that. Is this a legitimate issue, a legitimate concern?

Yes, it's a legitimate issue. We don't know what it means. Yes, there are many chemicals that can be measured in people's bodies. Whether this is a problem or not we really don't know. So therefore, it is a legitimate issue.

Exposure to these chemicals, then, could affect one person but not the next, depending on sensitivity?

There can certainly be differences in sensitivity or susceptibility. But in many cases we don't know what levels would be a problem. ... It's not just one chemical you have. You might have hundreds of chemicals. And of course those chemicals are superimposed upon your own natural physiology and hormonal profile and everything else.

-- Scott Streater

ABOUT THIS PROJECT

Twelve Tarrant County residents volunteered to have their blood tested for 83 toxic chemicals, many of which are used in common household and office products.

The *Star-Telegram* worked with Dr. Arnold Schecter, an environmental-sciences professor and public-health physician at the University of Texas School of Public Health in Dallas. Blood samples were drawn at Lone Star Screening in Euless and sent to ERGO laboratories in Hamburg, Germany.

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Coming Tuesday: Public concern is growing that the chemicals used to make nonstick cookware are leaching into people and the environment. But scientists are coming to believe that the bigger culprit is a host of other common products that use similar substances.

On the Web: For all the stories and additional graphics and video, go to www.star-telegram.com.

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