Growing Threats: Toxic Flame Retardants and Children's Health

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EXECUTIVE SUMMARY

Brominated flame retardants are chemicals that reduce the spread of fire in a variety of common products from fabrics to plastic. First introduced 30 years ago, they are now widely used despite minimal health testing, and they are rapidly building up inside our bodies. The testing that has been done indicates that brominated flame retardants are toxic to development and the levels found in some mothers and fetuses are rapidly approaching the levels shown to impair learning and behavior in laboratory experiments.

This report presents the latest scientific understanding of these toxic flame retardants in North America, their presence in our bodies and the environment, and their likely effects on children's health. Toxic flame retardants pose risks to human health and the environment. Manufacturers of consumer products commonly add flame-retardant chemicals to plastics and other flammable materials to reduce the risk of fire. One class of these chemicals, known as brominated flame retardants, now widely contaminate the environment, are accumulating in the human body, and have the potential to harm human health. The most studied of the brominated flame retardants are the polybrominated diphenyl ethers, or PBDEs. North American industry used 74 million pounds of PBDEs in 1999, accounting for half the world market. These chemicals escape into the environment from common consumer products like home furniture and electronics (including TVs, computers, and others) during manufacture, use, and disposal.

PBDEs are remarkably similar to PCBs, a class of chemicals banned in 1976 because it was found to cause immune suppression, altered sexual development, cancer, delayed brain development, lower IQ, and behavioral problems like hyperactivity in humans. As with PCBs, exposure to PBDEs may be particularly harmful during a critical window of brain development during pregnancy and early childhood.

Levels of toxic flame retardants in people are rising dramatically. Some types of PBDEs concentrate in the fatty tissues of living organisms. As a result, they bioaccumulate, or build up in the food chain, and now can be found in human blood, fat tissue, and breast milk. Initial studies of PBDE contamination of breast

milk indicate U.S. levels are 40 to 60 times higher than levels found in Sweden. Levels of PBDEs in animal and human tissues are growing exponentially, doubling every two to five years. At this rate, tissue levels will increase 100- to 1000-fold every 25 years.

When exposed to sunlight or when ingested by animals, some forms of PBDEs which do not themselves readily bioaccumulate may degrade in the environment into more bioaccumulative compounds. As a result, all commercial PBDE compounds should be considered bioaccumulative for policy purposes.

Levels of toxic flame retardants in people have already reached levels of concern. Recent research shows that PBDE exposure can interrupt brain development in mice, permanently impairing learning and movement. So far, scientists have not identified “safe” levels of exposure that do not produce damage. Additionally, both PCBs and PBDEs are found in humans, and their effects on brain development may be additive. The most highly exposed people may now have PBDE levels within two-fold of the levels shown to damage mice. If PBDE concentrations in people continue to double every 2.5 years, levels found in the average person will reach this threshold within ten years. Experience with PCBs shows that failure to act on early warnings can lead to irreversible environmental contamination and damage to health.

Scientists discovered the first indications of systemic harm caused by PCBs as early as 1937. However, PCBs were not banned until 1976, after hundreds of scientific studies documented widespread exposure and actual harm to human health. Further study showed new forms of health impact caused by lower levels of exposure, which continue to be documented decades after the chemicals were phased out.

Phasing out chemicals leads to reduced contamination and exposure levels. The European Union reduced the use of PBDEs in the late 1990s after finding increasing levels in the breast milk of Swedish mothers and preliminary evidence of toxic effects. Since 1998, concentrations of PBDEs in breast milk of Swedish women have declined steadily. Similarly, PCB levels found in the population began to decline after the U.S. banned the chemical. Reducing exposure prevented further harm to human health.

SAFER MEANS OF FIRE-PROOFING PRODUCTS ARE WIDELY AVAILABLE.

A variety of furniture, plastic, and electronics manufacturers have already deployed products that meet fire-safety standards without the use of PBDEs. Other strategies for flame-resistance include using inherently non-flammable materials and using alternative flame-retardant chemicals. For example, the furniture company IKEA recently replaced brominated flame retardants in fabrics with less toxic chemicals, and the Toshiba electronics company replaced toxic

flame retardants in casings for electronic parts by switching to a non-flammable type of plastic that didn't need any chemical additives.

POLICY RECOMMENDATIONS

The European Union has acted on early warnings of a significant health threat by banning several toxic flame retardants. In early 2003, the European Union officially banned the use of PBDEs and other toxic chemicals in electronics (such as computers and lighting) after mid-2006. A more comprehensive ban on the general marketing and use of several toxic flame retardants in Europe is on track for August 2004.

PHASE OUT TOXIC FLAME RETARDANTS

There are still unexplored aspects of the toxicity of brominated flame retardants, and complete study would take many years. However, the evidence indicates that immediate action is warranted in California and the United States. Given the magnitude of the potential threat to public health, the rapidly increasing levels of exposure, and the availability of alternatives, this report recommends immediately phasing out the use of PBDEs and other brominated flame retardants.

