HB

27

<TARGET><BILL>HB 27</BILL><SUBJECT>HB
27</SUBJECT><COMM>HL&C30</COMM></TARGET>

ALASKA STATE LEGISLATURE

REPRESENTATIVE GERAN TARR

Date: April 10, 2018

To: Representative Sam Kito, Chair, House Labor and Commerce Committee
hlac@akleg.gov

From: Representative Geran Tarr

Re: Scheduling HB 27 – Toxic Free Children's Act

I am writing to request a hearing for HB 27 – the Toxic Free Children's Act. It was amended in House Resources Committee to remove sections that required the Department of Environmental Conservation to prepare a list of chemicals that would be toxic to children. That section generated an expensive fiscal note, so it was removed from the bill. We have not yet received the updated fiscal note, but we have requested it from the department.

This bill is supported by dozens of health and safety organizations, including Alaska firefighters.

Staff assigned to this legislation is Diana Rhoades. She can be reached at Diana.Rhoades@akleg.gov or (907) 465-3424.

Thank you for your consideration.

Sincerely,

Representative Geran Tarr

January-May: State Capitol • Juneau, AK 99801-1182 • (907) 465-3424
June-December: 1500 W Benson Blvd • Anchorage, AK 99503 • (907) 269-0144
Rep.Geran.Tarr@akleg.gov - www.repgerantarr.com

ALASKA STATE LEGISLATURE

REPRESENTATIVE GERAN TARR

House Bill 27
Toxic Free Children's Act
Sponsor Statement

House Bill 27 would make it illegal to manufacture, sell or distribute child-related and other products with certain flame-inhibiting chemicals. It includes the class of chemicals called organohalogens and the flame-inhibiting chemical antimony.

A September 2017 decision by the Consumer Product Safety Commission (CPSC) provides guidance to manufacturers, importers, distributors, retailers, and consumers to avoid children's products, electronics, mattresses and home furniture that contain organohalogen flame retardants—a class of chemicals associated with serious human health problems.

These chemicals are particularly damaging to children and firefighters.

Ironically, these products that we coat with chemicals to make them less prone to fire, become more toxic when they burn. Organohalogen chemicals include PBDEs (polybrominated diphenyl ethers), which are in our detachable baby car seats, nursing pillows, crib mattresses, nap pads, changing pads, couches, carpets, baby strollers, plastic TV casings, and other products.

The International Association of Fire Fighters have been pushing for reform due to occupational-related cancers, which now account for more than half of their members' line-of-duty deaths each year - the largest health-related issue facing the fire-fighting profession.

Alarmingly, companies are still not required by the federal government to report the presence of toxic chemicals in their products.

It's time for Alaska to be proactive in the health and safety of the public, particularly children and firefighters. I urge your support of HB 27.

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ALASKA STATE LEGISLATURE

REPRESENTATIVE GERAN TARR

HB 27 Version J
Toxic Free Children's Act Sectional Analysis

Section 1: Creates the short title of Toxic Free Children's Act

Section 2: Amends AS 18.31 – Health and Safety Code

- Makes it illegal to manufacture, sell or distribute child-related and other products with certain flame-inhibiting chemicals (18.31.610)
- Requires persons that sell such products in Alaska to label those products with "this product contains a chemical flame retardant" (18.31.620)
- Creates a civil penalty of $500 for the first violation and $1000 each day thereafter if a person offers for sale or distributes child-related and other products with flame-inhibiting chemicals (18.31.630)
- In addition to the civil penalty, violation of AS 18.31.610 and 18.31.620 would also be an unfair trade practice under AS 45.50.471-45.50.561 – laws related to trade and commerce
- Allows the department to participate in an interstate chemicals clearinghouse to gather information on what policies other states and governmental entities are using to regulate chemicals (18.31.640)
- Provides definitions for child and consumer products (18.31.650)

Section 3: Adds AS 18.31.610 and 18.31.620 to the unfair trade practice as defined in the consumer protection section of trade and commerce laws in Alaska statute (45.50.471(b))

Section 4: Provides instructions for the revisor of statutes related to this bill

Section 5: Establishes the effective date of January 1, 2020

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ALASKA STATE LEGISLATURE

REPRESENTATIVE GERAN TARR

HB 27: Toxic Free Children's Act – Version J Summary of Changes

A committee substitute was offered in House Resources to replace listing individual chemicals and instead add the class of chemicals that the Consumer Product Safety Commission advised the public to avoid in September of 2017. Organohalogen flame retardants are a class of chemicals associated with serious human health problems.

Additionally, an amendment was offered in House Resources to:

Remove these sections:

- No longer requires the department to publish a list of chemicals of high concern to which children are at high risk of exposure (18.31.610)
- No longer describes how the department shall designate chemicals of high concern (18.31.620)
- No longer requires the department to periodically review and revise the list of chemicals of high concern (18.31.630)
- No longer allows the department to draft regulations to implement the law (18.31.680)

Amend this section

- Amends the definition of consumer products to add mattresses to it (18.31.650)

The bill now does this:

- Makes it illegal to manufacture, sell or distribute flame retardants listed in this bill;
- Creates a civil penalty of $500 for the first violation and $1000 a day thereafter if a person offers for sale or distributes any consumer products with flame retardants;
- Requires manufacturers that sell such products in Alaska to label those consumer products with "this product contains a chemical flame retardant" (*we are not requiring Alaska companies that still have these products to eliminate them from their shelves – but they must label them and will no longer be able to buy them*);
- Allows the department to participate in an interstate clearinghouse to gather information on what policies other states and governmental entities are using to regulate chemicals.

30-LS0264\D
Bannister
3/5/18

CS FOR HOUSE BILL NO. 27( )

IN THE LEGISLATURE OF THE STATE OF ALASKA

THIRTIETH LEGISLATURE - SECOND SESSION

BY

Offered:
Referred:

Sponsor(s): REPRESENTATIVE TARR

A BILL

FOR AN ACT ENTITLED

"An Act relating to chemicals that are of high concern for children and to the manufacture, sale, distribution, and labeling of products containing certain flame retardant chemicals; relating to an interstate chemicals clearinghouse; adding unlawful acts to the Alaska Unfair Trade Practices and Consumer Protection Act; and providing for an effective date."

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF ALASKA:

*** Section 1.** The uncodified law of the State of Alaska is amended by adding a new section to read:

SHORT TITLE. This Act may be known as the Toxic-Free Children's Act.

*** Sec. 2.** AS 18.31 is amended by adding new sections to read:

Article 5. Chemicals of High Concern for Childhood Exposure.

Sec. 18.31.610. Identification of chemicals of high concern. The department, after consultation with the Department of Health and Social Services, shall publish a

list of chemicals of high concern to which children are at high risk of potential exposure.

Sec. 18.31.620. Requirements for listing. (a) Before placing a chemical on the list, the department shall determine that the chemical is a chemical of high concern and that children are at high risk for potential exposure to the chemical.

(b) To determine that a chemical is a chemical of high concern, the department shall find that the chemical has been identified by a government entity, based on credible scientific evidence, as

(1) a carcinogen, a reproductive toxicant, a developmental toxicant, or an endocrine disruptor;

(2) persistent, bioaccumulative, and toxic; or

(3) very persistent and very bioaccumulative.

(c) To determine that there is a high potential for children to be exposed to a chemical of high concern,

(1) biomonitoring studies must demonstrate the presence of the chemical in human breast milk, human urine, or other bodily tissues or fluids;

(2) sampling and analysis must demonstrate the presence of the chemical in household dust, household indoor air, household drinking water, or elsewhere in the home environment; or

(3) the chemical must be an additive to or otherwise present in a consumer product.

Sec. 18.31.630. Review and revision of list. The department may periodically review the list and may revise the list by adding a chemical to the list or by removing from the list a chemical that does not satisfy the requirements of AS 18.31.620.

Sec. 18.31.640. Prohibition. (a) A person may not knowingly, in the course of business, manufacture in the state, sell in the state, offer for sale in the state, or distribute for sale in the state a consumer product that contains a chemical that inhibits flame production if the chemical

(1) is on the list;

(2) is TDCPP (Tris (1,3-dichloro-2-propyl) phosphate);

(3) is TCEP (Tris (2-chloroethyl) phosphate);

(4) is TCPP (Tris (1-chloro-2-propyl) phosphate);

(5) contains 100 or more parts per million of a nonpolymeric organohalogen flame retardant; or

(6) contains antimony (chemical abstracts service number 7440-36-0).

(b) This section does not apply to a consumer product that a person resells or offers for resale.

(c) In this section, "knowingly" has the meaning given in AS 11.81.900.

Sec. 18.31.650. Labeling. A person who manufactures a consumer product that contains a chemical that inhibits flame production and sells, offers for sale, or distributes the product in the state shall place on a label affixed to the product the following statement: "This product contains a chemical flame retardant."

Sec. 18.31.660. Civil penalty. (a) A person who violates AS 18.31.640 or 18.31.650 is liable to the state for a civil penalty that may not exceed

(1) for the first violation, $500 for each day that the violation continues; or

(2) for each violation after the first violation, $1,000 for each day that the violation continues.

(b) Violation of AS 18.31.640 or 18.31.650 is an unfair trade practice under AS 45.50.471 - 45.50.561, and, in addition to the civil penalty under (a) of this section, the remedies under AS 45.50.471 - 45.50.561 are available for the violation, except for the civil penalty under AS 45.50.551(b).

Sec. 18.31.670. Participation in interstate chemicals clearinghouse. The department shall participate in an interstate chemicals clearinghouse to

(1) assist the department to carry out its responsibilities under AS 18.31.610 - 18.31.690; and

(2) help coordinate the research and education needed to

(A) identify chemicals of high concern to which children are at high risk of potential exposure; and

(B) develop safer alternatives to the chemicals identified under (A) of this paragraph.

Sec. 18.31.680. Regulations. The department may adopt regulations under

AS 44.62 (Administrative Procedure Act) to implement AS 18.31.610 - 18.31.690.

Sec. 18.31.690. Definitions. In AS 18.31.610 - 18.31.690,

(1) "child" means a child who is under seven years of age;

(2) "consumer product" means clothing, toys, detachable car seats, nursing pillows, upholstered furniture, bedding, crib mattresses, nap pads, and changing pads, or other products used in the home primarily for or by a child or the parents or guardians of a child;

(3) "department" means the Department of Environmental Conservation;

(4) "list" means a list published under AS 18.31.610;

(5) "manufacturer" means a person who, in the course of business,

(A) manufactures a consumer product;

(B) affixes a brand name to a consumer product; or

(C) is the importer or first distributor in the United States of a consumer product if the consumer product was imported into the United States and if the person who manufactured or assembled the consumer product or whose brand name is affixed to the consumer product does not do business in the United States; in this subparagraph, "distributor" means a person who sells consumer products on a wholesale basis to a person for retail sale.

* **Sec. 3.** AS 45.50.471(b) is amended by adding a new paragraph to read:

(58) violating AS 18.31.640 or 18.31.650 (flame-inhibiting chemicals in consumer products).

* **Sec. 4.** The uncodified law of the State of Alaska is amended by adding a new section to read:

TRANSITION: FIRST LIST OF CHEMICALS. By January 1, 2020, the Department of Environmental Conservation, in consultation with the Department of Health and Social Services, shall publish the first list of chemicals under AS 18.31.610, enacted by sec. 2 of this Act.

* **Sec. 5.** The uncodified law of the State of Alaska is amended by adding a new section to read:

REVISOR'S INSTRUCTION. Wherever "this chapter" appears in AS 18.31.010 -

18.31.500, the revisor of statutes shall substitute "AS 18.31.010 - 18.31.500."

* **Sec. 6.** AS 18.31.640, 18.31.650, and 18.31.660, added by sec. 2 of this Act, and AS 45.50.471(b)(58), added by sec. 3 of this Act, take effect January 1, 2020.

Fiscal Note

State of Alaska
2018 Legislative Session

Bill Version:	CSHB 27(RES)
Fiscal Note Number:	2
(H) Publish Date:	4/6/2018

Identifier: HB027-DEC-EH-03-02-18
Title: HIGH-RISK CHEMICALS FOR CHILD EXPOSURE
Sponsor: TARR
Requester: House Resources Committee

Department: Department of Environmental Conservation
Appropriation: Environmental Health
Allocation: Environmental Health
OMB Component Number: 3202

Expenditures/Revenues

Note: Amounts do not include inflation unless otherwise noted below. (Thousands of Dollars)

	FY2019 Appropriation Requested	Included in Governor's FY2019 Request	Out-Year Cost Estimates				
OPERATING EXPENDITURES	**FY 2019**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**
Personal Services	213.3		213.3	213.3	213.3	213.3	213.3
Travel	13.0		13.0	13.0	13.0	13.0	13.0
Services	104.8		104.8	54.8	54.8	54.8	54.8
Commodities	15.0		1.0	1.0	1.0	1.0	1.0
Capital Outlay							
Grants & Benefits							
Miscellaneous							
Total Operating	**346.1**	**0.0**	**332.1**	**282.1**	**282.1**	**282.1**	**282.1**
Fund Source (Operating Only)							
1004 Gen Fund (UGF)	346.1		332.1	282.1	282.1	282.1	282.1
Total	**346.1**	**0.0**	**332.1**	**282.1**	**282.1**	**282.1**	**282.1**
Positions							
Full-time	2.0		2.0	2.0	2.0	2.0	2.0
Part-time							
Temporary							
Change in Revenues							
None							
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Estimated SUPPLEMENTAL (FY2018) cost: 0.0 *(separate supplemental appropriation required)*
(discuss reasons and fund source(s) in analysis section)

Estimated CAPITAL (FY2019) cost: 200.0 *(separate capital appropriation required)*
(discuss reasons and fund source(s) in analysis section)

ASSOCIATED REGULATIONS

Does the bill direct, or will the bill result in, regulation changes adopted by your agency? Yes
If yes, by what date are the regulations to be adopted, amended or repealed? 01/01/19

Why this fiscal note differs from previous version/comments:

Not applicable, initial version.

Prepared By: Christina Carpenter, Director — Phone: (907)269-7645
Division: Environmental Health — Date: 03/02/2018
Approved By: Alice Edwards, Deputy Commissioner — Date: 03/02/18
Agency: Department of Environmental Conservation

FISCAL NOTE ANALYSIS

STATE OF ALASKA
2018 LEGISLATIVE SESSION

Analysis

Analysis/Assumptions:
This bill would require the Department to review scientific data compiled by government entities and, in consultation with the Department of Health and Social Services, identify and list chemicals of high concern for children under the age of three. The Department may periodically review and revise the list.

The bill bans the manufacture, distribution, and sale of consumer products that children may come into contact with that contain any of three specifically listed flame-inhibiting chemicals or any chemicals included in the Department's newly required list of chemicals of high concern. This would require the Department to conduct significant outreach to product manufacturers and distributors, both in state and out of state (those that ship products to Alaska), to inform them of the prohibition and to educate and assist retailers and consumers in identifying products that contain the listed chemicals.

The Department will also need to conduct periodic inspections and lab analyses of products for compliance with the law and maintain membership in an interstate chemicals clearing house to assist the Department with maintaining the list of chemicals of concern for children.

Personal Services:
Two additional positions in the pesticides program within the Environmental Health component.

- Environmental Program Specialist IV (Toxicologist) to evaluate the data and to develop and update the list of priority chemicals.
- Environmental Program Specialist III to conduct outreach and perform inspections of local distributors and manufacturers.

Travel:
Conduct outreach, training, and inspections.

Services:
Membership in the Interstate Chemicals Clearinghouse will be required, as well as the management of an in-house data management system to track chemicals, distributors, and manufacturers in the state. Assistance would be required by the Department of Law to develop complex regulations prior to the bill effective date of January 1, 2019, as well as to advise the program on enforcement and violations.

Commodities:
New employee costs in the first year. Outreach materials, and supplies for the second year and subsequent years thereafter.

Capital:
Database development costs.

Fiscal Note

State of Alaska
2018 Legislative Session

Bill Version:	CSHB 27(RES)
Fiscal Note Number:	1
(H) Publish Date:	4/6/2018

Identifier: HB027-LAW-CIV-03-16-18
Title: HIGH-RISK CHEMICALS FOR CHILD EXPOSURE
Sponsor: TARR
Requester: House Resources

Department: Department of Law
Appropriation: Civil Division
Allocation: Commercial and Fair Business
OMB Component Number: 2717

Expenditures/Revenues

Note: Amounts do not include inflation unless otherwise noted below. (Thousands of Dollars)

	FY2019 Appropriation Requested	Included in Governor's FY2019 Request	Out-Year Cost Estimates				
OPERATING EXPENDITURES	**FY 2019**	**FY 2019**	**FY 2020**	**FY 2021**	**FY 2022**	**FY 2023**	**FY 2024**
Personal Services							
Travel							
Services							
Commodities							
Capital Outlay							
Grants & Benefits							
Miscellaneous							
Total Operating	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Fund Source (Operating Only)

None							
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Positions

Full-time							
Part-time							
Temporary							

Change in Revenues

None							
Total	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**

Estimated SUPPLEMENTAL (FY2018) cost: 0.0 *(separate supplemental appropriation required)*
(discuss reasons and fund source(s) in analysis section)

Estimated CAPITAL (FY2019) cost: 0.0 *(separate capital appropriation required)*
(discuss reasons and fund source(s) in analysis section)

ASSOCIATED REGULATIONS

Does the bill direct, or will the bill result in, regulation changes adopted by your agency? No
If yes, by what date are the regulations to be adopted, amended or repealed?

Why this fiscal note differs from previous version/comments:

Not applicable, initial version.

Prepared By: Valerie Rose, Budget Analyst — Phone: (907)465-3674
Division: Administrative Services Division — Date: 03/16/2018
Approved By: Jahna Lindemuth, Attorney General — Date: 03/16/18
Agency: Department of Law

FISCAL NOTE ANALYSIS

STATE OF ALASKA
2018 LEGISLATIVE SESSION

Analysis

HB 27 would add new sections to AS 18.31 related to chemicals of high concern for childhood exposure. The bill would require the Department of Environmental Conservation to consult with the Department of Health and Social Services and publish a list by January 1, 2019 of chemicals of high concern to which children are at high risk of potential exposure. Sec. 2 of the bill would establish the requirements to be met before a chemical is listed. Through proposed AS 18.31.640, the bill would prohibit a person in the state from manufacturing, selling, offering for sale, or distributing in the state a consumer product that contains certain chemicals that inhibit flame production. Sec. 2 of the bill would make a violation of AS 18.31.640 an unfair or deceptive practice under AS 45.50.471, which would allow the Department of Law's Commercial and Fair Business & Child Support Section to commence an investigation under AS 45.50.

Should HB 27 become law, the department expects a limited increase in work, but expects it could be absorbed into existing resources.

House Bill 27
Toxic Free Children's Act

Representative Geran Tarr

Regulation of Chemicals in Our Environment

- Federal Laws
  - Federal Insecticide, Fungicide, and Rodenticide Act (passed in 1910, pesticides)
  - Federal food, Drug, and Cosmetic Act (passed in 1938, drugs, cosmetics, foods, food additives)
  - Toxics Substances Control Act (passed in 1976)
    - Updated in 2016 with Frank Lautenberg Chemical Safety for the 21st Century Act

Regulation of Chemicals in Our Environment

- Federal Laws
  - Consumer Product Safety Improvement Act of 2008
    - Use children as the benchmark for safety
    - Included the Lead Free Toys Act
    - Status – *"CPSC has and is continuing to implement regulations based on CPSIA."*

Consumer Product Safety Commission, March 9, 2018

Frank R. Lautenberg Chemical Safety for the 21st Century Act

TSCA as reformed by the Frank R. Lautenberg Chemical Safety for the 21st Century Act	TSCA pre-reform
Mandatory duty on EPA to evaluate existing chemicals with clear and enforceable deadlines	No duty to review, no deadlines for action
Chemicals assessed against a risk-based safety standard	Risk-benefit balancing standard
Unreasonable risks identified in the risk evaluation must be eliminated	Significant risks might not be addressed due to cost/benefit balancing and no mandate to act
Expanded authority to more quickly require development of chemical information when needed	Testing on existing chemicals required lengthy rulemaking

THE POINT

MUCH REMAINS TO BE DONE

MUCH REMAINS TO BE LEARNED

Health Concerns Due to Exposure to Chemicals

- Cancer
- Reproductive Health disorders
- Developmental delays or cognitive impairment
- Birth defects
- Endocrine disruption
- Respiratory disorders
- Neurodevelopmental disorders

3 Ways for Exposure

- Absorption
  - Personal Care Products (directly to skin)
- Inhalation
  - Flame Retardants (in dust and burning)
- Eating
  - Pesticides on fruits and vegetables, in milk and meat

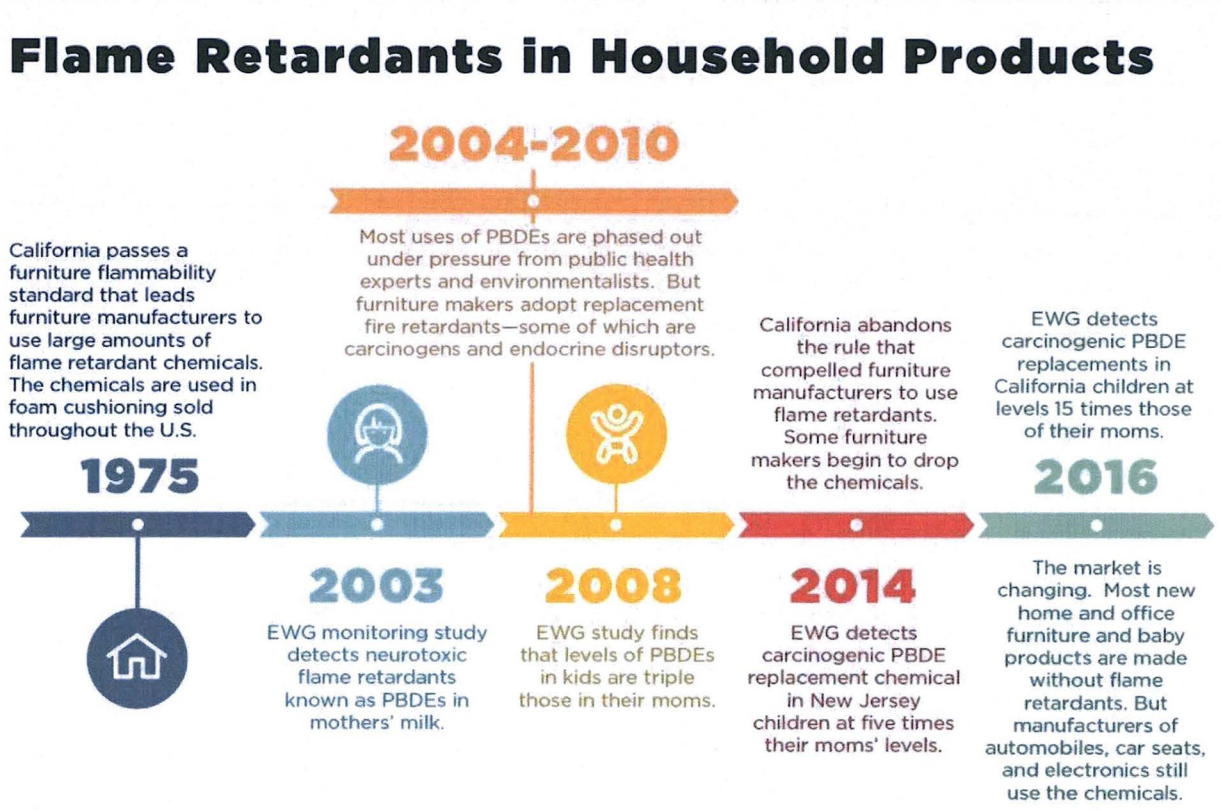
Flame Retardants (PBDEs)

- Used in children's products, furniture, electronics, plastics, building materials, motor vehicles, airplanes, and textiles
- Exposure is from ingestion of food and inhalation
- Chemical composition: Polybrominated diphenyl ether
  - Structurally similar to PCBs
  - Family of chemicals can make over 200 related chemicals

Flame Retardants (PBDEs)

- Chemicals bioaccumulate in blood, breast milk, and fat tissues
- Health impacts include thyroid hormone disruption, permanent learning and memory impairment, behavioral changes, and more
- Leading cause of cancer in Firefighters

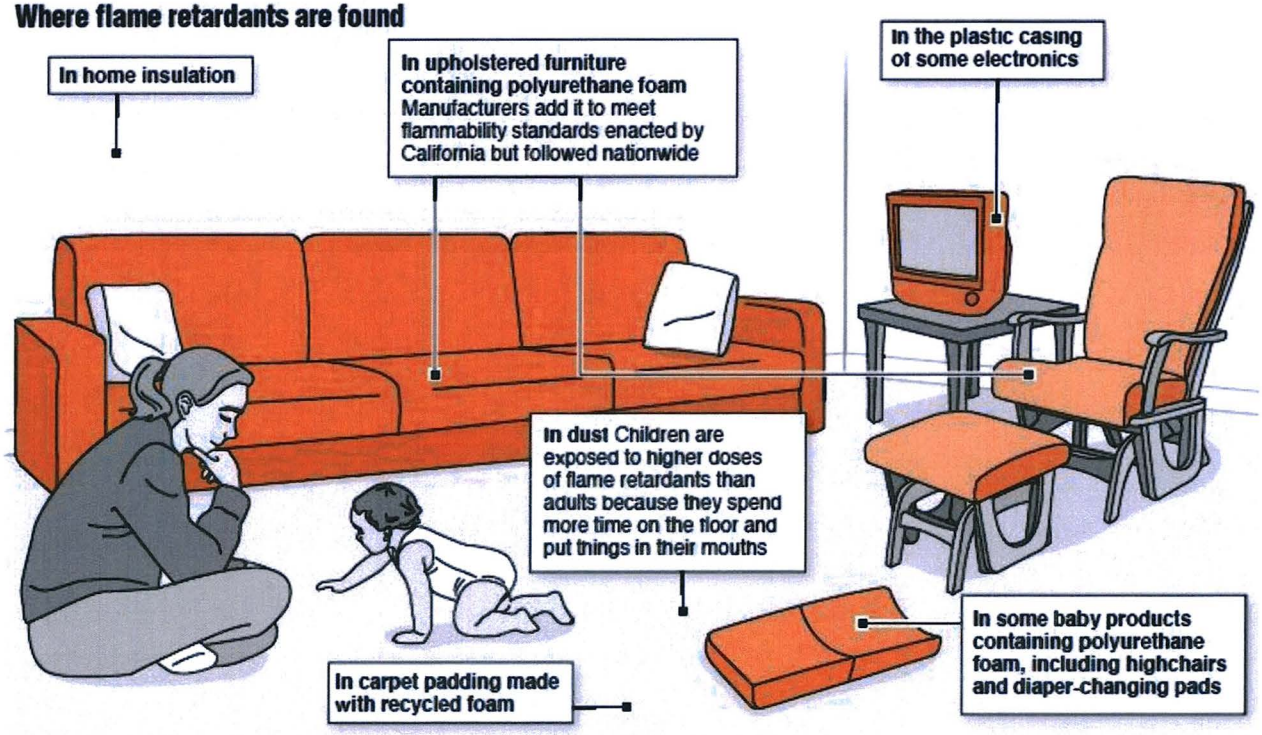
Why Flame Retardants?



How are We Exposed?

Flame retardants are present in virtually every American home even though some of the compounds have been linked to neurological deficits, developmental problems, impaired fertility and other health risks.

Where flame retardants are found

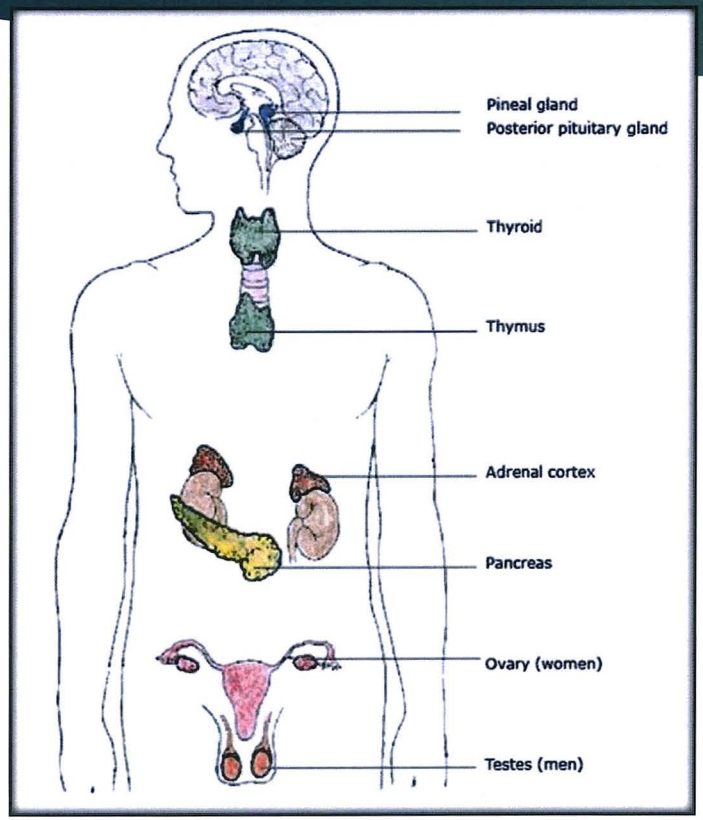


Source: EPA, Chicago Tribune reporting

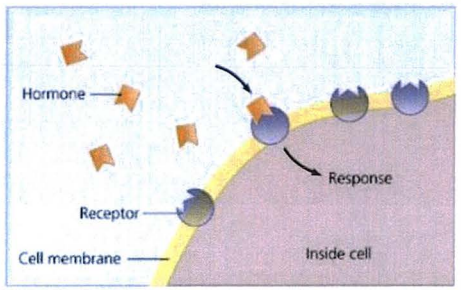
Graphic: Katie Nieland, Chicago Tribune

Children's Exposure is a Major Concern

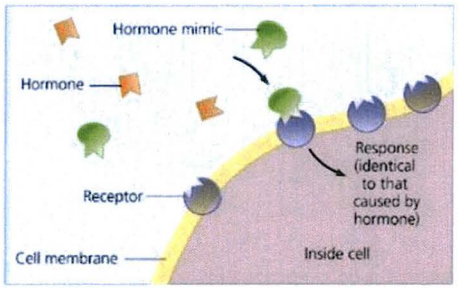
Endocrine System & Endocrine Disruption



Endocrine Disruption



(a) Normal hormone binding

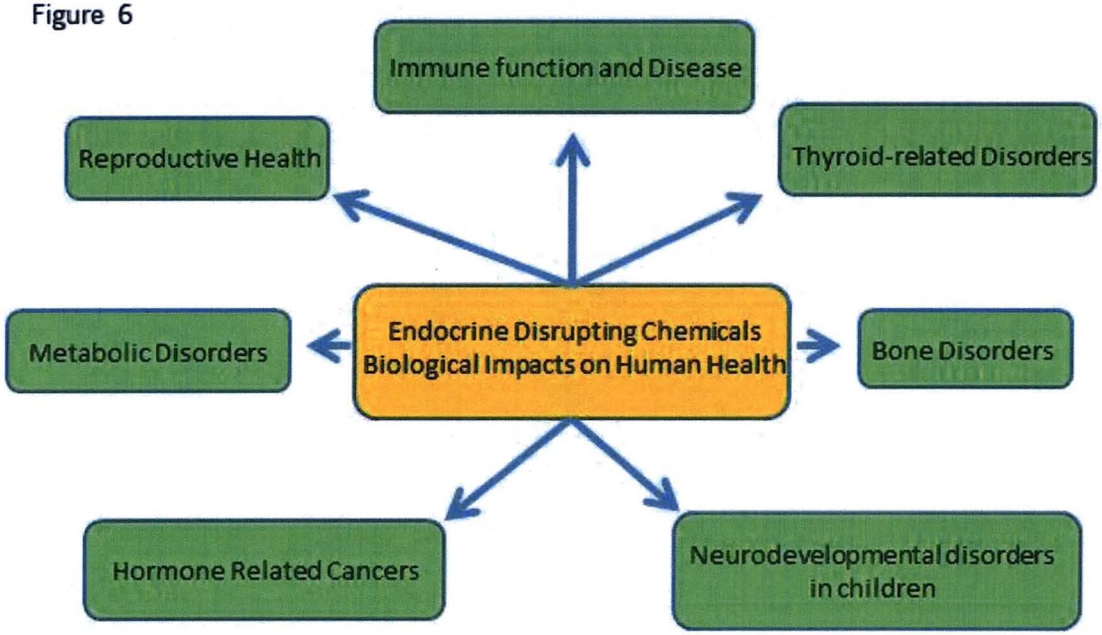


(b) Hormone mimicry

- Some chemicals, once inside the bloodstream, can "mimic" hormones.
- If molecules of the chemical bind to the sites intended for hormone binding, they cause an inappropriate response.
- Thus these chemicals disrupt the *endocrine* system.

Endocrine System & Endocrine Disruption

Figure 6



Source: State of the Science of Endocrine Disrupting Chemicals – 2012
Inter-Organization Programme for the Sound Management of Chemicals

Policy Solutions

1. Restrict use of known chemicals of concern
2. Restrict use of possible substitutes
3. Conduct Alaska research
4. Collaborate with other states

Questions?

State laws banning toxic flame retardants in children's products and or products generally:

State	Electronics	Batteries	Inaccessible components	Source	Adopted	Flame Retardant(s)
California	Not Exempted	Not exempted	Not exempted	LINK	2003	PBDEs
Hawaii	Not Exempted	Not Exempted	Not Exempted	LINK	2004	PBDEs
Illinois	Not Exempted	Not Exempted	Not Exempted	LINK	2005	PBDEs
Maine	Not Exempted	Not Exempted	Not Exempted	LINK	2004	PBDEs
Maryland	Not Exempted	Not Exempted	Not Exempted	LINK LINK LINK LINK	2005 2010 2013 2014	octaBDE, pentaBDE decaBDE TCEP TDCPP
Michigan	Not Exempted	Not Exempted	Not Exempted	LINK	2003	PentaBDE
Minnesota	Not Exempted Exempted	Not Exempted Exempted	Not Exempted Not Exempted	LINK (Sec.150) LINK and LINK	2007 2015	pentaBDE, octaBDE TDCPP, TCEP, decaBDE, HBCD
New York	Not Exempted	Not Exempted	Not Exempted	LINK LINK LINK	2004 2011 2014	PentaBDE, OctaBDE TCEP TDCPP
Oregon	Not Exempted	Not Exempted	Not Exempted	LINK LINK	2005 2009	PentaBDE, OctaBDE DecaBDE
Rhode Island	Not Exempted	Not Exempted	Not Exempted	LINK	2006	PentaBDE, OctaBDE
Vermont	Not Exempted	Not exempted	Not exempted	LINK LINK	2009 2013	PBDEs TCEP, TDDCP, (TCPP)
Washington	Not exempted Exempted	Not exempted Exempted	Not exempted Not exempted	LINK LINK	2007 2016	OctaBDE, PentaBDE TDDCP, TCEP, Decabromodiphenyl ether, HBDC, or additive TBBPA

Distributed by Rep. Tarr

Bicycle Helmets (OMB No. 3041–0127). In the **Federal Register** of July 21, 2017 (82 FR 33875), the CPSC published a notice announcing the agency's intent to seek an extension of approval of this collection of information. CPSC received no comments in response to that notice. Therefore, by publication of this notice, the Commission announces that CPSC has submitted to the OMB a request for extension of approval of that collection of information without change.

DATES: Written comments on this request for extension of approval of information collection requirements should be submitted by October 30, 2017.

ADDRESSES: Submit comments about this request by email: *OIRA_submission@omb.eop.gov* or fax: 202–395–6881. Comments by mail should be sent to the Office of Information and Regulatory Affairs, Attn: OMB Desk Officer for the CPSC, Office of Management and Budget, Room 10235, 725 17th Street NW., Washington, DC 20503. In addition, written comments that are sent to OMB also should be submitted electronically at *http://www.regulations.gov,* under Docket No. CPSC–2010–0056.

FOR FURTHER INFORMATION CONTACT: Charu S. Krishnan, Consumer Product Safety Commission, 4330 East West Highway, Bethesda, MD 20814; (301) 504–7221, or by email to: *ckrishnan@cpsc.gov.*

SUPPLEMENTARY INFORMATION: CPSC has submitted the following currently approved collection of information to OMB for extension:

Title: Safety Standard for Bicycle Helmets.

OMB Number: 3041–0127.

Type of Review: Renewal of collection.

Frequency of Response: On occasion.

Affected Public: Manufacturers and importers of bicycle helmets.

Estimated Number of Respondents: 38 manufacturers and importers will maintain test records of an estimated 200 models total annually, including older models and new models. Testing on bicycle helmets must be conducted for each new production lot and the test records must be maintained for 3 years.

Estimated Time per Response: 200 hours/model to test 40 new models (including new prototypes) and an estimated 100 hours/model to test new production lots of 160 older models. Additionally, manufacturers and importers may require 4 hours annually per model for recordkeeping for approximately 200 models.

Total Estimated Annual Burden: 24,800 hours (24,000 hours for testing and 800 hours for recordkeeping).

General Description of Collection: In 1998, the Commission issued a safety standard for bicycle helmets (16 CFR part 1203). The standard includes requirements for labeling and instructions. The standard also requires that manufacturers and importers of bicycle helmets subject to the standard issue certificates of compliance based on a reasonable testing program. Every person issuing certificates of compliance must maintain certain records. Respondents must comply with the requirements in 16 CFR part 1203 for labeling and instructions, testing, certification, and recordkeeping.

Alberta E. Mills,

Acting Secretary, Consumer Product Safety Commission.

[FR Doc. 2017–20779 Filed 9–27–17; 8:45 am]

BILLING CODE 6355–01–P

CONSUMER PRODUCT SAFETY COMMISSION

[CPSC Docket No. CPSC–2015–0022]

Guidance Document on Hazardous Additive, Non-Polymeric Organohalogen Flame Retardants in Certain Consumer Products

AGENCY: Consumer Product Safety Commission.

ACTION: Guidance document.

SUMMARY: The Commission announces that it has approved a statement that provides guidance for manufacturers, importers, distributors, retailers, and consumers of certain consumer products that may contain harmful organohalogen flame retardants in an additive form. To protect consumers and children from the potential toxic effects of exposure to these chemicals, the Commission recommends that manufacturers of children's products, upholstered furniture sold for use in residences, mattresses (and mattress pads), and plastic casings surrounding electronics refrain from intentionally adding non-polymeric, organohalogen flame retardants ("OFRs") to their products. Further, the Commission recommends that, before purchasing such products for resale, importers, distributors, and retailers obtain assurances from manufacturers that such products do not contain OFRs. Finally, the Commission recommends that consumers, especially those who are pregnant or with young children, inquire and obtain assurances from retailers that such products do not contain OFRs.

FOR FURTHER INFORMATION CONTACT: DeWane Ray, Deputy Director, Safety Operations, Consumer Product Safety Commission, 4330 East West Highway, Bethesda, MD 20814; telephone: (301) 504–7547, or email: *JRay@cpsc.gov.*

SUPPLEMENTARY INFORMATION: The text of the guidance document is as follows:

Guidance for Hazardous Additive, Non-Polymeric Organohalogen Flame Retardants in Certain Consumer Products

Summary: The U.S. Consumer Product Safety Commission [1] issues this guidance to manufacturers, importers, distributors, retailers, and consumers to protect consumers (particularly children) from exposure to additive, non-polymeric organohalogen flame retardants ("OFRs") [2] found in the following products: (1) Durable infant or toddler products, children's toys, child care articles or other children's products (other than children's car seats); (2) upholstered furniture sold for use in residences; (3) mattresses and mattress pads; and (4) plastic casings surrounding electronics.[3] OFRs, also referred to as halogenated flame retardants, typically are added to foams, textiles, and polymers before, during or after production in theory to improve their resistance to fire. OFRs are not chemically bound to the substrate and may be released from the product, thereby leading to potential human and environmental exposures. On June 30, 2015, a coalition of consumer advocates and health professionals petitioned the Commission to declare four categories of consumer products containing OFRs to be "banned hazardous substances" under the Federal Hazardous Substances Act ("FHSA"). The petitioners claim that due to their inherent physical-chemical properties, OFRs, among other things, are toxic, migrate widely out of products regardless of how the products are used, bioaccumulate, and present a serious public health concern. On September 20, 2017, the Commission voted to grant the petition to initiate rulemaking under

[1] The Commission voted 3–2 to publish this Guidance Document in the **Federal Register**. Commissioner Robert S. Adler, Commissioner Marietta S. Robinson, and Commissioner Elliot F. Kaye voted to approve publication of the Guidance Document. Acting Chairman Ann Marie Buerkle and Commissioner Joseph P. Mohorovic voted against publication of the Guidance Document.