REFORM U.S. CHEMICALS POLICY

The threat posed by toxic flame retardants demonstrates a national failure to effectively protect public health from toxic chemicals used in industry and placed in consumer products. Tens of thousands of industrial chemicals are on the market with little or no information about potential health impacts. Even where significant evidence of harm to public health exists, inadequate resources and legal authority prevent regulatory agencies from taking protective action.

Chemicals that are untested or known to be hazardous should not be on the market or in widespread use and distribution. U.S. chemicals policy should be reformed to ensure that manufacturers and industrial users provide regulatory agencies and the public with adequate information about their products so that agencies can act to protect public health from potentially dangerous substances before damage is done. The case of toxic flame retardants presents an apt case study of the failings of current policy.

INTRODUCTION

California has the toughest furniture fire safety standards of all U.S. states. These regulations prevent fires and save lives. The U.S. Association of Fire Marshals estimates that if the United States as a whole had flammability standards for furniture as strong as those in California, the number of fires would be reduced by 4,000 per year (or 20%), and fire deaths would be reduced by

half, or 400 deaths per year.1

Manufacturers of consumer products use flameretardant chemicals to meet fire safety standards. For the past three decades, one class of chemicals known as brominated flame retardants has been added to products ranging from furniture foam to upholstery fabric to the housings of televisions and other electronics. The use of brominated flame retardants, which contain the toxic chemical element bromine, has created some unanticipated problems. In the emerging case of the polybrominated diphenyl ethers (PBDEs), these problems are becoming all too clear. PBDEs have now spread around the world and are steadily accumulating in the tissues of human beings and other animals. From the breast tissue of women in San Francisco to the blubber of Arctic whales, these toxic chemicals are a much closer part of our lives than their manufacturers ever intended.

Lab research indicates that the toxic flame retardants now found in our bodies have the potential to disrupt the process of brain development in fetuses and infant children. Humans are constantly exposed to a mixture of these chemicals from the first day in the womb. These chemicals may be working together to interrupt normal brain development and produce other toxic effects. At the same time, various studies have found dramatically increasing numbers of children with developmental, learning, and behavior disorders over the last decade, including attention deficit disorder, attention deficit hyperactivity disorder, and autism.2 While it is usually impossible to connect a single chemical to a broad health trend, the National Academy of Sciences recently estimated that toxic exposures play a role in as many as 1 in 4 cases of developmental disorders.3 Toxic flame retardants could be joining lead, mercury, and PCBs among the chemicals responsible for harming children's health and development.

Recent concern about PBDEs is eerily reminiscent of the debate over PCBs, (polychlorinated biphenyls) in the 1960s, which led to their ban in the mid 1970s. After incidents of accidental PCB poisoning prompted concern, scientists found that lowlevel exposure to PCBs was a worldwide problem. After years of study, scientists began to find adverse health effects at PCB levels found in the general population. For example, children born to mothers who had eaten PCB-contaminated fish from the Great Lakes had learning, memory, and behavioral problems. Severe and irreparable damage was found in accidental poisoning victims, including altered reproductive and neural development, immune suppression, and cancer. Even twenty-seven years after these chemicals were banned in the U.S., PCB contamination and exposure persists across the globe today.

Several brominated flame retardants are structurally quite similar to PCBs, and consequently may affect the body in similar ways. As such, brominated flame retardants may have the dubious honor of becoming the modern successor to PCBs.

Fortunately for public health, alternative ways to protect against fire are widely available. Companies are coming up with new ways to design products to be flame-resistant, using inherently nonflammable materials and switching to less toxic chemical additives in their products.

Toxic flame retardants are only one class of many different chemicals in wide use despite inadequate study of health effects and inadequate restrictions on use where health effects are known. Investigating potential hazards and taking regulatory action to protect health when threats are discovered can help lead to a world that is both safe and healthy for our children

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RESEARCHERS LINK FLAME RETARDANTS TO HAZARDS STUDIES INDICATE THE WIDELY USED CHEMICALS AFFECT SEXUAL AS WELL AS BRAIN DEVELOPMENT.

By Marla Cone

Flame retardants, already linked to effects on the brain, can also alter sex hormones, reducing male fertility and disrupting ovary development, according to scientific studies to be released this week.

Environmental scientists gathering in Boston for an international conference are revealing the results of about 100 new studies showing that the contaminants, which accumulate in breast milk, have spread worldwide and are a greater threat to children and fetuses than earlier research indicated.

Although California has a new law that will ban two types of PBDEs, or polybrominated diphenyl ethers, in 2008, experts warn that the chemicals are expected to keep growing in the U.S. environment and human bodies for years to come. Only California and the European Union have restricted their use.

Also, for the first time, scientists are reporting evidence that another flame retardant — not subject to any regulation — poses similar hazards to people and wildlife. The retardant, deca BDE, is used in large volumes in TV sets and computers.

A variety of new studies shows that deca BDE is also accumulating in breast milk and is increasing in the environment, even in remote Arctic lakes. About 100 million pounds of the compound are applied each year to electronics equipment. Because it is not subject to restrictions anywhere in the world, more of it is in use than any other flame retardant.