[2] For purposes of this guidance, OFRs refers to additive, non-polymeric chemicals only; it does not include reactive or polymeric OFRs.

[3] This guidance is not a binding or enforceable rule and would not change any person's rights, duties, or obligations under the Federal Hazardous Substances Act or any other Act administered by the Commission.

the FHSA and directed the staff to convene a Chronic Hazard Advisory Panel pursuant to the procedures of section 28 of the Consumer Product Safety Act (15 U.S.C. 2077) to further study the effects of these OFRs as a class of chemicals on consumers' health. In the meantime, based on the overwhelming scientific evidence presented to the Commission to date, the Commission has serious concerns regarding the potential toxicity of OFRs, and the risks of exposure, particularly to vulnerable populations, to OFRs, from the four categories of products listed in the petition. Accordingly, the Commission requests that manufacturers of children's products, furniture, mattresses, and electronics casings eliminate the use of such chemicals in these products. The Commission also recommends that, before purchasing such products for resale, importers, distributors, and retailers obtain assurances from manufacturers that such products do not contain OFRs. Finally, the Commission recommends that consumers, especially those who are pregnant or with young children, inquire and obtain assurances from retailers that such products do not contain OFRs.

Hazard: Scientific evidence to date demonstrates that OFRs, when used in non-polymeric, additive form, migrate from consumer products, leading to widespread human exposure to mixtures of these chemicals. Exposures to OFRs occur because of the semi-volatile property of these chemicals that results in migration of the chemicals and the chemicals' absorption into household dust and other surfaces where they persist in the indoor environment. At this time, there is no known way to direct consumers to use affected products in a manner that would guarantee reducing exposures to the American population to an acceptable level. Numerous peer-reviewed, published studies show that the vast majority of consumers have measurable quantities of OFRs in their blood. The known adverse health effects of these chemicals to consumers include: Reproductive impairment (*e.g.,* abnormal gonadal development, reduced number of ovarian follicles, reduced sperm count, increased time to pregnancy); neurological impacts (*e.g.,* decreased IQ in children, impaired memory, learning deficits, altered motor behavior, hyperactivity); endocrine disruption and interference with thyroid hormone action (potentially contributing to diabetes and obesity); genotoxicity; cancer; and immune disorders. These chemicals have a disproportionately negative health effect on vulnerable populations, including children.

Guidance: Under the FHSA, 15 U.S.C. 1261(g) and (f)(1)(A), any substance or mixture of substances which is toxic, *i.e.,* that has the capacity to produce illness through ingestion, inhalation, or absorption through any bodily surface, and may cause substantial injury or illness during or as a proximate result of customary or reasonably foreseeable handing or use is a "hazardous substance." A product intended or packaged for household use containing a hazardous substance is required to have precautionary labeling under the FHSA (15 U.S.C. 1261(p)), but if labeling is not adequate to protect against the potential hazard, the Commission may declare the product banned. (15 U.S.C. 1261(q)(1)(B)). If an article intended for use by children is a hazardous substance or bears or contains a hazardous substance that is susceptible of access by a child to whom the article is entrusted, the article is a banned hazardous substance. *Id.* 1261(q)(1)(A).

To date, the Commission has not banned household products containing OFRs or required precautionary labeling for such products. However, on September 20, 2017, based on the overwhelming scientific evidence presented to date, the Commission voted to grant the petition to initiate rulemaking under the FHSA and directed the staff to convene a Chronic Hazard Advisory Panel pursuant to the procedures of section 28 of the Consumer Product Safety Act (15 U.S.C. 2077) to further study the effects of OFRs as a class of chemicals on consumers' health. Much of the evidence currently before the Commission suggests OFRs, as a class of chemicals, present a serious public health issue. Therefore, the Commission has serious concerns regarding the potential toxicity of OFRs, and the risks of exposure, particularly to vulnerable populations, to OFRs, from the four categories of products listed in the petition.

For these reasons, the Commission considers the use of OFRs in children's products, upholstered furniture sold for use in residences, mattresses and mattress pads, and plastic casings surrounding electronics to be ill-advised and encourages manufacturers to eliminate using them in such products. Further, the Commission recommends that, before, purchasing such products for resale, importers, distributors, and retailers obtain assurances from manufacturers that such products do not contain OFRs. Finally, the Commission recommends that consumers, especially those who are pregnant or with young children, inquire and obtain assurances from retailers that such products do not contain OFRs.

Alberta E. Mills,

Acting Secretary, U.S. Consumer Product Safety Commission.

[FR Doc. 2017–20733 Filed 9–27–17; 8:45 am]

BILLING CODE P

DEPARTMENT OF DEFENSE

Department of the Air Force

Record of Decision for the KC–46 Third Main Operating Base (MOB 3) Beddown

AGENCY: Department of the Air Force.

ACTION: Notice of Availability (NOA) of a Record of Decision (ROD).

On September 8, 2017, the United States Air Force signed the ROD for the KC–46 Third Main Operating Base (MOB 3) Beddown. The ROD states the Air Force decision to beddown up to twelve (12) KC–46 Primary Aerospace Vehicles Authroized (PAA) in one squadron at Seymor Johnston Air Force Base, where the Air Force Reserve Command (AFRC) leads the Mobility Air Force Mission.

The decision was based on matters discussed in the Final Environmental Impact Statement (FEIS) for the KC–46 Third Main Operating Base (MOB 3) Beddown (*http://www.kc-46a-beddown.com/*); contributions from the public and regulatory agencies; and other relevant factors. The FEIS was made available to the public on April 14, 2017 through a NOA in the **Federal Register** (82 FR 17991) with a 30-day wait period that ended on May 15, 2017.

Authority: This NOA is published pursuant to the regulations (40 CFR part 1506.6) implementing the provisions of the NEPA of 1969 (42 U.S.C. 4321, *et seq.*) and the Air Force's Environmental Impact Analysis Process (32 CFR parts 989.21(b) and 989.24(b)(7)).

FOR FURTHER INFORMATION CONTACT: Mr. Hamid Kamalpour, AFCEC/CZN, 2261 Hughes Ave., Ste. 155, Lackland AFB, TX 78236–9853. Ph: (210) 925–2738.

Henry Williams, Jr.,

Acting Air Force Federal Register Liaison Officer.

[FR Doc. 2017–20822 Filed 9–27–17; 8:45 am]

BILLING CODE 5001–10–P

ALASKA FIRE CHIEF'S ASSOCIATION

One Sealaska Plaza, Suite 200 Juneau, Alaska 99801
(907) 586-1325 Fax (907) 463-5480
www.alaskafirechiefs.org

March 5, 2018

Representative Geran Tarr
State Capitol Room 126
Juneau, Alaska 99801

Representative Tarr,

On behalf of the Alaska Fire Chiefs Association I am writing to give our support to HB 27; "An Act relating to chemicals that are of high concern for children and to the manufacture and sale of products containing certain flame retardant chemicals; relating to an interstate chemicals clearinghouse; adding an unlawful act to the Alaska Unfair Trade Practices and Consumer Protection Act; and providing for an effective date."

Study after study have concluded that organohalogen flame retardant chemicals are a leading cause of cancer in firefighters. These products are used throughout today's households in furniture and other materials. When these flame retardants burn they release toxic cancer causing chemicals such as dioxins and furans which firefighters are then exposed to. The elimination of organohalogen flame retardant chemicals will go a long way to provide a less toxic atmosphere for our firefighters and help reduce their exposure to these toxins.

The Alaska Fire Chiefs Association on behalf of all firefighters in Alaska want to thank you for introducing HB 27 and we support its passage.

Sincerely,

Jeff Tucker, President
Alaska Fire Chiefs Association

ALASKA PROFESSIONAL FIRE FIGHTERS ASSOCIATION
PO Box 111222 ANCHORAGE, AK 99511
North Pole – Fairbanks – Shemya – Anchorage – Juneau – Ketchikan
www.alaskapffa.org

March 6, 2018

Representative Geran Tarr

State Capital Room 126

Juneau, Alaska 99801

Representative Tarr,

I am writing today in support of HB 27 High-Risk Chemicals for Child Exposure. The Alaska Professional Fire Fighters support this bill and encourage passage. HB 27 would work to ban chemicals proven to be dangerous to firefighters and the community such as PBDE flame retardants.

Our organization represent 500 firefighters across Alaska. They face all types of dangers in the line of duty. While we cannot eliminate all risk, but we have an obligation to ensure our firefighters work in the safest environment possible. Eliminating dangerous chemicals that offer little benefit goes a long way toward achieving a safer work environment.

It is no secret that cancer is a big concern for firefighters. The data exists that shows we experience cancer at much higher rates than the public. Much of this is attributed to absorption of carcinogens during fire fighting operations. When Flame retardants burn large amounts of cancer causing dioxins and furans are released and absorbed and inhaled by firefighters. Recent studies have shown firefighters have three times the level of these harmful chemicals in their systems after a fire. Eliminating these flame retardants would be a step in the right direction.

Alaska should follow the lead of many states and manufactures who have eliminated the use of these harmful chemicals that offer little if any benefit. The Alaska Professional Fire Fighters support HB 27 and encourage passage.

Thomas A. Wescott

President Alaska Professional Fire Fighters

ACAT
Alaska Community Action on Toxics
505 West Northern Lights Boulevard, Suite 205
Anchorage, Alaska 99503
www.akaction.org

March 8, 2018

Dear Representative Tarr and Representative Josephson, Co-Chairs; and Members of the House Resources Committee:

On behalf of the Alaska Community Action on Toxics, we thank Representative Tarr for sponsoring HB 27, High Risk Chemicals for Child Exposure. This is an important measure to protect the health of Alaskan children, firefighters, our families and communities. We look forward to the opportunity to provide testimony in the House Resources Committee hearing on March 9 and sincerely hope that the Committee will pass this bill.

HB 27 protects vulnerable Alaskans from high risk exposure to organohalogen flame retardant chemicals found in everyday products such as toys, nap mats, breast feeding pillows, and other children's products, as well as upholstered furniture. Our review of the substantial body of scientific peer-reviewed literature shows that exposure to these harmful flame retardant chemicals is associated with serious adverse health effects including neurodevelopmental harm (reduced IQ, memory impairment, learning deficits), infertility and other reproductive disorders, interference with thyroid hormone levels and other endocrine system effects, immune disorders, and cancers. HB 27 serves as a critical preventative measure in support of the health and well being of Alaskans and provides substantial savings in health care costs associated with these diseases.

People in Alaska are disproportionately exposed to persistent, bioaccumulative, and toxic flame retardant chemicals because Alaskans spend more time indoors in more insulated areas and in homes with less ventilation during the long winter. Toxic flame retardant chemicals can be released from objects such as couch foam and become attached to household dust that people can inhale or ingest. Because children play on the floor and put their hands in their mouths, they ingest these harmful flame retardants. Studies have found 2-5 times higher levels of flame retardant chemicals in toddlers than in their parents. Also, global distillation occurs when persistent chemicals such as flame retardants are transported by atmospheric and marine currents from warmer to colder regions of the Earth and remain there. The cold acts as a hemispheric sink and traps the harmful chemicals in Alaska and other Arctic and sub-Arctic regions. Alaska Community Action on Toxics coordinates community-based research in the Norton Sound region of Alaska with six universities and supported by the National Institutes of Healthy. We have recently published a series of papers in peer-reviewed journals which demonstrate elevated levels of flame retardant chemicals in households, traditional foods, and serum of the people of St. Lawrence Island. These levels are shown to interfere with thyroid function.

Highly toxic flame retardants chemicals are in a variety of products we use every day. However, they do not provide fire safety benefits. While chemical companies say their flame retardants make our products safer, the truth is that flame-retardants added to polyurethane foam products have been shown to be ineffective in fire protection. They generate excessive smoke and toxic chemical byproducts that expose firefighters to a toxic soup, including cancer-causing dioxins and furans.

HB 27 presents an opportunity for the Alaska State Legislature to protect the health of our citizens. Although there are no federal laws that protect people from the unnecessary addition of flame retardants to furniture and children's products, the federal Consumer Product Safety Commission (CPSC) issued a warning about products containing organohalogen flame retardant chemicals.

> *"The known adverse health effects of these chemicals to consumers include: reproductive impairment (e.g., abnormal gonadal development, reduced number of ovarian follicles, reduced sperm count, increased time to pregnancy); neurological impacts (e.g., decreased IQ in children, impaired memory, learning deficits, altered motor behavior, hyperactivity); endocrine disruption and interference with thyroid hormone action (potentially contributing to diabetes and obesity); genotoxicity; cancer; and immune disorders. These chemicals have a disproportionately negative health effect on vulnerable populations, including children."* [September 28, 2017].

At the same time that the CPSC issued this guidance, it began a rulemaking process to ban the use of the entire class of organohalogen flame retardants from 1) children's toys and child care articles, 2) mattresses and mattress pads, 3) upholstered household furniture, and 4) the outer plastic casings for electronics. Because that rulemaking will likely take years to complete, the CPSC issued a public warning to request that manufacturers of the products "eliminate the use of such chemicals in these products." Unwilling to wait for the slow-moving federal process, sixteen states are considering policies in 2018 to ban toxic flame retardants: Alaska, Connecticut, Iowa, Indiana, Massachusetts, Maryland, Mississippi, North Carolina, New Hampshire, New Jersey, New York, Tennessee, Virginia, Washington, and West Virginia. Thirteen states have already adopted 33 policies to end the use of toxic fire retardant chemicals.

The Toxic-Free Children Act (HB 27) is good for business because it helps Alaskan businesses meet the increasing consumer demand for safer products and encourages innovation and the development of safer alternatives in furniture and other products.

We urge support and passage of HB 27.

Sincerely,

Pamela Miller
Executive Director, Alaska Community on Toxics

ALASKA ACADEMY OF
FAMILY PHYSICIANS

Dear Members of the Alaska State Legislature:

The Alaska Academy of Family Physicians is submitting this letter in support of HB 27, the Toxic-Free Children Act that would protect the health of Alaska's children by preventing exposure to toxic flame retardant chemicals. If passed, these bills will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. The legislation will also require the labeling of children's products to inform people whether these products contain toxic flame retardant chemicals.

Chemical flame retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for their safety. Yet, these chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm.

Our children are vulnerable to exposure and toxic health effects of these chemicals. We need legislation to phase out harmful flame retardant chemicals from children's products and furniture. Fortunately, fire safety can be achieved without these toxic chemicals because there are safe, economical, and effective alternatives to toxic flame retardants.

It is the responsibility of our Alaska State Legislature to take action in passing the Toxic-Free Children Act (HB 27) to protect the health of our children and our future generations. We urge you to support passage of HB27 during this legislative session. Thank you for your consideration and leadership on this important public health issue. We thank Representative Geran Tarr for sponsoring this bill.

Sincerely,

Jean Tsigonis, MD

President, Alaska Academy of Family Physicians

Alaska Academy of Family Physicians
907-360-9690
academy@alaskaafp.org

Testimony in support of HB 27

Good afternoon and thank you for giving me the opportunity to speak to you today in support of House Bill 27. My name is Thomas Zoeller and I am a Professor in the Biology Department at the University of Massachusetts Amherst. My research over the past 25 years has been focused on understanding how thyroid hormone controls brain development and whether – and how - environmental chemicals like halogenated flame retardants can interfere with this action.

It is first important to recognize that thyroid hormone is essential for brain development – in the fetus, in newborns and in children. This fact is so well-recognized that every baby born in this country is tested for normal functioning of the thyroid gland at birth. In some regions of the country, as many as 1 in 1200 newborns have low thyroid hormone, and it is considered a medical emergency to ensure that they are identified and treated quickly to limit the cognitive deficits caused by low thyroid hormone during development.

It has also become clear that thyroid hormone levels in pregnant women are important for development of the fetus. This appears to be especially true in the first trimester when the fetal thyroid gland has not yet developed, but when thyroid hormone is still required for brain development.

My research on halogenated flame retardants such as PBDEs tetrabromo bisphenol A and some perfluorinated chemicals has demonstrated that these chemicals can interfere with thyroid hormone in the developing brain, but in ways that we do not fully understand.

Currently, the only tool we have to test whether these flame retardants affect the human thyroid system is to measure blood levels of thyroid hormone. But work in my laboratory and the laboratory of others has shown that some of these chemicals can interfere with thyroid hormone in brain in a manner that is not consistent with changes in blood levels of thyroid hormone.

We have expanded this work recently to humans by testing whether halogenated chemicals can interfere with thyroid hormone actions in the placenta. We have focused on placenta for the obvious reason that the tissue is available and is a known target of thyroid hormone action, but it is also likely that similar effects are occurring in the fetal brain. In collaboration with our Canadian colleague Dr. Larissa Takser in Quebec, our findings are fully consistent with the conclusion that environmental chemicals – most likely halogenated flame retardants – can interfere with thyroid hormone action in humans without affecting hormone levels in the mother or in cord blood.

This observation should be deeply concerning to everyone in this room because it means that common chemicals found in the home and workplace can affect the health of our children like a stealth bomber: flying below the radar of the ways we test chemicals for safety or to study the impacts of these chemicals on human health.

In closing, it is clear to me that these halogenated flame retardants can and do affect human development in part by interfering with thyroid hormone. This conclusion is based on years of high-resolution research that cannot be duplicated for every halogenated flame retardant. These chemicals are robbing our children and grandchildren of critical intellectual potentials. While these effects may not be visible on the faces of our children, they are no less important to them individually or to our society.

Thank you again for your attention.

NATIVE VILLAGE OF GAMBELL

P.O. BOX 90 • Gambell, Alaska 99742
Telephone: (907) 985-5346 • FAX: (907) 985-5014

Native Village of Gambell

03/07/2018

Dear Co-Chair Representatives Tarr and Josephson and Members of the House Resources Committee:

We are submitting this letter in support of HB 27, the Toxic-Free Children Act, a bill that would protect the health of Alaska's children by preventing exposure to toxic flame retardant chemicals. If passed, these bills will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. The legislation will also require the labelling of children's products to inform people whether these products contain toxic flame retardant chemicals.

Chemical flame retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for their safety. Yet, these chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm. Alaska Native people are more highly exposed to persistent, bioaccumulative chemicals, including many toxic flame retardants that contaminate our traditional foods. People of the north are also likely to be more highly exposed to harmful flame retardant chemicals that contaminate our indoor air and household dust. We also call your attention to the Alaska Federation of Natives Resolution 15-17 that passed in support of this legislation at the 2015 AFN Convention, the largest representative annual gathering in the United States of any Native peoples.

Our children are vulnerable to exposure and toxic health effects of these chemicals. We need to enact legislation to phase out harmful flame retardant chemicals from children's products and furniture. Fortunately, fire safety can be achieved without these toxic chemicals because there are safe, economical, and effective alternatives to toxic flame retardants.

Because of the lack of meaningful chemicals policy reform at the federal level, it is the responsibility of our Alaska State Legislature to take action in passing the Toxic-Free Children

Act (HB 27) to protect the health of our children and our future generations. We urge you to support passage of HB 27 during this legislative session. Thank you for your consideration and leadership on this important public health issue.

Sincerely,

Eddie Ungott

Eddie Ungott, President of NVG

KAWERAK, INC. • P.O. Box 948 • Nome, AK 99762

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STEBBINS
ST. MICHAEL
TELLER
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WALES
WHITE MOUNTAIN

March 8, 2018

Dear Co-Chair Representatives Tarr and Josephson and Members of the House Resources Committee:

We are submitting this letter in support of HB 27, the Toxic-Free Children Act, a bill that would protect the health of Alaska's children by preventing exposure to toxic flame retardant chemicals. If passed, these bills will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. The legislation will also require the labelling of children's products to inform people whether these products contain toxic flame retardant chemicals.

Chemical flame retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for their safety. Yet, these chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm. Alaska Native people are more highly exposed to persistent, bioaccumulative chemicals, including many toxic flame retardants that contaminate our traditional foods. People of the north are also likely to be more highly exposed to harmful flame retardant chemicals that contaminate our indoor air and household dust. We also call your attention to the Alaska Federation of Natives Resolution 15-17 that passed in support of this legislation at the 2015 AFN Convention, the largest representative annual gathering in the United States of any Native peoples.

Our children are vulnerable to exposure and toxic health effects of these chemicals. We need to enact legislation to phase out harmful flame retardant chemicals from children's products and furniture. Fortunately, fire safety can be achieved without these toxic chemicals because there are safe, economical, and effective alternatives to toxic flame retardants.

Because of the lack of meaningful chemicals policy reform at the federal level, it is the responsibility of our Alaska State Legislature to take action in passing the Toxic-Free Children Act (HB 27) to protect the health of our children and our future generations. We urge you to support passage of HB 27 during this legislative session. Thank you for your consideration and leadership on this important public health issue.

Sincerely,

M Bahnke

Melanie Bahnke
President

Representative Geran Tarr
Alaska State Capitol
Juneau, Alaska 99801

March 5, 2018

Dear Representative Tarr:

On behalf of the American Cancer Society Cancer Action Network (ACS CAN), I would like to thank you for your dedication to protecting the health of all Alaskans through your work on House Bill 27 regarding toxic flame retardant chemicals.

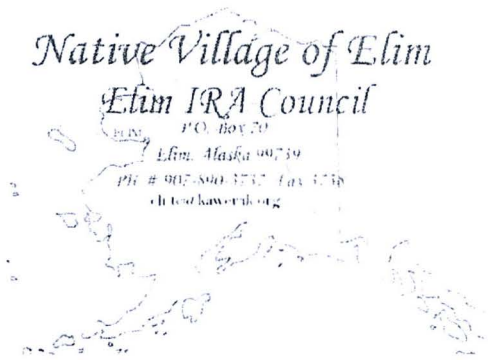
Cancer prevention is a critical element of the mission of ACS CAN. Primary prevention, which has traditionally focused on factors such as tobacco use, nutrition and physical activity, and sun exposure, can also include understanding and minimizing cancers related to human exposure to toxic substances and pollutants. Relative to your HB27, exposure to various flame retardant chemicals has been found to have serious health effects. Studies have linked exposure to carcinogenic, mutagenic, and neurotoxic effects.

Further, exposure to flame retardant chemicals is widespread. Exposures occur because flame retardant chemicals, typically contained in upholstered furniture, migrate out and into air and dust where they are inhaled, ingested, and absorbed into our bodies. Presence of these chemicals has resulted in a daily, life-long exposure that no one escapes; of special concern are exposures to pregnant women, children and firefighters. ACS CAN supports this legislation. I look forward to Alaska joining other states that have taken action on flame retardant chemicals to protect the public.

Sincerely,

Emily Nenon
Alaska Government Relations Director
American Cancer Society Cancer Action Network

3851 Piper Street, Suite U240 • Anchorage, AK • 99508
Phone 907.273.2097 • Fax 907.273.2073



Dear Co-Chair Representatives Tarr and Josephson and Members of the House Resources Committee:

We are submitting this letter in support of HB 27, the Toxic-Free Children Act, a bill that would protect the health of Alaska's children by preventing exposure to toxic flame retardant chemicals. I passed, these bills will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. The legislation will also require the labelling of children's products to inform people whether these products contain toxic flame retardant chemicals.

Chemical flame retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for their safety. Yet, these chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm. Alaska Native people are more highly exposed to persistent bioaccumulative chemicals, including many toxic flame retardants that contaminate our traditional foods. People of the north are also likely to be more highly exposed to harmful flame retardant chemicals that contaminate our indoor air and household dust. We also call your attention to the Alaska Federation of Natives Resolution 15-17 that passed in support of this legislation at the 2015 AFN Convention, the largest representative annual gathering in the United States of any Native peoples.

Our children are vulnerable to exposure and toxic health effects of these chemicals. We need to enact legislation to phase out harmful flame retardant chemicals from children's products and furniture. Fortunately, fire safety can be achieved without these toxic chemicals because these are safe, economical, and effective alternatives to toxic flame retardants.

Because of the lack of meaningful chemicals policy reform at the federal level, it is the responsibility of our Alaska State Legislature to take action in passing the Toxic-Free Children Act (HB27) to protect the health of our children and our future generations. We urge you to support passage of HB 27 during this legislative session. Thank you for your consideration and leadership on this important public health issue.

Sincerely, Robert A Keith

Robert Keith
Native Village of Elim President

March 7, 2018

Dear Members of the Alaska State Legislature:

Alaska Children's Trust's vision is all children in Alaska grow up in safe, stable and nurturing communities. We support House Bill 27, the Toxic-Free Children Act that would protect the health of Alaska's children by preventing exposure to toxic flame retardant chemicals. Passing, this bill will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. The legislation will also require the labelling of children's products to inform people whether these products contain toxic flame retardant chemicals.

Toxic flame retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are hidden in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for safety. These chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm.

Our children are vulnerable to exposure and toxic health effects of these chemicals. We need your help to enact legislation to phase out harmful flame retardant chemicals from children's products and furniture. Fire safety can be achieved without these toxics because there are safe, economical, and effective alternatives to toxic flame retardants.

Because our children lack meaningful protection from chemicals at the federal level, the Alaska State Legislature can take action, to pass the Toxic-Free Children Act (HB 27) to protect the health of our children and our future generations. We urge you to support passage of HB 27 during this legislative session. Thank you for your consideration and leadership on this important public health issue.

Sincerely,

Trevor J. Storrs
Executive Director

Pathology Associates
2801 DeBarr Road
Anchorage, AK 99508
(907) 264-1171 phone (907) 264-1702 fax

March 5, 2018

Dear Members of the Alaska State Legislature:

We are submitting this letter in support of HB 27, the Toxic-Free Children Act that would protect the health of Alaska's children by preventing exposure to toxic flame retardant chemicals. If passed, these bills will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. The legislation will also require the labeling of children's products to inform people whether these products contain toxic flame retardant chemicals.

Chemical flame retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for their safety. Yet, these chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm.

Our children are vulnerable to exposure and toxic health effects of these chemicals. We need to enact legislation to phase out harmful flame retardant chemicals from children's products and furniture. Fortunately, fire safety can be achieved without these toxic chemicals because there are safe, economical, and effective alternatives to toxic flame retardants.

It is the responsibility of our Alaska State Legislature to take action in passing the Toxic-Free Children Act (HB 27) to protect the health of our children and our future generations. We urge you to support passage of HB27 during this legislative session. Thank you for your consideration and leadership on this important public health issue.

Sincerely,

Syn Ching Lim

Syn Ching Lim, HTL (ASCP)

Dear Members of the House Resources Committee:

I teach psychology courses at a university, and my wife teaches pre-school children in Anchorage. As persons involved in education, we believe it is very important to create and maintain a safe environment where healthy development of the brain can occur without influence of various harmful chemicals. Therefore we believe it is very important to reduce children's exposures to toxic chemicals.

Flame retardant chemicals are known to have harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm. These chemicals are virtually unregulated for their safety, yet are widely used in products we bring home to our children. The Toxic-Free Children Act(HB 27) is an opportunity to take a huge step forward in protecting the health of Alaska's children by preventing exposure to toxic flame retardant chemicals. HB 27 will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. We need to enact legislation to phase out harmful flame retardant chemicals from children's products and furniture. Fortunately, fire safety can be achieved without these toxic chemicals because there are safe, economical, and effective alternatives to toxic flame retardants.

Because of the lack of meaningful chemicals policy reform at the federal level, it is the responsibility of our Alaska State Legislature to take action in passing the Toxic-Free Children Act (HB 27) to protect the health of our children and our future generations. Thank you, Representative Tarr and Drummond, for your consideration and leadership on this important public health issue. We urge representatives of the House resources committee to support passage of HB 27 during this legislative session.

Sincerely,
Yasuhiro Ozuru Naomi Ozuru
Yasuhiro and Naomi Ozuru

8901 Winchester Street Anchorage AK 99507

Phone 907-519-5599

SIVUQAQ, INCORPORATED
P.O. BOX 101 ~ GAMBELL, ALASKA 99742
Telephone: (907) 985-5826 ~ Fax: (907) 985-5426
Email: sivuqaq@gci.net or sivuqaqregistrar@yahoo.com
Registrar Telephone: 985-5003

March 6, 2018

Dear Members of the Alaska State Legislature,

Sivuqaq, Incorporated is writing this letter in support of HB 27, the Toxic-Free Children's Act that would protect the health of Alaska's children by preventing exposure to toxic flame retardant chemicals. If passed, these bills will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and furniture. The legislation will also require the labeling of children's products to inform people whether these products contain toxic flame retardant chemicals.

Chemical flame retardants are widely used in children's products, carpeting and furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for their safety. Yet, these chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm.

Our children are vulnerable to exposure and toxic health effects of these chemicals. We need to enact legislation to phase out harmful flame retardant chemicals from children's products and furniture. Fortunately, fire safety can be achieved without these toxic chemicals because there are safe, economical, and effective alternatives to toxic flame retardants.

It is the responsibility of our Alaska State Legislature to take action in passing the Toxic-Free Children Act (HB 27) to protect the health of our children and our future generations. We urge you to support passage of HB27 during this legislative session. Thank you for your consideration and leadership on this important public health issue.

Sincerely,

Erika Apatiki
Manager
Sivuqaq, Incorporated

NORTHERN ARIZONA
UNIVERSITY
College of Engineering & Natural Sciences

Biological Sciences

Northern Arizona University
PO Box 5640
Flagstaff, AZ 86011-5640

928-523-2381
928-523-7500 fax
nau.edu/cens

March 7, 2018

Dear Representatives Josephson and Tarr,

I am writing in support of HB 27. I am a professor of ecotoxicology at Northern Arizona University, and formerly at the University of Alaska. I have studied flame retardant chemicals, as well as other classes of contaminants, throughout Alaska for many years. I would like, in particular, to draw your attention to the work we have conducted on St. Lawrence Island in the Bering Sea, funded by the National Institutes of Health. We found particularly high levels of PBDE flame retardant chemicals in the environment around the village of Gambell, and we found that levels of certain PBDE chemicals in the blood serum of St. Lawrence Island residents were associated with changes to thyroid hormone levels. PBDEs are known to disrupt thyroid function, which poses a particular risk for the fetus and young children. Therefore, to the extent that legislation can reduce exposures of children and pregnant women to these chemicals, such legislation will promote the health and wellbeing of Alaskans. This is especially important for thyroid-disrupting contaminants such as PBDEs because thyroid hormones are critical to brain development, as well as to many other health outcomes. Please let me know if I may provide any further information.

Sincerely,

Frank von Hippel
Professor

UNITE HERE LOCAL 878

530 E. 4th Avenue • P.O. Box 100564 • Anchorage, Alaska 99510
(907) 272-6591 • 1-800-478-4373 • Fax (907) 277-8595
Health/Legal Information: call (800) 325-6532 or (907) 561-5119
Pension Information: call (800) 452-4155

March 6, 2018

Dear Co-Chairs Tarr and Josephson and Members of the House Resources Committee:

We are submitting this letter in support of HB 27, the Toxic-Free Children Act, a bill that would protect the health of Alaska's children, families, firefighters, and our workers by preventing exposure to harmful flame retardant chemicals. We thank Representative Tarr for her sponsorship of this important legislation. If passed, this bill will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. The legislation will also require the labelling of children's products to inform people whether these products contain toxic flame retardant chemicals.

Chemical flame retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for their safety. Yet, these chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm.

We are concerned about the safety of chemicals in everyday products that are used in our homes and workplaces. We now have definitive scientific evidence that links exposure to chemical flame retardants with serious health outcomes. These factors are eroding consumer confidence. At the same time, studies show that there is no proven fire safety benefit when using these chemicals. In 2017, the Consumer Product Safety Commission issued guidance to manufacturers, importers, distributors, retailers, and consumers to protect the health of consumers, especially children, from exposure to organohalogen flame retardant chemicals found in infant or toddler products, upholstered furniture, mattresses and mattress pads, and plastic casings of electronics. The Commission also called upon manufacturers to eliminate this toxic class of chemicals in these products, and for retailers to obtain assurances from suppliers that products don't contain them. There is an important and urgent need for state legislation to ensure the safety of these products while the Commission is proceeding with a lengthy rulemaking.

We support HB 27 because this legislation provides an opportunity to ensure that our workers and their families have good information and safe products and working environment. The legislation will help us better serve our members and the community.

Thank you for your consideration. We urge you to please pass HB 27 to protect the health of Alaska's children, firefighters, and our families.

Sincerely,

Marvin Jones
President
Unite Here Local 878
Anchorage, AK

The Arc
of Anchorage

The Arc of Anchorage
2211 Arca Drive
Anchorage, AK 99508

T: (907) 277-6677
F: (907) 272-2161
www.thearcofanchorage.org

Sponsor: Rep. Geran Tarr
Co-Sponsor: Rep. Harriet Drummond
State of Alaska House of Representatives

March 6, 2018

Dear Rep. Tarr and Rep. Drummond:

The Arc of Anchorage understands House Bill 27 is coming to a hearing later this week on March 9 and on behalf of The Arc, I am submitting this letter to support the Toxic-Free Children Act, also known as HB 27. The Arc agrees it is important to protect Alaska's children by preventing unhealthy exposure to toxic flame retardant chemicals. If passed, the bill will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. The bill requires labelling of such products to inform consumers if products contain toxic flame retardant chemicals as well.

Chemical flame retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Current federal law allows these toxic chemicals to be unregulated for their safety. These chemicals are a serious public health threat and are particularly toxic to children. These chemicals have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm.

Children are vulnerable to exposure with negative health effects due to the chemicals. The Arc urges our state to protect our children by requiring non-toxic materials and products to be used/sold that are safe, economical, and effective alternatives to toxic flame retardants. The Arc of Anchorage encourages all Alaskan lawmakers to support passage of HB 27 this legislative session.

Thank you for your consideration and leadership on this important public health issue. Should you have any questions about The Arc's support on this matter, feel free to contact me.

Sincerely,

Barbara Rodriguez-Rath, MSW
Chief Executive Officer
brath@thearcofanchorage.org | 907.777.0127

NATIVE VILLAGE OF SAVOONGA- P.O. BOX 120, SAVOONGA, AK 99769 - PHONE 984-6414 - FAX 984-6027

Native Village of Savoonga

March 06, 2018

Dear Co-Chair Representative Tarr and Josephson and Members of the House Resources Committee:

We are submitting this letter in support of HB 27, the Toxic-Free Children Act, a bill that would protect the health of Alaska's children by preventing exposure to toxic flame retardant chemicals. If passed, these bills will prevent the manufacture, sales, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. The legislation will also require the labelling of children's products to inform people whether these products contain toxic flame retardant chemicals.

Chemical flame retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for their safety. Yet, these chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm. Alaska Native people are more highly exposed to persistent, bio accumulative chemicals, including many toxic flame retardants that contaminate our traditional foods. People of the north are also likely to be more highly exposed to harmful flame retardant chemicals that contaminate our indoor air and household dust. We also call your attention to the Alaska Federation of Natives Resolution 15-17 that passed in support of this legislation at the 2015 AFN Convention, the largest representative annual gathering in the United States of any Native peoples.

Our children are vulnerable to exposure and toxic health effects of these chemicals. We need to enact legislation to phase out harmful flame retardant chemicals from children's products and furniture. Fortunately, fire safety can be achieved without these toxic chemicals because there are safe,

economical, and effective alternatives to toxic flame retardants.

Because of the lack of meaningful chemicals policy reform at the federal level, it is the responsibility of our Alaska State Legislature to take action in passing the Toxic-Free Children Act (HB 27) during this legislative session. Thank you for your consideration and leadership on this important public health issue.

Sincerely, Delbert Pungowiyi

Delbert Pungowiyi, President

March 7, 2018
Representative Geran Tarr
Alaska State Legislature
Rep.Geran.Tarr@akleg.gov

Dear Ms. Tarr:

I support HB 27 which is intended to protect the children in Alaska from exposure to flame retardants typically applied to children's clothing such as pajamas. I am pleased that you have taken this initiative. I am personally very aware of the impact of these exposures because I was involved in research funded under the National Toxicology Program before I arrived in Alaska in 1979. I also worked an additional summer in 1980 at the same Oregon Health Sciences Center in the Pharmacology Department. I have a Ph.D. in Analytical Chemistry and my training allowed me to train many chemistry majors and to set up the ASET Lab at UAA. I have since retired because of the program reductions in the Chemistry Department.

I was a co-author on four publications involving the metabolism and distribution of the flame-retardant compounds used in children's clothing in rodent models. The compounds are readily absorbed through the skin especially in the abdominal area and then they are metabolized mainly by the liver. These halogen-based organophosphates rapidly breakdown to produce free radicals which then bind to DNA and RNA leading to errors in the biological code and are potentially mutagenic and carcinogenic. Their properties are what make them a good source of free radical ions which react with oxygen to terminate the combustion mechanism. Halo-organic compounds were also used to terminate potential explosions on the North Slope of Alaska until it was found that the halo-organics being used were involved in ozone reduction in the stratosphere. As to children's clothing, there are other material designs that can reduce combustion but once the compounds were introduced to retard combustion it became a cheap way to meet the fire codes. Actuality millions of children were exposed to toxic compounds who really should never should have been. The long-term implications are likely to not be known for some time.

I am including my Vita in which the first few publications include the studies of these compounds.

Thank you for your courage in taking this step forward. Please make this letter available to all members of the Alaska State Legislature and to the Governor.

John M. Kennish

John M. Kennish
kennish@live.com

Holly Kent
8211 Wisteria St.
Anchorage, AK 99502

March 7, 2018

Dear Members of the Alaska State Legislature:

I am submitting this letter in support of HB 27, the Toxic-Free Children Act that would protect the health of Alaska's children by preventing exposure to toxic flame retardant chemicals. If passed, this bill will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. The legislation will also require the labeling of children's products to inform people whether these products contain toxic flame retardant chemicals.

Chemical flame retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for their safety. Yet, these chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm.

Our children are vulnerable to exposure and toxic health effects of these chemicals. We need to enact legislation to phase out harmful flame retardant chemicals from children's products and furniture. Fortunately, fire safety can be achieved without these toxic chemicals because there are safe, economical, and effective alternatives to toxic flame retardants.

It is the responsibility of our Alaska State Legislature to take action in passing the Toxic-Free Children Act (HB 27) to protect the health of our children and our future generations. We urge you to support passage of HB27 during this legislative session. Thank you for your consideration and leadership on this important public health issue.

Sincerely,

Holly Kent

Planned Parenthood®
Act. No matter what.

Planned Parenthood Votes Northwest and Hawaii

Representative Tarr
Alaska State Capitol
Juneau, AK 99801

Re: House Bill 27

March 2nd, 2017

Dear Representative Tarr,

On behalf of Planned Parenthood Votes Northwest and Hawaii, I write today to thank you for your leadership and for sponsoring HB 27, which would regulate toxic chemicals in children's products. Promoting healthier families is a priority that we all share, and it's time that the state of Alaska took this important step towards eliminating dangerous toxins from our everyday lives.

Planned Parenthood is the nation's leading reproductive health care provider and strongly supports policies that positively impact all aspects of peoples' reproductive health and wellness. An increasing number of studies indicate that toxins, or "chemicals of high concern," can lead to serious adverse reproductive health and fertility outcomes. Exposure to chemicals, particularly during critical windows of development such as fetal growth, have been linked to decreased fertility, sexual dysfunction, and increased risks of prostate and breast cancers later in life.

Developing infants, children, pre-teens and teenagers are also particularly vulnerable. Exposure to even small amounts of toxic substances during important developmental windows can lead to disease early in life, later in life, or even across generations. Toxic substances that build up in children's bodies can affect their health and future pregnancies long after they've been exposed. Therefore, HB 27 is good for all Alaskans – whether or not they have children, are pregnant, or want to have children in the future.

It's time we protected everyone, especially low-income communities, from the health havoc being caused by toxic chemicals in everyday household products. Low-income families are less likely to have access to health insurance or quality, affordable care to prevent or treat health issues that arise from toxic children's products. And while some people are able to buy all-natural products and avoid the health problems that toxic chemicals cause, that's a luxury that low-income families don't have.

We need policies that identify existing toxic substances, phase out their use and replace them with alternatives that are safer for Alaska's families. The threats to public health from inaction are too great to ignore. Our children deserve to inherit a safe and healthy world. HB 27 puts Alaska one step closer to securing a healthier future for our youth.