About 1,000 scientists — mostly from North America, Europe and Japan — are gathered at the Dioxin 2003 conference, which is designed to share research

on contaminants that persist in the environment and accumulate in human bodies and in wildlife.

Many scientists warn that the chemicals pose a toxic threat that is unprecedented since DDT and PCBs were outlawed in the U.S. in the 1970s. Experts are especially concerned about high exposures in the United States, where the flame retardants are most heavily used.

"These chemicals have been shown to be taken up by the body. They hang around a long time and they accumulate. Even when we stop using them, we will have a legacy that will take years to go away. Decades, probably," said Linda Birnbaum, the U.S. Environmental Protection Agency's director of experimental toxicology. The EPA says it is evaluating the risks of the compounds but has no plans to regulate them.

Chemical industry representatives say that the flame retardants are credited with saving thousands of lives worldwide because they have been proved to slow the spread of flames in furniture and electronics. Chemical companies support the California ban on penta and octa PBDEs, used mostly in furniture, but say the restriction of the deca compound used in electronics is unwarranted.

Peter O'Toole, a spokesman for the Bromine Scientific and Environmental Forum — an industry group representing companies that manufacture PBDEs — said the "weight of the evidence clearly supports the safety" of deca and that several U.S. agencies previously have said it poses no significant risk.

Many scientists gathered at the conference are calling for a more detailed investigation into the amounts and sources of flame retardants in Americans and their food — particularly fish, meat and dairy products — and for research that looks for effects in human infants as well as adults. U.S. research has been limited compared to work done in Europe and Canada.

One new study of women in Texas concludes that U.S. women contain "extremely elevated" levels of PBDEs, which "raises concern for potential toxicity to nursing infants," according to the research led by the University of Texas Health Science Center.

Environmental concentrations are doubling on average every four years in the United States and Canada. Some women are approaching levels that have harmed newborn animals' developing brains in laboratory tests, scientists say.

Previously, scientists had reported that when small doses of PBDEs used in upholstered furniture and bedding were fed to newborn rodents, it disrupted their thyroid hormones, which guide how the brain develops. That raises concerns that the PBDEs could be causing subtle changes in the intelligence, memory and hearing of human babies, because the hormones control their brain development

too.

At this week's conference, German scientists are reporting that even smaller doses fed to newborn lab animals alter their reproductive development as well, apparently by interfering with estrogen hormones. Studies by Berlin's Freie Universitat show that the flame retardants are toxic to the female rodents' ovaries and reduce the males' reproductive performance, Birnbaum said.

Stockholm University environmental chemist Aake Bergman, who is chairing a session on flame retardants at the Boston conference, said the German studies "indicate a hitherto unknown effect."

In the 1990s, research by Bergman and other Swedish scientists prompted European industries to voluntarily phase out the two types of PBDEs, and, as a result, levels in breast milk there are declining.

In the United States, however, studies of several hundred people show that women in Indianapolis, Texas and the San Francisco Bay Area have 10 to 100 times more PBDEs in their breast milk and blood than European women. No one knows how the contaminants are getting into human bodies or why some U.S. women are more highly exposed than others living in the same cities.

PBDEs gradually accumulate in human fat and, in pregnant women, pass into the womb and enter the fetus. Babies are highly exposed before birth, and then get an added dose from breast milk. Nonetheless, doctors say women should continue to breast-feed their infants because of the known benefits.

New studies conducted in Europe and Canada report that the compounds are in indoor dust and rural septic tanks. That could mean the source of contamination in people's bodies is furniture or electronics equipment in their houses or offices.

"My theory is that the exposure is coming through ordinary homes," Bergman said.

The research implicating deca BDE is stirring the most objections from the chemical industry, which has said that the chemical is benign. Industry groups long have said that it does not accumulate in the environment or human bodies and that there are no proven health risks.

Derek Muir, a research scientist at Canada's National Water Research Institute, has found the deca compound in the sediments of remote lakes in the Canadian Arctic. Muir said although the common wisdom is that the chemical is not mobile, it apparently is clinging to atmospheric particles and migrating long distances.

Also, for the first time, low levels of deca have been found in women's breast milk, although it was found in only six of 23 women tested at a Dallas clinic, according to the Texas study, led by Arnold Schecter. O'Toole of the chemical industry group says that fact is reassuring, because it shows most people are unexposed.

But Bergman said it shows that "deca is more of a problem than perhaps realized, and we do have a number of arguments now [to ban it]. We know it is accumulating in birds of prey, and seeing it in mother's milk is a bad observation." Scientists at Sweden's Uppsala University report that deca reduces the learning ability of rodents exposed as newborns, similar to the PBDEs subject to the California ban.

One of the most intriguing new studies is one by the University of Maryland that shows that when deca is consumed by fish, it transforms itself into the types of PBDEs that are known to be hazardous.

Bergman said the finding is important because it shows that "deca is an environmentally unfriendly compound."

The European Union is expected to decide this year whether to restrict deca, but there are no such efforts in California or anywhere else in the U.S.