Sincerely,

Alyson Currey
Regional Field Organizer and Legislative Liaison

Planned Parenthood Votes Northwest & Hawaii
3231 Glacier Hwy, Juneau, AK 99801
907.957.8708 | Alyson.Currey@ppvnh.org

THE STATE of ALASKA
GOVERNOR BILL WALKER

Department of Health and Social Services

Senior and Disabilities Services
Governor's Council on Disabilities & Special Education
Patrick J. Reinhart, Executive Director

3601 C Street, Suite 740
Anchorage, Alaska 99503
Main: 907.269.8990
Fax: 907.269.8995

March 8, 2018

RE: Letter of Support for HB 27, the Toxic-Free Children Act

Dear Co-Chairs Tarr and Josephson and Members of the House Resources Committee:

The Governor's Council on Disabilities and Special Education (the "Council") fills a variety of federal and state roles, including serving as the State Council on Developmental Disabilities (SCDD) under the Developmental Disabilities Assistance and Bill of Rights Act. As the state DD Council, the Council works with Senior and Disabilities Services (SDS) and other state agencies to ensure that people with intellectual and developmental disabilities and their families receive the services and supports that they need, as well as participate in the planning and design of those services. One of the duties of the state DD Council is providing comments on bills that may have an impact on individuals with intellectual and/or developmental disabilities and their families.

To this end, the Council would like to issue this letter of support for HB 27, the Toxic-Free Children Act, a bill that would protect the health of Alaska's children and families by preventing exposure to toxic organohalogen flame retardant chemicals found in children's products and upholstered furniture. The Council extends its sincere appreciation to Representative Tarr for sponsoring this important public health legislation.

We are aware that the federal Consumer Product Safety Commission (CPSC) issued the following warning in 2017 about products containing organohalogen flame retardant chemicals.

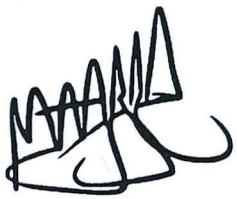
> *"The known adverse health effects of these chemicals to consumers include: reproductive impairment (e.g., abnormal gonadal development, reduced number of ovarian follicles, reduced sperm count, increased time to pregnancy); neurological impacts (e.g., decreased IQ in children, impaired memory, learning deficits, altered motor behavior, hyperactivity); endocrine disruption and interference with thyroid hormone action (potentially contributing to diabetes and obesity); genotoxicity; cancer; and immune disorders. These chemicals have a disproportionately negative health effect on vulnerable populations, including children."*

The United States Centers for Disease Control and Prevention (CDC) has identified harmful flame retardants in bodies of more than 90% of Americans. Exposure to flame retardants is associated with adverse health effects such as cancer, miscarriages, premature births, neurological and developmental delays, and respiratory problems.

This provides significant justification for the Alaska State Legislature to enact HB 27. It should be noted that sixteen states are considering policies in 2018 to ban toxic flame retardants: Alaska, Connecticut, Iowa, Indiana, Massachusetts, Maryland, Mississippi, North Carolina, New Hampshire, New Jersey, New York, Tennessee, Virginia, Washington, and West Virginia.

We urge the House Resources Committee to pass HB 27 because prevention of neurodevelopmental and other adverse health effects is key to our mission. Thank you for your careful consideration of this critical public health measure.

Respectfully,



Maggie Winston, Chair

Art Delaune, Legislative Chair

TESTIMONY OFJOSEPH FLEMING

(Submitted in writing to Alaskan House Resource Committee - 3/19/2018)

I am writing to give my support to HB 27; Act relating to chemicals that are of high concern for children and to the manufacture and products containing certain flame retardant chemicals; relating to an clearinghouse; adding an unlawful act to the Alaska Unfair Trade Practices Protection Act; and providing for an effective date.

Study after study have concluded that organohalogen flame retardant pose a serious health risk to the public in general, although Firefighters are particularly vulnerable. I assume that others will explore the health risks in detail. I will deal with the effectiveness of fire retardants and whether or not any health risk is even warranted.

Part One – Have the historical furniture flammability standards made a difference?

In the past, flame retardants were added to furniture in order to pass the California Fire Tests: TB117 (a small flame), for residential furniture and TB133 (a more robust test), for "public spaces" furniture.

- In 2013, Underwriters Labs tested FR and Non-FR furniture and concluded –

2. Substitution of TB 117 flame retardant treated foam (frPU) in place of untreated foam (PU):
   - Fire growth behavior was unchanged – rapid development with a high peak release rate.
   - Average peak heat release rate was reduced by 15% for corner ignition and side back location. and unchanged for the back bottom ignition.
   - Elapsed times for the heat release rate to reach 1000 kW (flashover) were comparable

http://www.ul.com/global/documents/offerings/industries/buildingmaterials/fireservice/furniture/Upholstered%20Furniture%20Flammability%20report.pdf

- In 2012, the Consumer Product Safety Commission tested furniture and concluded –

Overall. the results demonstrated that the addition of a fire barrier markedly increased the fire safety of the furniture. The data indicated that the fire sizes were smaller and the time to reach the peak fire size was slower with fire barriers. regardless of the fabric or foams used. Among the other effects examined. a relative difference was noticed in the foams. but the fire-retardant foams did not offer a practically significantly greater level of open-flame safety than did the untreated foams.

https://www.cpsc.gov/s3fs-public/openflame.pdf

❖ *Joseph Fleming is a Deputy Chief on The Boston Fire Department and a member of the International Association of Fire Fighters. He has testified before several state legislatures regarding the risk/benefit of flame retardants.*

- In 1995, Hugh Tally, a consultant with the furniture industry published a paper that looked at the real world benefit of TB117. He concluded -

> ***California TB-117 foam made no difference in the cigarette ignition propensity of any of the cushions tested.***
>
> ***With the exception of sample pairs 07 and 08, all of the cushions tested in the small open flame tests ignited. In 20 of the 30 small open flame tests, (66.7% of the tests) the conventional foam cushions appeared to be equal to or better than the TB-117 cushions in ignition and flame spread characteristics. It should be pointed out that in the 10 test pairs in which the TB-117 cushions appeared to perform better than the conventional foam cushions, the differences in time to ignition and flame spread were very small. Thus, there is no significant, consistent evidence from these data that cushions made with TB-117 foam perform in a small open flame scenario any better than cushions made from conventional foams.***

It seems clear that having foam that passed TB117 provided little indication of how furniture would burn in real world scenarios. But if the historical standards did not improve flammability the how can the FR industry claim that they made a difference?

Part Two – Do flame retardants deserve major credit for the reduction in fire deaths?

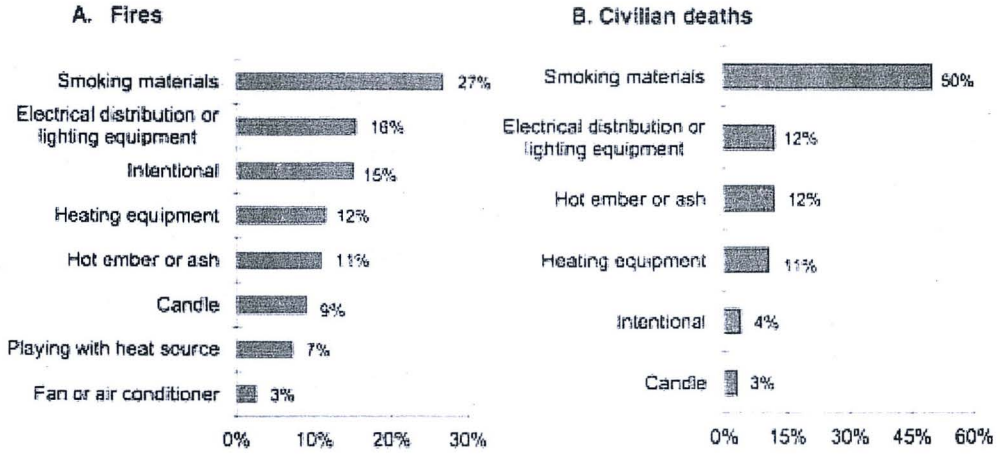
> ***FACT:*** *Flame retardants provide an important layer of fire protection and help save lives. Indeed, fires have dropped significantly over the past 40 years and a major contributor to the decline in fires and fire deaths since the 1970s was the development of a comprehensive set of fire-safety measures that include flame retardants. .... The fact is flame retardants help prevent fires from starting, slow the spread of some initial fires, reduce the intensity of fires, and provide occupants of a home or building or workers in various situations additional life-saving time to escape a fire, as well as time for firefighters to respond to a fire.* https://www.flameretardantfacts.com/fact-checker/

No one has been able to connect the reduction in fire deaths over the past 40 years to the use of flame retardants. As the NFPA recently stated, http://www.nfpa.org/news-and-research/fire-statistics-and-reports/fire-statistics/fire-causes/household-products/upholstered-furniture

> Assessing the probable impact of any one approach to fire safety is challenging. New materials enter the marketplace. Upholstered furniture is a durable product. Newer furniture is likely to have been manufactured to current flammability standards. Over time, things get spilled on the furniture, the fabric may wear out, and the furniture may pass to a different household. It is important to remember that these statistics are based on all upholstered furniture, some of which may be very old.
>
> Changes in the environment also complicate the issue. Homes are much more likely to have smoke alarms today than they were in 1980. This means that more fires may be discovered before fire department assistance is required. Fewer people are smoking. The Consumer Product Safety Commission (CPSC) required lighters to be child-resistant beginning in 1994, resulting in a drop in fires started by children playing. The increase in candle sales in the 1990s was accompanied by an increase in candle fires that began to fall in the early

Another problem with attributing the reduction in fire deaths from furniture fires to the use of fire retardants is that TB117 measured a propensity to small flame ignition, while the vast majority of fatal furniture fires involve non-flaming ignition. According to the same NFPA report -

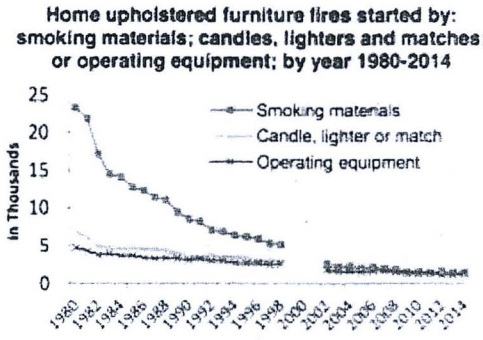
Figure 4. Leading Causes of Home Structure Fires that Began with Upholstered Furniture: 2010-2014

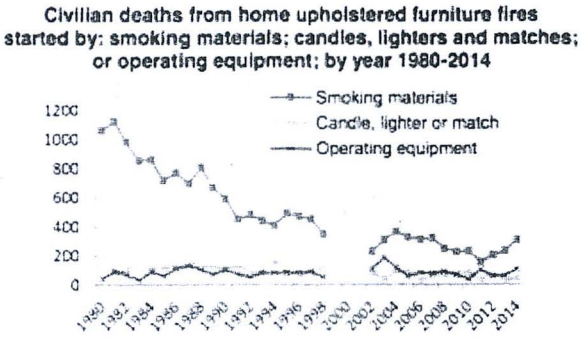


[4] Estimates for smoking materials, candles, matches and lighters include a proportional source of fires and losses with heat source code 60 "heat from open flame or smoking materials, other."

It should be noted that the new California Test, TB117-2013, is a smoldering resistant furniture test that does not require flame retardants. http://www.bearhfti.ca.gov/about_us/tb117_2013.pdf

There is another chart in this NFPA Report that provided insight into this issue.





While the number of fires and fire fatalities from smoking materials has decreased sharply the number of fires and fire fatalities from flaming ignition has decreased only a small amount. This

decrease coincided with a large increase in the use of smoke alarms and a large decrease in smoking. It does not appear that the use of flame retardants in furniture made an impact.

In a paper titled, "White Paper on Upholstered Furniture Flammability, "John Hall, of the NFPA, estimate the historical benefits of flame retardants. http://www.nfpa.org/news-and-research/publications/nfpa-journal/2013/september-october-2013/features/old-problem-fresh-look According to John Hall -

Fire prevention and mitigation effects of fire retardants

Fire retardants have been used to pass small-open-flame tests of filling material. It is not clear how effective these treatments are in resisting small-open-flame ignition of a complete piece of upholstered furniture or in resisting the kind of flaming heat source created when smoldering ignition of the covering fabric is not prevented.

Recent experiments by CPSC and UL have not shown a consistent or significant effect of fire retardants on measures of fire growth. such as peak heat release rate or time to reach peak heat release rate. For example. a memo on tests conducted in 2012 by CPSC concluded "a relative difference was noticed in the foams. but the fire-retardant foams did not offer a practically significantly greater level of open-flame safety than did the untreated foams."[18] If the fire-retardant treatment tested was applied in order to pass a test like TB 117. however. then it was not designed for that kind of fire performance.

In other words. the small-open-flame ignitions that motivated the introduction of fire retardants constitute a modest share of total upholstered furniture fatal fire deaths (about 10-15%) and always have. For other fire scenarios – notably the large open flame ignitions involving fire spread from another burning item – available test evidence has not shown a significant effect. and one would not expect an effect because the treatments were never designed to resist such large ignition heat sources. Either way. the evidence suggests the past impact of historically favored fire retardant treatments on fire deaths could not have been very large. even if they reliably performed as intended in all fires.

Part Three – Will banning certain flame retardants incase, "*the risk of increased fires generally, of greater intensity?*"

In my opinion, although this is a valid item to take into consideration, once the facts are understood it is not a major concern. To believe that the decrease use of flame retardants in furniture will increase fire risk, one would have to prove that their use in the past decreased fire risk and/or that they improved real world fire behavior. As I have illustrated, the past use of flame retardants does not appear to have improved real world fire behavior or impacted the available fire statistics.

In the NFPA "White Paper," mentioned earlier, there is an attempt to estimate the size of the furniture fire problem, including when the furniture is the 2nd item ignited. (This may provide insight into the potential benefit of the use of flame retardants.)

Table 2. Upholstered furniture fire problem, 2006-2010 averages, including fires with upholstered furniture as primary item contributing to fire spread, by major scenario

	Fires	Civilian Deaths	Civilian Injuries	Direct Damage (in Millions)
Lighted tobacco product	1,900 (21%)	270 (45%)	320 (29%)	$97 (17%)
Open flame from other fire	2,200 (25%)	130 (21%)	280 (25%)	$138 (24%)
Operating equipment	1,500 (17%)	70 (12%)	140 (13%)	$81 (14%)
Small open flame	1,400 (16%)	60 (10%)	220 (20%)	$69 (12%)
Ember, ash or other or unclassified hot or smoldering object	1,300 (15%)	60 (10%)	130 (11%)	$150 (27%)
Unclassified.	600 (7%)	20 (3%)	30 (3%)	$31 (5%)

9

Even if one accepts the statistical methodology used to arrive at the numbers, several items should be considered.

1. The majority (55%) of ignition sources are smoldering and these are addressed by TB117-2013, which does not require flame retardants to be added to the furniture.
2. Starting in 2020, Underwriters Laboratories (UL217) will be mandating that all smoke alarms pass more robust fire tests, as well as be resistant to nuisance alarms. Smoke alarms that pass these new tests will respond to both flaming and smoldering ignited furniture fires faster than in the past. This will provide more time for occupants to safely exit the house, without the need for fire retardants.
3. The combination of TB117-2013 and the updated Ul217 should greatly reduce the risk of furniture fires from flaming and smoldering ignition even without the use of flame retardants.

Why should Alaska expose its citizens, especially firefighters, to any chemicals, particularly chemicals hazardous to humans and/or the environment, without a reasonable expectation that this major increase in risk, to health and the environment will be justified by a major reduction in fire risk? Since I have demonstrated that there is no reason to expect a reduction in fire risk from the use of flame retardants in furniture, what justifies any risk to citizens, firefighters and the environment?

International Brotherhood of Electrical Workers
Local 1547

3333 DENALI STREET, SUITE 200
ANCHORAGE, ALASKA 99503-4038

TELEPHONE (907) 272-6571
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FAX (907) 777-7255

DAVE REAVES
BUSINESS MANAGER • FINANCIAL SECRETARY

KNUTE ANDERSON
PRESIDENT

Dear Co-Chairs Tarr and Josephson and Members of the House Resources Committee:

On behalf of the 5,000 members of the International Brotherhood of Electrical Workers Local 1547, I am writing in support of HB 27.

HB 27 will protect the health of Alaska's children by preventing the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. Under current federal law, these toxic chemicals are virtually unregulated for their safety. We now have scientific evidence that proves exposure to chemical flame retardants causes serious health problems.

One of the tenets of our union is safety. In the 1800's when we were founded one of every two electrical workers were killed on the job. Being proactive on this issue helps reduce costs and risks as workers, especially first responders. Exposure to harmful chemicals in the workplace will only result in lost productivity at a financial cost to employers.

We support HB 27 because this legislation provides an opportunity to ensure that all Alaskans have good information and safe products.

Thank you for your consideration of our views. Please support HB 27.

Sincerely,

Dave Reaves
Business Manager
IBEW Local 1547

Jasmine Jemewouk
1531 Alpenhorn Ave
Anchorage, Alaska 99503
March 8, 2018

Dear Co-Chairs Tarr and Josephson and Members of the House Resources Committee,

I am writing this letter in support of HB 27, the Toxic-Free Children Act. The protection against the exposure of organohalogen flame retardant chemicals, which are in children's products and home furniture, is crucial for the safety of Alaska's children, families, and firefighters. As a board member, on behalf of the Alaska Community Action on Toxics, we extend our sincere appreciation to Representative Tarr for sponsoring this important public health legislation.

There are multiple ways for organohalogen flame retardants to disproportionally effect Alaskans, which is why the support for HB 27 is so crucial. Organohalogen flame retardants are known to be dangerous by multiple scientific papers in peer-reviewed literature. They have well-documented harmful effects, due to the use of organohalogen flame retardants in consumer products. This chemical is known to leach out of products, which exposes people in their home and work environments. Children in Alaska are disproportionally exposed to organohalogen flame retardants due to a variety of factors. They tend to spend more time indoors with less ventilation during long winters which causes them to come into greater contact with household dust, resulting in harm to their developing brains and reproductive organs. Global distillation causes persistent chemicals such as flame retardants to be transported to the Arctic by atmospheric and marine currents. The Arctic is a hemispheric sink and traps the chemicals, which then bioaccumulate in fish, wildlife, and people. As an Alaskan Native who greatly depends on a subsistence lifestyle, it's important to protect our environment and people by keeping these chemicals out.

We are aware that the federal Consumer Product Safety Commission (CPSC) issued the following warning in 2017 about products containing organohalogen flame retardant chemicals.

NATIVE MOVEMENT

WWW.NATIVEMOVEMENT.ORG

Friday March 9, 2018

Dear Co-Chair Representatives Tarr and Josephson and Members of the House Resources Committee:

We are submitting this letter in support of HB 27, the Toxic-Free Children Act, a bill that would protect the health of Alaska's children by preventing exposure to toxic flame retardant chemicals. If passed, these bills will prevent the manufacture, sale, and distribution of toxic and unnecessary flame retardant chemicals in children's products and home furniture. The legislation will also require the labeling of children's products to inform people whether these products contain toxic flame retardant chemicals.

Chemical flame-retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for their safety. Yet, these chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm. Alaska Native people are more exposed to persistent, bioaccumulative chemicals, including many toxic flame-retardants that contaminate our traditional foods. We also call your attention to the Alaska Federation of Natives Resolution 15-17 that passed in support of this legislation at the 2015 AFN Convention, the largest representative annual gathering in the United States of any Native peoples.

Because of the lack of meaningful chemicals policy reform at the federal level, it is the responsibility of our Alaska State Legislature to take action in passing the Toxic-Free Children Act (HB 27) to protect the health of our children and our future generations. We urge you to support passage of HB 27 during this legislative session. Thank you for your consideration and leadership on this important public health issue.

Sincerely,

Enei MBRA

Enei Begaye-Peter
Executive Director, Native Movement
PO Box 83467 Fairbanks, AK 99709

NORTON SOUND
HEALTH CORPORATION

Providing quality health services and promoting wellness within our people and environment.

March 7, 2018

Dear Co-Chair Representatives Tarr and Josephson and Members of the House Resources Committee:

We are submitting this letter in support of HB 27, the Toxic-Free Children Act, a bill that would protect the health of Alaska's children by preventing exposure to toxic flame- retardant chemicals. If passed, these bills will prevent the manufacture, sale, and distribution of toxic and unnecessary flame- retardant chemicals in children's products and home furniture. The legislation will also require the labelling of children's products to inform people whether these products contain toxic flame- retardant chemicals.

Chemical flame retardants are widely used in children's products, carpeting, and home furniture. These harmful chemicals are found in toys, nap mats, nursing pillows, changing pads, baby carriers, carpet padding, and upholstered furniture foam. Under current federal law, these toxic chemicals are virtually unregulated for their safety. Yet, these chemicals pose a serious public health threat, are particularly toxic to children, and do not provide a fire safety benefit. They have a range of harmful health effects, including cancer, learning disabilities, developmental impairment, and reproductive harm. Alaska Native people are more highly exposed to persistent, bio-accumulative chemicals, including many toxic flame retardants that contaminate our traditional foods. People of the north are also likely to be more highly exposed to harmful flame- retardant chemicals that contaminate our indoor air and household dust. We also call your attention to the Alaska Federation of Natives Resolution 15-17 that passed in support of this legislation at the 2015 AFN Convention, the largest representative annual gathering in the United States of any Native peoples.

Our children are vulnerable to exposure and toxic health effects of these chemicals. We need to enact legislation to phase out harmful flame- retardant chemicals from children's products and furniture. Fortunately, fire safety can be achieved without these toxic chemicals because there are safe, economical, and effective alternatives to toxic flame retardants.

Because of the lack of meaningful chemicals policy reform at the federal level, it is the responsibility of our Alaska State Legislature to take action in passing the Toxic-Free Children Act (HB 27) to protect the health of our children and our future generations. We urge you to support passage of HB 27 during this legislative session. Thank you for your consideration and leadership on this important public health issue.

Sincerely,

Angie Gorn

Angie Gorn, NSHC President/CEO

T. 907.443.3311 | F. 907.443.2113 | P.O. Box 966, Nome, Alaska 99762-0966 | www.nortonsoundhealth.org

March 7, 2018

Opik Ahkinga
Environmental Coordinator
Native Village of Diomede
P.O. Box 7079
Little Diomede, Alaska 99762
dio.env103@yahoo.com

Co-Chair Representatives Tarr and Josephson
House of Resources Committee Members
Alaska State Legislature

Dear Representative Tarr and Josephson and Members of the House of Resources Committee:

My name is Opik Ahkinga. I am the Environmental Coordinator for the Native Village of Diomede. The goal of the Native Village of Diomede is to continue to build capacity to manage an environmental program to reduce solid waste generation and to educate the community of negative impacts to the people, land, air, and the Alaskan ocean. An important part of my job focuses on Children's Environmental Health. Children are vulnerable to harmful household chemical products. We need to help our children develop and understanding of environmental health, by engaging them to make healthier choices for creating a safer living environment. In 2017, the Diomede EPA Indian General Assistance Program (IGAP), established the first time ever Inaliq Youth Committee. DIO IGAP provides technical assistance with youth members by online research, hands-on activities of making safe household products, conducting community litter clean-ups, and by sharing public outreach.

Economic growth continues to increase impacts and brings issues to our tiny isolated community. Just like the rest of the world, Diomede locals purchase new materials, resulting in solid and hazardous waste pollution. All trash on Diomede is burned, bringing bad toxic smoke into the sky; what doesn't burn ends up into the ocean. Therefore, we are contributors of climate change and ocean acidification. All products that add the chemical flame retardants are used in our homes, workplaces, health clinic, and schools as well. Little do many moms and family members know that the toys babies put into their mouths contain toxic flame retardants. Toddlers have higher levels of chemicals in their bodies because they are exposed to these toxins. Do babies and children know that chemicals products in their everyday lives have a negative effect to their health?

Continuing to manufacture chemical flame retardants in our children's household products are threatening lives. I ask the Alaska State Legislature to support HB 27, the Toxic-Free Children Act, to protect the health of our children. I strongly believe that if you support this bill you will impact many lives.

Let's achieve proper health care for our future leaders...the Children.

Sincerely,

Opik

Opik Ahkinga
Environmental Coordinator
Native Village of Diomede

Testimony by Alison Talley
In Support of HB 27 - The Toxic Free Children Act
March 9, 2018

Thank you for this opportunity to speak in support of HB 27 – the Toxic Free Children Act. My name is Alison Talley. I live in Juneau and am the mother of three adopted children, all of them born in Alaska. Two of my children have learning disabilities and I am a volunteer with the Learning Disabilities Association of Alaska.

Here's a shocking statistic: One in six children in the United States has a reported learning or developmental disability - that means autism, attention deficit hyperactivity disorder, and other learning or developmental delays.[1] Learning and developmental disabilities have lasting impacts on children, families and on society. On average, it costs twice as much to educate a child with a learning or developmental disability as it does to educate a child without a disability.[2]

There is now scientific agreement that toxic chemicals, including PBDE flame retardants, can harm brain development and contribute to learning, behavioral or intellectual deficits. The National Academy of Sciences states that environmental factors, including toxic chemicals, contribute to more than a quarter of all learning and developmental disabilities in U.S. children.[3]

In July 2016 leading scientists and health professionals published a statement naming PBDEs as examples of toxic chemicals that are increasing children's risks for neurodevelopmental disorders, including ADHD, learning disabilities and autism.[4] The statement also outlines the scientists' concerns with halogenated flame retardants that are replacing PBDEs, and notes that the replacement flame retardants are similar in structure to PBDEs, and emerging evidence shows they are similarly neurotoxic.[5]

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[1] Boyle, CA, Boulet S, Schieve LA, et al. Trends in the prevalence of developmental disabilities in U.S. children, 1997-2008, Pediatrics. Jun 2011;127(6):1034-1042.

[2] Chambers JG, Parris TB, Harr JJ. 2004. What Are We Spending on Special Education Services in the United States, 1999-2000? Washington, DC: American Institutes for Research. Available: http://www.csef-air.org/publications/seep/national/AdvRpt1.pdf [accessed 25 May 2016].

[3] National Research Council (US) Committee on Developmental Toxicology. Scientific Frontiers in Developmental Toxicology and Risk Assessment. 2000; executive summary. Washington (DC): National Academies Press. ISBN-10: 0-309-07086-4

[4] Bennett D, Bellinger DC, Birnbaum LS, et al; Project TENDR: Targeting Environmental Neuro-Developmental Risks: the TENDR consensus statement. *Environ Health Perspect*. 2016;124(7):A118-A122.

[5] Bennett D, Bellinger DC, Birnbaum LS, et al; Project TENDR: Targeting Environmental Neuro-Developmental Risks: the TENDR consensus statement. *Environ Health Perspect*. 2016;124(7):A118-A122.

Halogenated flame retardants cross the placenta to the fetus and are detected in umbilical cord blood and in breast milk.[10] Halogenated flame retardants migrate from products such as furniture, baby and children's products, electronics casings and mattresses into household dust. The EPA estimates that children ages 1–5 ingest approximately four to five times more dust than adults.[11]

Toddlers get flame retardants in house dust on their hands, and then put their hands in their mouths. They can also put objects that contain flame retardants into their mouths. Here in Alaska our children spend a lot of time indoors during the winters, so our children may be even more highly exposed to toxic chemicals in house dust than children in other parts of the country.

But maybe those levels are so low they don't matter much – after all, we're talking about parts per billion. Here's what is important to understand: Researchers have identified "critical windows of vulnerability" during fetal development and early childhood when the brain is especially at risk from toxic chemicals, even at extremely low exposure levels.[12,13]

Parts per billion sounds deceptively small. But consider chemicals, like Ritalin, that are designed to alter behavior. The prescribed dose of Ritalin for a child with ADHD affects the child's brain at about the same level as the level of flame retardants that are found in children.[14] Both the prescribed behavior-altering chemical, Ritalin, and the behavior-altering toxic flame retardant chemicals are active in the child's body and brain at levels of parts per billion.

Here is what we know: We know that infants and children (even before they are born) are regularly exposed to halogenated flame retardants, in part because these chemicals migrate from products into house dust and are ingested. We know that halogenated flame retardants are active in children's bodies at levels that can disrupt thyroid hormone, which in turn

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[10] U.S. Environmental Protection Agency. Flame retardant alternatives for Hexabromocyclododecane. 2014 June; p. 2-12. Available at: http://www.epa.gov/sites/production/files/2014-06/documents/hbcd_report.pdf

[11] U.S.EPA. Child Specific Exposure Factors Handbook. WD, editor. National Center for Environmental Assessment. 2002. EPA-600-P-00- 002B.

[12] Zoeller RT, Brown TR, Doan LL, Gore AC, Skakkebaek NE, Soto AM, Woodruff TJ, Vom Saal FS. Endocrine-disrupting chemicals and public health protection: a statement of principles from The Endocrine Society. Endocrinology. 2012 Sep;153(9):4097-110.

[13] Rice D, Barone S, Jr. Critical periods of vulnerability for the developing nervous system: evidence from humans and animal models. Environ Health Perspect. 2000; 108(suppl 3):511-33.

[14] Lanphear BP. The impact of toxins on the developing brain. Annu Rev Public Health. 2015 Mar 18;36:214.

ALL ALASKA
PEDIATRIC
PARTNERSHIP

March 13, 2018

Dear Co-Chairs Tarr and Josephson and Members of the House Resources Committee,

On behalf of the All Alaska Pediatric Partnership and its board of directors, I am writing to you in support of HB27, the Toxic-Free Children Act, a bill that would protect the health of Alaska's children, families, and firefighters by preventing exposure to toxic organohalogen flame retardant chemicals found in children's products and upholstered furniture.

Numerous scientific papers in the peer-reviewed literature have documented the harms posed by the use of organohalogen flame-retardants in consumer products. Children are especially at-risk because they come into greater contact with household dust than adults, and studies show that children, whose developing brains and reproductive organs are most vulnerable, have three to five times higher blood levels of these chemicals than their parents. Children in Alaska are especially vulnerable because they tend to spend more time indoors in homes with greater insulation and less ventilation during the long winter months.

We are aware that the federal Consumer Product Safety Commission (CPSC) issued the following warning in 2017 about products containing organohalogen flame retardant chemicals.

"The known adverse health effects of these chemicals to consumers include: reproductive impairment (e.g., abnormal gonadal development, reduced number of ovarian follicles, reduced sperm count, increased time to pregnancy); neurological impacts (e.g., decreased IQ in children, impaired memory, learning deficits, altered motor behavior, hyperactivity); endocrine disruption and interference with thyroid hormone action (potentially contributing to diabetes and obesity); genotoxicity; cancer; and immune disorders. These chemicals have a disproportionately negative health effect on vulnerable populations, including children."

The All Alaska Pediatric Partnership thanks you for sponsoring HB 27 and we support its passage.

Sincerely,

Tamar Ben-Yosef

Tamar Ben-Yosef

Executive Director,
All Alaska Pediatric Partnership

Public testimony

Thank you for the opportunity to provide testimony in support to HB 27. My name is Samarys Seguinot Medina. I am a scientist and public health professional. But primarily I'm a mother and grandmother.

I thought it would be relevant and important for this hearing to remember former Dr. David M. Heimbach who failed to disclose his ties to the flame retardant chemical industry.

He testified at least three times in Juneau between 2010 and 2012 against bills to restrict chemicals proven to be hazardous, especially to children.

Washington medical board reported that Heimbach invented tragic stories of children burn victims in his testimony to Alaska and other states. Heimbach fabricated testimony and falsely presented himself as an unbiased burn expert when, in fact, he was on the payroll of the manufacturers of chemical flame retardants. Washington state officials said that he had been paid $240,000 for his help.

Chemical industry is paying people to give false testimony. This is an example of the deceptive tactics that the chemical industry uses for their own benefit without any consideration of the harm they can cause to people, especially children who are the most vulnerable.

Is our duty and responsibility as citizens and public servants to care for our children and provide, ethically and respectfully, the protection they need so they can thrive and grow in a safe and healthy environment. I support HB 27 and I want to thank Rep. Tarr and Rep. Josephson for working for the well-being of our children.

References:

Toxic Hot Seat documentary. http://www.imdb.com/title/tt3212404/

TOXIC HOT SEAT takes an in-depth look at a nexus of money, politics and power – and a courageous group of firefighters, mothers, journalists, scientists, politicians and activists as they fight to expose what they assert is a shadowy campaign of deception that has left a toxic legacy in America's homes and bodies for nearly 40 years.

Set against the backdrop of the award-winning 2012 Chicago Tribune investigative series Playing with Fire, TOXIC HOT SEAT tells an intricate story, detailing how chemical companies that produce flame retardants spend millions of dollars on lobbyists, publicists and influencers, and how Big Tobacco had a hand in convincing fire-safety officials to back a standard that, in effect, requires all furniture to be filled with toxic flame retardants.

Investigative Report from Chicago Tribune: Playing with Fire.
http://media.apps.chicagotribune.com/flames/index.html

Caitlyn Ellis

From: Shelagh Sands <shelaghsands@gmail.com>
Sent: Thursday, April 12, 2018 2:43 PM
To: House Labor and Commerce
Subject: House Bill 27

Dear House and Commerce Committee members,

I believe this is a very important bill. We need to protect our children from Toxins.
I think it would be wise for your committee to hold a public hearing on this, so you can hear from the public just how concerned they are about the toxins addressed in this bill.

Banning the family of chemicals, organohalogens, that are used as flame retardants is important for our children and our firemen. Alaska children are more exposed as they are on the floor more due to our inclement weather. These chemicals adhere to dust on the floor.

Please be wise about our future here in Alaskan and get more information for yourselves from holding a public hearing. You will see what a concern this is for us.

Thank you

Shelagh Sands

Caitlyn Ellis

From: Larri Spengler <lspengler@ak.net>
Sent: Thursday, April 12, 2018 5:18 PM
To: Rep. Sam Kito; House Labor and Commerce
Subject: House Bill 27

Greetings:

Please hold a hearing on this important bill. Toxins are a lurking, problematic problem for Alaskans, especially young Alaskans.

Thank you.

Larri Spengler

Larri Irene Spengler
4545 Thane Road
Juneau, Alaska 99801
907-586-9768 (phone/fax)
lspengler@ak.net

Caitlyn Ellis

From: Margaret Ramos <ramosashe@gmail.com>
Sent: Friday, April 13, 2018 12:34 AM
To: Rep. Sam Kito; House Labor and Commerce
Subject: House Bill 27

Dear Chairman Kito and House Labor and Commerce Committee Members,

House Bill 27, The Alaska Toxic-Free Children's Act, is intended to protect Alaska children from the use and exposure to harmful flame retardants. These toxic chemicals, specifically organohalogens, can cause more harm than good because of their health risks and there are safer alternatives for making children's products flame retardant.

With the information available, there is no time to wait for a slow and uncertain, years long process for federal regulation to develop and take effect. As one of 16 states now considering legislation to end use of these toxic fire retardant chemicals in children's products, Alaska must join the 13 proactive states which have already passed such policies.

HB 27 now needs a hearing in your Labor and Commerce Committee. Please do your part in making this bill happen and hold the hearing. I know we can agree that we all care about the future and well being of our children.

Thank you for your leadership.

Margaret Ramos
Douglas, Alaska 99824

Follow up from public testimony / 21 pages

Regulation of Endocrine-Disrupting Chemicals Insufficient to Safeguard Public Health

R. Thomas Zoeller

Department of Biology, University of Massachusetts Amherst, Amherst, Massachusetts 01003

The following article, "The Metabolically Healthy but Obese Phenotype Is Associated With Lower Plasma Levels of Persistent Organic Pollutants as Compared With the Metabolically Abnormal Obese Phenotype" (*JCEM* 2014;99:E1061–E1066) is one of many new studies that links endocrine-disrupting chemicals (EDCs) to disease. The study reports that obese patients with higher blood levels of persistent organic pollutants (POPs) had significantly greater insulin resistance and worse measures of cardiovascular disease compared with obese patients with lower blood levels of POPs. POPs are toxic man-made chemicals used in agricultural, industrial, and manufacturing processes. The study authors suggest that POPs may contribute to the development of insulin resistance and cardiometabolic disease in obese patients.

The good news is that POPs have been strictly regulated since the Stockholm Convention in 2004. The bad news is that these chemicals are still omnipresent and are even found in Arctic locations thousands of miles from known sources. Furthermore, there are many other chemicals with endocrine-disrupting effects that are underregulated or not regulated at all.

In the United States, federal agencies including the Food and Drug Administration and the Environmental Protection Agency are responsible for identifying and regulating potentially hazardous chemicals. In the European Union (E.U.), the task falls largely to the European Commission, but with the added complexity of implementation at the national level. The Organisation for Economic Cooperation and Development provides a bridge between the U.S. and E.U. systems, establishing protocols that are agreed upon by all participating parties. In all these efforts, however, endocrinologists are woefully underrepresented, if they participate at all, in the processes of assessing and developing policies. As a result, established policies do not take into account critical endocrine principles. Through scientific publications, education, and awareness-raising efforts, the Endocrine Society is working to change this.

Many well-designed, heavily reviewed, National Institutes of Health-funded studies show that exposure to even low doses of EDCs can have adverse effects during critical life periods when organisms may be most vulnerable, yet current regulations often disregard these findings. The Endocrine Society asserts that regulatory decisions on the use of EDCs should be made based on the best available science, and the Society has been joined in this call by other major health organizations.

Endocrinologists have a valuable and unique insight into the impact of EDCs, and those actively engaged in the development of new knowledge in relevant disciplines should be involved in evaluating the weight of evidence of EDC studies as well as in the design and interpretation of studies that inform the regulation of EDCs. To this end, the Endocrine Society continues to call on policymakers to enhance screening programs for EDCs by incorporating well-defined and accepted principles of endocrinology. Furthermore, the Society urges policymakers to make sure endocrinologists have a seat at the table when determining effective chemical screening and regulatory measures.

The Society is increasing knowledge and understanding of EDCs through publication of its 2009 Scientific Statement and 2012 Statement of Principles, EDC programming at ENDO, and ongoing advocacy efforts in the United States and abroad.

ISSN Print 0021-972X ISSN Online 1945-7197
Printed in U.S.A.

Received May 9, 2014. Accepted May 9, 2014.

For related article see page E1061

In 2012, the Society began advocacy work in the E.U. to disseminate its science-based messages on EDCs. Since then, the Society has expanded its efforts in the E.U. and beyond. By participating in global efforts, such as the Strategic Approach to International Chemicals Management, the Society and its partners are helping to raise awareness of EDCs in a framework that comprises more than 150 stakeholders, including more than 100 governments. By raising awareness of the issues and providing the expertise needed to identify real solutions, progress becomes a real possibility.

As the evidence mounts for potential public health risks from EDC exposure, so does the political will to better understand and evaluate the endocrine effects of the more than 80 000 chemicals in use worldwide. The Endocrine Society brings invaluable scientific insights into the efforts to do so.

Acknowledgments

Address all correspondence and requests for reprints to: Professor Robert Thomas Zoeller, PhD, University of Massachusetts Biology Department, Morrill Science Center, Amherst MA 01003. E-mail: tzoeller@bio.umass.edu.

Disclosure Summary: The author has nothing to declare.

This editorial was submitted to *JCEM* by the Endocrine Society to reflect its position on an important policy issue. For further information, contact the Society's Advocacy and Public Outreach Core Committee at govt-prof@endocrine.org.

Zoeller et al. Environmental Health 2014, 13:118
http://www.ehjournal.net/content/13/1/118

ENVIRONMENTAL HEALTH

COMMENTARY Open Access

A path forward in the debate over health impacts of endocrine disrupting chemicals

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Abstract

Several recent publications reflect debate on the issue of "endocrine disrupting chemicals" (EDCs), indicating that two seemingly mutually exclusive perspectives are being articulated separately and independently. Considering this, a group of scientists with expertise in basic science, medicine and risk assessment reviewed the various aspects of the debate to identify the most significant areas of dispute and to propose a path forward. We identified four areas of debate. The first is about the definitions for terms such as "endocrine disrupting chemical", "adverse effects", and "endocrine system". The second is focused on elements of hormone action including "potency", "endpoints", "timing", "dose" and "thresholds". The third addresses the information needed to establish sufficient evidence of harm. Finally, the fourth focuses on the need to develop and the characteristics of transparent, systematic methods to review the EDC literature. Herein we identify areas of general consensus and propose resolutions for these four areas that would allow the field to move beyond the current and, in our opinion, ineffective debate.

Keywords: Endocrine disruptor, UNEP, WHO, State of the science

Background

Several recent publications have reflected intense debate concerning the potential health effects of "endocrine disrupting chemicals" (EDCs). For example, Kortenkamp et al. [1] produced a "State of the Art" of EDCs document under contract from the European Commission, about which there was a critical editorial [2], and a response [3]. Likewise, Vandenberg et al. [4] conducted a major review of the evidence for low-dose effects of chemicals on the endocrine system, about which there was a critical editorial [5], and a rebuttal [6]. More recently, a group of toxicology journal editors [7] wrote an open letter to the then science advisor to the European Commission concluding that the Commission was proposing an approach that lacks "adequate scientific evidence" [8]; this letter was criticized by a number of scientists in two separate responses [9,10]. In 2010, the United Nations Environmental Programme (UNEP) and the World Health Organization (WHO) assembled a working group of 16 scientists from 10 countries to write a review on the state of the science of endocrine disruptors, with specific content added by 9 other experts [11]. Twenty-three independent scientists from 12 countries reviewed the semi-final draft, and the final version was reviewed and approved by UNEP and WHO scientists prior to its publication in early 2013. Like before, a group of authors published a critical editorial of this document [12] and many of the same criticisms have been found elsewhere [13].

Thus, in large measure, the current "debate" has taken the form of two apparently mutually exclusive perspectives, but perhaps revolving around issues that may in fact not be disputed between the groups. To illustrate this, the then Chief Scientific Advisor to the President of the European Commission (Professor Anne Glover) held a meeting between representatives of the two opposing perspectives [7-9], and there was surprising consensus on issues that Dietrich et al. had originally contested [13]. Because the critical analysis of the UNEP/WHO report [11] by Lamb et al. [12] is the longest and most detailed, and because it covers the same issues expressed in other critical reviews, we use this as the focus of our current analysis. Our goal is to review aspects of the debate as revealed in these

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publications, identify areas of disagreement, and propose a common path forward.

The role of definitions: is everyone talking about the same thing?

Endocrine Disrupting Chemical (EDC)

Several groups have proposed definitions for an EDC. These definitions have been reviewed previously [14,15] and are included in Table 1. For example, the definition proposed by the WHO/IPCS document of 2002 [16] is: "An endocrine disrupter is an exogenous substance or mixture that alters function(s) of the endocrine system and consequently causes adverse health effects in an intact organism, or its progeny, or (sub) populations". This definition employs certain terms ("function(s) of the endocrine system", "endocrine system", "adverse effect") that have been inconsistently applied and, therefore, have created the appearance of a dispute where none may exist.

The first area of debate is the term "function(s) of the endocrine system". Some authors use this term to mean a change in hormone concentrations in the blood. Therefore, an EDC would include a candy bar which, when eaten, would cause insulin secretion, thereby altering the "function" of an endocrine system. This issue was highlighted by Nohynek et al. [14], who wrote, "... could a single Chinese meal or a cup of coffee wreak havoc with our endocrine systems? Does this assumption appear reasonable?" Obviously, no one would propose that a candy bar or a meal of Chinese food would constitute disruption of the function of the endocrine system; but they do change hormone concentrations in the blood. This concept can be found in many publications because of the way "endocrine function" is being interpreted.

In contrast, recent research demonstrates that EDCs can change the responses of the endocrine system to normal events [19]. For example, studies have shown that the female hormone, 17β-estradiol, can increase insulin production in the pancreas, but that the chemical bisphenol A can overstimulate the estrogen receptor potentially leading to insulin resistance – an important component of type 2 diabetes [20]. In addition, recent evidence also shows that EDCs can interfere with the effects of hormones in tissues in a manner that is not reflected by changes in hormone concentrations in the blood [21]. In recognition of this, the Endocrine Society (the largest professional society of clinical and research endocrinologists) offered a biologically-based definition of an endocrine disruptor: "An ED is an exogenous chemical, or mixture of chemicals, that interferes with any aspect of hormone action" [15]. In this view, an EDC would be a chemical that changes the way the pancreas responds to the candy bar (or a meal of Chinese food), or that blocks the ability of insulin concentrations to rise or to act to lower glucose. By focusing on "hormone action" instead of "endocrine function", a

Table 1 Definitions of endocrine disruptors

Date	Agency	Definition
1996	US EPA[1]	An exogenous agent that interferes with the production, release, transport, metabolism, binding, action, or elimination of natural hormones in the body responsible for the maintenance of homeostasis and the regulation of developmental processes.
1996	EU[2]	An exogenous substance that causes adverse health effects in an intact organism, or its progeny, secondary to changes in endocrine function. A potential ED is a substance that possesses properties that might be expected to lead to endocrine disruption in an intact organism.
1998	The Environment Agency	An endocrine disruptor is an exogenous substance that causes adverse health effects in an organism, or its progeny, consequent to endocrine function.
1999	National Academy of Science	The term hormonally active agents (HAAs) is used to describe substances that possess hormone-like activity regardless of mechanism. Convincing evidence that an HAA can affect the endocrine system would be its ability to bind to classic hormone receptors and promote measureable responses such as the induction of hormone-responsive genes or gene products. However, chemicals can disrupt hormonal processes by a variety of other mechanisms.
2000	The Royal Society	EDCs are substances which may interfere with normal function of the endocrine (hormone) system of human and animals, since many of them mimic the structure of natural hormones produced in the body.
2000	German Consultative Study	Substances able to disrupt endocrine processes with the potential for impairing development and reproduction or increasing the risk of cancer.
2002	WHO/IPCS[3]	An exogenous substance or mixture that alters function(s) of the endocrine system and consequently causes adverse effects in an intact organism, or its progeny, or (sub)populations. A potential endocrine disruptor is an exogenous substance or mixture that possesses properties that might be expected to lead to endocrine disruption in an intact organism, or its progeny, or (sub)populations.
2012	Endocrine Society[4]	An exogenous chemical, or mixture of chemicals, that interferes with any aspect of hormone action.

[1]United States Environmental Protection Agency [17].
[2]European Union at the Weybridge Conference [18].
[3]World Health Organization/International Programme on Chemical Safety [16].
[4][15].

candy bar (or a meal of Chinese food, or a coffee) would not fit this definition of an EDC because it does not interfere with hormone action.

We should note here that by hormone "action" we mean "hormone receptor activation" that leads to developmental or physiological effects. Hormone receptors are proteins that mediate the effect of the hormone on a cell; EDCs can interfere with hormone action either by interacting directly with a receptor, or by interfering with the normal delivery of the hormone to the receptor [19]. By "normal delivery", we mean that a chemical can interfere with hormone synthesis, release, transport in blood or across membranes, metabolism or clearance. In short, any process that affects the ability of the hormone to come into contact with the receptor to impact "hormone action". In addition, some chemicals have been shown to interact with a hormone receptor and cause it to exert a different action [22]. This kind of mechanism will be particularly insidious because it will produce effects that do not faithfully recapitulate an agonist or antagonist action.

The various definitions of an EDC proposed by regulatory agencies are not likely to change. And, in principle, the term "endocrine function" is reasonable as long as it is viewed in terms of hormone action and not simply of hormone concentrations in blood. Thus, the current debate would be greatly advanced if we could agree that what is meant by "endocrine function" is, in fact, "hormone action" (in the sense defined above).

Endocrine system

A second, related concept – and one that is a major contributor to the debate – is the way the endocrine system is understood, and the way its role in human health and disease is envisioned. For example, Lamb et al. [12] state that, "... the endocrine system is specifically designed to respond to environmental fluctuations and such homeostatic responses generally are considered normal, adaptive, and necessary as long as they are transient and within the normal homeostatic range". Likewise, Dietrich et al. [8] state that, "... endocrine systems play a fundamental role in the physiological response to changes in the environment with the aim of keeping an organism's biology within the homeostatic space. It is the task of the toxicologists to make the distinction between those effects that are within this adaptive range and effects that go beyond the boundaries of this space and thus can be called adverse".

There are two elements of this definition and perspective of the endocrine system that contribute to the debate. First is the concept that the endocrine system is specifically designed to respond to environmental fluctuations. While the endocrine system does respond to physical stressors in the environment to maintain (e.g.) body temperature, water and ion balance, cardiovascular function etc., the endocrine system also plays essential roles in growth and development, intermediary metabolism and reproduction [23]. Thus, the perspective that the endocrine system's primary role is to maintain the organism within homeostatic space conflicts with primary texts of endocrinology, and does not appear to take into consideration the essential role of hormones in brain development [24], in sexual differentiation (e.g., [25]), in establishing the set-point for metabolism or stress responses later in life [26,27] and others. This conflict between "homeostasis" and "developmental effects" accounts for a significant amount of the debate. In addition, the second element is that the Lamb et al. and Dietrich et al. perspective of the endocrine system appears to imply that environmental chemicals represent a natural, physical stressor such as temperature, water and food availability, etc., to which the endocrine system can respond in an adaptive way. In contrast, research in the field of EDCs establishes clearly that industrial chemicals interfere with hormone action in ways that cannot be considered similar to natural environmental stressors and are often irreversible [15,19].

Adverse effects

A third related issue is the term "adverse effect". As described by Nohynek et al. [14], "All current definitions agree that the definition of an 'adverse health effect' means toxicity, i.e. pathology or functional impairment. Therefore, only a substance that produces toxicity in an intact organism via a hormonal or hormone-like mechanism represents a genuine ED." This definition and a similar one used by Lamb et al. [12] deviate somewhat from the IPCS wording [28]: "change in morphology, physiology, growth, development, reproduction or life span of an organism, system, or (sub) population that results in an impairment of functional capacity, an impairment of the capacity to compensate for additional stress, or an increase in susceptibility to other influences." If we accept all of these definitions of an adverse effect, then it becomes even more important to focus on "hormone action" rather than "endocrine function". There is likely to be widespread agreement that an EDC would produce an adverse health effect (i.e., toxicity) if and only if it interferes with hormone action, which may or may not be related to a change in hormone concentrations in the bloodstream.

Because the process to determine whether an endpoint is "adverse" is not transparent, there remains great concern about whether this term is applied consistently [29], as well as whether it acknowledges scientific measurements that map to, or predict, human diseases. In addition, it will be critical to reach agreement about whether "adverse effects" only apply to individual clinical symptoms (e.g., death or cancer) or whether an increase

in disease burden in a population is included. It is important to note that because there are several accepted definitions of "adverse effect", differences between these definitions will likely influence which scientific studies are included in a particular risk assessment (e.g., Table 2).

Thus, to move forward, it is essential to define our language related to EDCs. First, it is important that we realize that adverse outcomes of chemical exposure – however they are defined – can be mediated by an endocrine mechanism if and only if the chemical interferes with hormone action. This may be reflected by changes in hormone concentrations in the blood, but we should not interpret "endocrine function" as a "change in hormone concentration". Second, our definition of the endocrine system must take into consideration the developmental and organizational effects of hormones. It makes little sense scientifically to have groups of authors who have never studied the endocrine system create new definitions that are not recognized by scientists who have developed the knowledge base for the field. Finally, we must agree on what constitutes an "adverse effect". Several regulatory agencies have defined an "adverse effect" and these can reasonably be the basis for this discussion.

Features of hormone action: which elements of hormone action are most relevant to the EDC debate?

Several features of hormones and hormone action are the focus of this debate, but different authors emphasize different features. Which are the most important? This part of the EDC debate is more nuanced because hormone action is complex, but it generally falls under the categories of "potency", "endpoints", "timing" and "thresholds".

Potency

Pharmacologists define potency as a measure of a substance's activity, expressed as the amount of a substance that is required to produce a specific effect at a specific level of intensity. In the field of toxicology, this could mean the dose that induces death in 50% of treated animals (the LD50) or the dose that reduces body weight by 20%. It is important to recognize that a chemical will have a different activity (i.e., potency) on different specific effects (i.e., endpoints). For example, lead is much more potent at affecting the developing brain than it is at causing death. This means that a discussion of a chemical's potency must include mention of the specific effects being considered.

In the study of EDCs, potency is often used to compare the doses required to induce a specific response (e.g., a significant change in uterine weight) for a test substance compared to a dose of a hormone (for example, the natural estrogen, 17β-estradiol). Nohynek et al. [14] compared the potency of a variety of chemicals to the synthetic estrogen 17α-ethinylestradiol (EE) and conclude that comparing EE with benzylparaben (BP) is like comparing the power of an aircraft carrier (EE) with that of a child on a bicycle (BP). This kind of general comparison is visually impressive but, without a discussion of the endpoints being employed for the comparison and whether that endpoint is sensitive or insensitive to the hormone, it does not advance our understanding of potency. Recent evidence demonstrates that there are EDCs that have been described as "weak estrogens" in some contexts that are equipotent to 17β-estradiol in other contexts [15]. Thus, to move this discussion forward, we must agree on the endpoints that are important to consider as metrics of "potency" and recognize that as new science becomes available, our perception of the relative potency of a chemical may change.

Thresholds

The threshold model in toxicology predicts that there will be no effect of a chemical below a 'threshold' of exposure, but there will be effects at doses above. This concept is the basis upon which decisions of chemical safety are determined, when toxicity testing has not been performed at doses that mimic human exposures [31,32]. Although simple to imagine, this concept is actually highly complex for several reasons. First, the existence of dose thresholds cannot be proven or disproven based on experimental observation because measured effects themselves have a limit of detection that will obscure the observation of a threshold, if it exists [33]. Second,

Table 2 Definitions for 'adverse effect' and their origins

Origin	Definition	Reference
US EPA	"a biochemical change, functional impairment, or pathologic lesion that affects the performance of the whole organism, or reduces an organism's ability to respond to an additional environmental challenge"	[30]
IPCS/OECD	"a change in morphology, physiology, growth, development or lifespan of an organism which results in impairment of functional capacity or impairment of capacity to compensate for additional stress or increase in susceptibility to the harmful effects of other environmental influences"	[28]
US FDA	none	
EFSA	none	
Nohynek et al.	"toxicity, i.e. pathology or functional impairment"	[14]

identifying a threshold in the human population is confounded because not all people are equally sensitive to the effects of a chemical; there would be a graded response to a chemical thereby obscuring the observation of a threshold, if there is one. Slob, as well as the authorship of the National Academy of Sciences document "Science and Decisions", have argued that it is impossible to define thresholds at the population level for any endpoint (including cancer and non-cancer effects) [34]. Finally, because different endpoints are differentially sensitive to hormones, it is unrealistic to imagine a single threshold value, if they exist, for all endpoints of an EDC.

The belief in a dose threshold is therefore derived from the way one imagines that an EDC acts to produce an adverse effect, rather than being evidence-based. We are a long way from a full understanding of the endocrine system and of the ways hormones act; thus, it stands to reason that we are also a long way from a full understanding of the ways EDCs act. To move this debate forward, we must acknowledge first that dose thresholds are impossible to prove or disprove experimentally, as indeed has been recognized during a meeting of the participants in the public debate, with the then Chief Scientific Advisor to the EU Commission President, Professor Anne Glover [14]. Second, it is essential to appreciate that the discussion must be based on the recognition of the limits of our understanding of endocrine systems and hormone actions. This will require more humility than hubris.

Endpoints

The term "endpoint" is broad and typically refers to a measure of disease, a symptom, or a predictor of disease that is being evaluated in response to chemical exposure. Because hormones have roles in the development and regulation of virtually every system and organ in the body, the range of "endpoints" that may be affected by an exogenous hormone or EDC is extensive.

A large part of the EDC debate is on the various endpoints that have been used in studies to assess chemical effects. One type of study, guideline studies, uses prescribed methods that have been agreed upon by committees and validated to demonstrate their reproducibility [35]. Although there are positive aspects to guideline studies (i.e., reproducible methods), even validated laboratories have difficulties replicating the effects of specific compounds at specific doses [36]. Furthermore, guideline endpoints – primarily body and organ weight – have been shown to be significantly less sensitive than the endpoints examined by specialists who study effects of EDCs on a particular developmental or physiological process.

Moreover, guideline endpoints do not map explicitly to a specific human disease or dysfunction [15]. They also do not cover the entirety of the diseases that can be affected by EDCs; for example, there is no guideline assay to assess whether a substance alters the response of an organism to a hormonal or carcinogenic challenge, a high fat diet, stress, or other environmental factors. Yet, these environmental factors are known to contribute to many human diseases including cancers, reproductive disorders, metabolic disorders, and others. Moreover, there are no guideline endpoints that predict the effects of chemical exposures on asthma, diabetes, or many of the chronic diseases that plague human populations today.

Although there is extensive evidence that non-guideline studies, examining non-guideline endpoints, have identified adverse effects of EDCs [4,15], these are often not accepted in chemical safety assessments for reasons that have little to do with their predictive power and more to do with compliance to specific record-keeping methods [37]. To develop more predictive and comprehensive endpoints is a complex issue and beyond the scope of this review. However, a collaboration currently underway between the National Institute of Environmental Health Science (NIEHS), the National Toxicology Program (NTP), and the Food and Drug Administration (FDA) is comparing the sensitivity of guideline and non-guideline endpoints in the same animals exposed to EDC treatment [38]. This so-called "CLARITY-BPA" study also represents a paradigm that could easily incorporate a strategy to validate new and more sensitive endpoints into guideline studies [39].

Timing

From the perspective of endocrinology, the timing of exposure is one of the most important influences on the effects of a hormone or an EDC [40]. This issue not only derives its importance from the recognition of hormone effects in development, but also from the importance of discussions of "adverse effects" and "potency". More specifically, hormones produce effects during development that can either have direct effects on the adult offspring or life-long effects on the way the individual responds to various hormones as adults. For example, thyroid hormone action during fetal development is necessary for normal brain development; thyroid disruption or thyroid hormone insufficiency during development can reduce cognitive function (e.g., global intelligence) throughout life [24]. However, thyroid disruption or thyroid hormone deficiency in adults will have different effects, many of which are reversible [41]. Likewise, androgens are responsible for the male external (and internal) reproductive structures; thus, a genetic male with a mutation that completely prevents androgen action will be phenotypically female [42]. In contrast, a deficiency in androgen action in adult males will have completely different effects.

Also, the impacts of endocrine disrupting exposures during development may not be observed until much later in life. In the case of diethylstilbestrol (DES),

cancers of the reproductive tract did not appear in the female offspring of women prescribed DES until after puberty [43]. Likewise, because testicular cancer is of fetal origin but does not appear until after puberty, there is concern that endocrine dysfunction or disruption during fetal development can also lead to a delayed adverse effect [44]. Indeed it is becoming clear from animal studies that many complex non-communicable diseases typically experienced in adulthood (cancers, metabolic syndrome, infertility, etc.) have their origins during development that can be produced by a variety of environmental stressors including EDCs [45].

"Low dose" effects

Hormones produce effects at extremely low concentrations under normal conditions [46]. Natural hormones typically circulate in the body at part-per-billion and part-per-trillion concentrations; only a small fraction of the total concentration of circulating steroid hormone in blood is in a form that is free to impact tissues [4]. There is a significant literature about the impact of EDCs at a "low dose" [47]. In the study of EDCs, the term "low dose" is used in different ways and typically to distinguish studies that examine effects: (1) below the doses used in traditional toxicology studies, i.e., doses below the no or low adverse effect level (NOAEL or LOAEL); (2) at doses in the range of typical human exposures; or (3) at doses in animals that replicate the circulating concentrations of a substance in humans [4].

There is desire among some practitioners in the field to simplify this language and use only a single definition for "low dose", but a consensus has not yet been reached [48]. In 2002, an expert panel assembled by the NTP and the US EPA summarized the evidence for low dose effects of four EDCs, which were found to have reproducible and consistent effects on specific endpoints [49]. This panel included scientists from academia, government laboratories, and industry; thus, suggestions that there is a lack of consensus on the presence of "low dose effects" [5,12], or that low dose effects are "hypothetical... highly improbable, if not impossible" [14] are inaccurate and outdated at best. A series of reviews, published in 2012 and 2013, updated the evidence for the effects of EDCs at a "low dose", and revealed low dose effects for more than two dozen EDCs beyond those considered by the 2002 NTP/EPA panel [4,6]. These issues were also discussed at a 2012 international workshop attended by governmental, industry and academic scientists [48]. To resolve this issue, we will first have to agree to use consistent language; all three definitions of "low dose" are valid, but we must ensure that any debate is focused on the same definition. Second, we will have to agree on endpoints that are considered "adverse" because one argument is that while there are effects of EDCs at "low doses" by any definition, these effects are not adverse.

What constitutes "sufficient evidence" of harm for regulatory agencies to take action?

In his presidential address, Sir Austin Bradford Hill made the following observation that resonates true today:

> "Finally, in passing from association to causation I believe in 'real life' we shall have to consider what flows from that decision. On scientific grounds we should do no such thing. The evidence is there to be judged on its merits and the judgment (in that sense) should be utterly independent of what hangs upon it - or who hangs because of it."

Studies in environmental epidemiology aim to determine whether environmental factors (like EDC exposures) are associated with a disease or dysfunction within a population. Unlike controlled, randomized clinical trials, exposures to EDCs are almost always uncontrolled and other factors (such as the long latency between exposure and disease outcome) can complicate this type of study. Moreover, chemical exposures do not occur in isolation and, even in newborns, there are literally dozens of chemicals found in the bloodstream [50]. Considering these factors, it has been strongly debated whether environmental epidemiology studies can show causal relationships between exposures and disease as Bradford Hill envisaged the elements of data contributing to a conclusion of a causal association [51].

Therefore, a significant part of this debate centers on the definition of "causation" and the methods employed to determine causal relationships. Lamb et al. [12] define "causation" as follows: "To say that an agent causes an adverse effect means that the agent interacts with an organism to produce changes that lead to adverse effects that would not have occurred had the agent not been present." This definition may, for example, exclude cigarette smoking as a cause of lung cancer because not all lung cancers are attributable to smoking. Likewise, in an experiment designed to identify the dose at which 50% of the animals die (i.e., LD50), both living and dead animals received the same dose of agent; Lamb et al.'s definition may not allow one to conclude that the agent caused 50% of the animals to die because the other 50% was exposed to the chemical but did not die.

The nature of causation is a core issue for science, and there is a great deal written on this subject [52]. It is possible that Lamb et al. intended to say that a toxic chemical *causes* an adverse effect when it increases the frequency or intensity – over that of controls – of that "adverse endpoint". Yet, even if this were Lamb et al.'s intended definition for causation, it would preclude

drawing conclusions about causal relationships from any environmental epidemiology studies, which by nature are not controlled. In the field of environmental epidemiology, it is generally recognized that, in principle, an agent causes an adverse effect when some proportion of the disease burden is attributable to exposure to that agent. The elements for establishing causation proposed by Bradford-Hill almost 50 years ago [51] provide a framework by which a causal relationships can be deduced. Yet, these elements depend on a level of expert judgment and appear to be employed by different groups in different ways. Therefore, it is important to clearly evaluate how the various elements as articulated by Hill fit the EDC debate (Table 3).

These considerations seem to have been ignored when Lamb et al. [12] criticized the UNEP/WHO report [10] for not adopting the Bradford-Hill approach. In fact, the UNEP/WHO report presents a detailed discussion of the challenges associated with the Bradford-Hill approach as a tool for judging causality within the context of EDCs. These problems were recognized by Bradford-Hill himself [43] but are consistently overlooked. He pointed out in particular that the question of causality should not be discussed in isolation, separated from the context in which decisions have to be made whether to act on the available evidence or not. He observed that," it almost inevitably leads us to introduce differential standards before we convict. Thus on relatively slight evidence we might decide to restrict the use of a drug for early-morning sickness in pregnant women. If we are wrong in deducing causation from association no great harm will be done. The good lady and the pharmaceutical industry will doubtless survive. On fair evidence we might take action on what appears to be an occupational hazard, e.g. we might change from a probably carcinogenic oil to a non-carcinogenic oil in a limited environment and without too much injustice if we are wrong. But we should need very strong evidence before we made people burn a fuel in their homes that they do not like or stop smoking the cigarettes and eating the fats and sugar that they do like." Indeed, Bradford Hill himself went as far as stating that "none of my nine viewpoints can bring indisputable evidence for or against the cause and effect hypothesis and none can be required as a sin qua non.....what they can do is help us to make up our minds on the answer to the fundamental question – is there another way of explaining the set of facts before us".

Thus, it will be important to make progress in this debate to have a rational and three-dimensional view of "causation" and to apply this view consistently. Finally, it is important to reach a consensus about how to "weigh" results of epidemiology studies against data collected in controlled exposure studies, and how to "weigh" epidemiology studies with different designs against one another. This will be discussed in more detail below.

Transparent, reproducible methods are needed for systematic reviews of EDCs. As noted in the introduction, two recent major reviews of the EDC literature were highlighted for the lack of systematic review of the literature. For example, Lamb et al. [12] concluded that the UNEP/WHO document [11] lacked a systematic approach to the literature to such a degree that it could not be considered a "state of the science" of EDCs. However, it would appear that Lamb and colleagues themselves do not always adhere to these standards. In 2007, two of the authors critiquing the UNEP/WHO document [11], Hentz and Lamb, published a document for the Weinberg Group entitled "2007 Update: State of the Science and Policy for Endocrine Disruption", dated May 29, 2007 [Note: This document is no longer available on the internet, but on request, the authors are happy to provide the document to anyone interested]. This succinct (14 pages) report develops the theme on the basis of 21 references, and shows that it may well be possible to produce a state of the science document without a systematic approach to analyzing the literature. Discussions of this kind are largely futile and do nothing to resolve the impasse in the debate about endocrine disrupters. Lamb et al. [12] also concluded that techniques of systematic reviews are well established and that the recent US EPA review on non-monotonic dose-responses was both methodical and even-handed. However, a National Academy Committee concluded just the opposite; that the US EPA review was neither methodical nor even-handed in its approach, and recommended that the report be re-done [53].

It is perhaps human nature to find an analysis well performed when one agrees with the conclusion; likewise, it is easy to find fault with analytical procedures when one does not agree with the conclusion. Clearly, this is why it is important to develop an effective procedure for systematic reviews, and independent scientists at the National Toxicology Program and academic groups currently are in the process of developing the framework and detailed criteria for systematic reviews [54-56]. One essential element of systematic review is to evaluate the quality of the publication under consideration for inclusion [57]. However, evaluating the quality of the experimental design and methods requires reviewers with expertise in the specific area of research, and this issue is not often considered. Expert knowledge is central – and critical – to "weighing" the value of different studies with different designs. This is also the view presented in the UNEP/WHO report on EDCs, in the subchapter "Framework for evaluation of evidence for endocrine disruption in humans and wildlife" [11]. Thus, a significant amount of work remains to develop systematic review methods that are generally accepted.

Table 3 Bradford Hill Elements of Data Contributing to a Causal Association and EDCs

Hill Elements[1]	Application to EDCs
Strength of Association	
The examples used were testis cancer in chimney sweeps and lung cancer in smokers. In both examples, the strength of the associations were made by comparing death rates in a control group (men who were not chimney sweeps and non-smokers, respectively).	There are no groups of people unexposed to EDCs. Moreover, no one is exposed to a single chemical. Finally, endocrine diseases and disorders are clearly multicausal. Thus, the concept of strength of the association must be adjusted as it is applied to EDCs.
Consistency	
The concept is that multiple studies should observe the same relationships between exposure and outcome.	In principle, there should also be consistent observations between relationships of interest. However, there are at times modifying factors that can change this. For example, perchlorate exposure is inversely related to serum thyroid hormone in populations with low iodine intake or in those who smoke cigarettes. However, this is not the case in populations with high iodine intake and/or who do not smoke.
Specificity	
The example was that of nickel refiners of South Wales with a high incidence of cancer of the lung or nose. The specificity of this relationship could be used as evidence of causation. However, Hill cautioned about making too much of the specificity of the relationship and concluded that, "In short, if specificity exists we may be able to draw conclusions without hesitation; if it is not apparent, we are not thereby necessarily left sitting irresolutely on the fence."	The specificity of relationships of interest with EDCs must be evaluated carefully because hormone systems are involved in a great many processes and this is life-stage specific. For example, androgens play an important role in development of the male reproductive system in the fetus, but in the adult, androgens are related to different processes in men and women. Likewise, transient hypothyroidism during fetal development can lead to lower IQ and attention deficit, but transient hypothyroidism in the adult can lead to weight gain that is reversible.
Temporality	
Hill's concept was to be cautious about the temporal relationship of associations with particular attention to the question of which element of the dyad came first? For example, do particular dietary habits lead to disease, or does the disease predispose those affected to prefer a specific diet?	The temporal relationship between exposure to an EDC and a specific endocrine-mediated adverse outcome may be quite complex. The classic example is that of DES exposure during fetal life and the production of reproductive tract cancer 20 years later (long after DES was gone). This relationship was observed because women were prescribed DES and there were specific records of exposure. This will not likely be the case for non-accidental exposures to EDCs. Thus, "temporality" may be important, but it may not be a concurrent relationship.
Biological Gradient	
Hill noted that the linear increase in the death rate from lung cancer with number of cigarettes smoked daily added greatly to the simple evidence that the cancer rate was higher in smokers than non-smokers. But he didn't discount a relationship in which the death rate is higher in people who smoke fewer cigarettes per day.	The shape of the dose–response is important for EDCs, but there may be more variability depending on the mechanism of disruption. For example, perchlorate should produce a typical S-shaped dose–response curve on thyroid hormone concentrations in the human population because it is a competitive inhibitor of iodine uptake into the thyroid gland. In contrast, BPA is likely to produce more of a "square wave" dose–response curve because it is an indirect antagonist on the thyroid hormone receptor.
Plausibility	
Hill insisted that "it will be helpful" if the causation we suspect is biologically plausible. However, we cannot demand this. In short, the association we observe may be one new to science or medicine and we must not dismiss it too light-heartedly as just too odd.	Likewise for EDCs, biological plausibility will likely strengthen our confidence in the causal nature of relationships of interest. Moreover, our knowledge of hormone actions will likely drive us to evaluate specific relationships. However, there is a great deal we have to learn about the endocrine system, and requiring complete knowledge of the endocrine mechanism mediating a relationship of interest is unrealistic.
Coherence	
Hill reasoned that the interpretation of a causal relationship between exposure and outcome should not conflict with generally known facts of the natural history and biology of the disease.	Coherence is also important for EDCs. Thus, the interpretation of causation should not conflict with generally known facts of the biology of the endocrine system under study.
Experiment	
Hill reasoned that occasionally, confidence in a conclusion of causality could be strengthened by changing elements of the environments and observing a predicted change. For example, dust in the workplace could be reduced, oil changed, work conditions altered. He did not include animal or biochemical experiments.	For EDCs, animal and biochemical experimental evidence must be integrated with (or without) epidemiological data to consider that a chemical may produce an adverse outcome through an endocrine mechanism. This is a novel component of assessing the evidence and the logic guiding this has not been formally validated. Because of the complexity of hormone action, such experiments need to be properly designed with positive and negative controls, and must be properly interpreted based on principles of endocrinology.

Table 3 Bradford Hill Elements of Data Contributing to a Causal Association and EDCs *(Continued)*

Analogy	
Hill reasoned that known causal relationships can reasonably be extended to other relationships that have similar characteristics. His example was that with the effects of thalidomide and rubella being known, it would be more likely to be reasonable to accept slighter but similar evidence with another drug or viral disease in pregnancy.	Likewise, it is reasonable in the EDC field to extend this to include analogous endpoints. For example, if we observe a relationship between phthalate exposure and anogenital distance in newborn boys, we can reasonably extend this relationship to other androgen-dependent endpoints. Moreover, if we know that a chemical has antiandrogenic properties *in vitro*, it is reasonable to tailor the endpoints that are evaluated *in vivo* to androgen-sensitive endpoints. Likewise, if we observe a relationship between PCB exposure and the expression of thyroid hormone-responsive genes in the placenta, we can reasonably extend this to thyroid hormone action in tissues we cannot obtain, such as the fetal/neonatal brain. And if we know that PCBs have anti-thyroid properties, we should evaluate thyroid-sensitive endpoints.

[1]These elements are taken from: Hill AB. The Environment and Disease: Association or Causation? Proc R Soc Med. 1965 May;58:295–300 [51].

A tool commonly used by risk assessors for assessing study quality, the Klimisch score [58], was developed by three industry toxicologists, writing that "Tests conducted and reported according to internationally accepted guidelines and in accordance with Good Laboratory Practices (GLP) should have the highest grade of reliability", and thus are given the highest score. Use of the Klimisch scoring system, and the high evaluation of studies using GLP in general, are unfortunate examples of the conflation of high quality study reporting with high quality study design and execution.

As new tools are developed, it will be important to recognize that integration of data across multiple information streams (*in vitro*, laboratory animal, epidemiology, etc.) will be important [57], and that evaluating the quality and relevance of information across disciplines requires people expert in those disciplines. Once developed and shown to produce non biased assessments, systematic review methods should be used to assess the EDC literature. However, because current approaches to systematic reviews limit their use to a single chemical-disease dyad, a state of the science review may not be possible to complete using systematic review criteria because it would require hundreds (or more) of individual systematic reviews, followed by a meta-analysis of the systematic reviews, before any final conclusions could be reached. For example, although the 2002 IPCS document on EDCs discussed systematic reviews [16], it was only employed in Chapter 7 for the purpose of illustration and used endometriosis and TCDDs and/or PCBs; in addition, it lacked many of the elements being described currently by the NTP and NAS. In light of the absence of systematic review guidelines and the impossibility of using them for such a large undertaking, state of the science reviews are likely to always require the expertise of scientists working in the field and narrative reviews.

Conclusions

There is intense scientific debate on the issue of EDCs that is not productive in its current form. We list here nine points that could provide a constructive path forward.

1. The definition of an EDC should focus on hormone action instead of hormone concentrations in blood. This would focus the debate on mechanisms of EDC effects rather than alterations in "homeostasis".
2. An accepted definition of "adverse" is needed, along with more transparency in the ways in which particular endpoints are considered adverse (or "adaptive"). At this time, the IPCS/OECD definition of adverse is preferred as it includes not only direct/immediate responses to chemical exposure but also situations where the exposure results in a phenotype only in the presence of an additional environmental challenge or stressor.
3. The definition of the endocrine system should be that which emphasizes the role of hormones in development and the importance of timing of hormone action.
4. The potency of a substance is dependent on the endpoint. It is therefore important to agree on the endpoints to consider as metrics of "potency" and recognize that as new science becomes available our perception of the relative potency of chemicals may change.
5. Guideline studies rely on endpoints validated for reproducibility, not for their power to predict adverse effects in the human population. The current CLARITY-BPA study provides a mechanism by which new endpoints can be quickly validated for inclusion in guideline studies. In the meantime, the publically-funded, scientific literature must be included in any analysis of EDC effects.
6. There are currently three definitions of "low dose"; thus it is critical that the definition being used is noted in any related discussion. It is not acceptable to dismiss low dose effects simply because there is not one widely accepted definition.
7. The debate over whether EDC effects have a threshold, while scientifically interesting, cannot be

proven or disproven with available technology. Thus, continuing this debate is not productive.

8. There is a need for agreement on the rules of evidence sufficient to conclude a causal relationship between environmental exposures and health outcomes. Although there are challenges to the use of the Hill approach for EDCs, agreeable adaptations could be made for use in this field.
9. It is important to develop transparent, consistent and unbiased criteria for the systematic review of EDCs. However, systematic review methods are currently used to address highly focused questions exploring chemical-disease dyads such as, does chemical X cause disease Y? It is therefore currently not possible to use systematic review criteria to answer broad questions that draw from all fields of endocrine disruption.

Abbreviations

BP: Benzylparaben; BPA: Bisphenol A; EDCs: Endocrine Disrupting Chemicals; EE: 17α-ethinylestradiol; EPA: Environmental Protection Agency; FDA: Food and Drug Administration; GLP: Good Laboratory Practice; IPCS: International Programme on Chemical Safety; LD50: Lethal Dose 50%; LOAEL: Lowest Observed Adverse Effect Level; NAS: National Academy of Science; NIEHS: National Institute of Environmental Health Science; NOAEL: No Observed Adverse Effect Level; NTP: National Toxicology Program; OECD: Organization of Economic Cooperation and Development; PCB: Polychlorinated biphenyl; TCDD: Tetrachlorodibenzo-dioxin; UNEP: United Nations Environmental Programme; WHO: World Health Organization.

Competing interests

The authors declare that they have no competing interests.

Authors' contributions

The first draft was prepared by RTZ and LNV and circulated among all the other authors who made revisions. Revisions were compiled by RTZ who submitted the manuscript. All authors confirmed approval of all changes. This process began in April of 2014 and was completed in September of 2014.

Acknowledgements

The authors gratefully acknowledge the following agencies: Swedish governmental academic research through Research Council, Stockholm University, Karolinska Institute, Stockholm County Council, Knut and Alic Wallenberg Foundation (alb); The Research Council Formas, and the Swedish Foundation for Strategic Environmental Research (Mistra) through the MistraPharma research program (ib), The Danish Innovation fund (nek); European Commission DG Environment, the European Food Safety Authority, DG Research (FP7 Quality of Life), the Danish EPA, the French ANSES, the OAK Foundation Geneva (ak); National Research Fund, the Medical Research Council and the University of Pretoria (rb); Academy of Finland and Sigrid Juselius Foundation, EU Fp7 Quality of Life, and Turku University Hospital (jt); National Institutes of Environmental Health Science (rtz).

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Received: 10 September 2014 Accepted: 8 December 2014
Published: 22 December 2014

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doi:10.1186/1476-069X-13-118
Cite this article as: Zoeller *et al.*: A path forward in the debate over health impacts of endocrine disrupting chemicals. *Environmental Health* 2014 **13**:118.

Exposure to endocrine-disrupting chemicals in the USA: a population-based disease burden and cost analysis

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Summary

Background Endocrine-disrupting chemicals (EDCs) contribute to disease and dysfunction and incur high associated costs (>1% of the gross domestic product [GDP] in the European Union). Exposure to EDCs varies widely between the USA and Europe because of differences in regulations and, therefore, we aimed to quantify disease burdens and related economic costs to allow comparison.

Methods We used existing models for assessing epidemiological and toxicological studies to reach consensus on probabilities of causation for 15 exposure–response relations between substances and disorders. We used Monte Carlo methods to produce realistic probability ranges for costs across the exposure–response relation, taking into account uncertainties. Estimates were made based on population and costs in the USA in 2010. Costs for the European Union were converted to US$ (€1=$1·33).

Findings The disease costs of EDCs were much higher in the USA than in Europe ($340 billion [2·33% of GDP] *vs* $217 billion [1·28%]). The difference was driven mainly by intelligence quotient (IQ) points loss and intellectual disability due to polybrominated diphenyl ethers (11 million IQ points lost and 43 000 cases costing $266 billion in the USA *vs* 873 000 IQ points lost and 3290 cases costing $12·6 billion in the European Union). Accounting for probability of causation, in the European Union, organophosphate pesticides were the largest contributor to costs associated with EDC exposure ($121 billion), whereas in the USA costs due to pesticides were much lower ($42 billion).

Interpretation EDC exposure in the USA contributes to disease and dysfunction, with annual costs taking up more than 2% of the GDP. Differences from the European Union suggest the need for improved screening for chemical disruption to endocrine systems and proactive prevention.

Funding Endocrine Society, Ralph S French Charitable Foundation, and Broad Reach Foundation.

Introduction

Since the adverse effects of endocrine-disrupting chemicals (EDCs) on human beings were first identified,[1] growing evidence has supported the hypothesis that multiple industrial chemicals are associated with adverse health effects due to endocrine dysfunction at exposure levels commonly found in the environment.[1] The Endocrine Society defines EDCs as substances that alter the hormonal and homoeostatic systems of organisms through environmental or developmental exposures, resulting in adverse health effects. EDCs include industrial solvents or lubricants and their by-products (polychlorinated biphenyls, polybrominated biphenyls, and dioxins), plastics (bisphenol A), plasticisers (phthalates), pesticides (methoxychlor, chlorpyrifos, dichlorodiphenyltrichloroethane), and pharmaceutical agents (diethylstilbestrol). Potential adverse consequences of exposure to EDCs include prostate and breast cancer, infertility, male and female reproductive dysfunction, birth defects, obesity, diabetes, cardiopulmonary disease, and neurobehavioural and learning dysfunctions.[2]

After the initial scientific statement by the Endocrine Society,[1] a group of experts, on behalf of WHO and the UN Environment Programme (UNEP), published a report documenting substantial laboratory and human evidence supporting a causative role of EDCs in disease and dysfunction across the human lifespan.[3] Initial criticisms of the WHO and UNEP report were rebutted,[4] and a second Endocrine Society scientific statement has summarised stronger evidence of disease causation.[5]

Various publications have documented substantial health and economic burdens due to EDCs in the European Union, identifying more than 99% probability of disease contribution, with the median annual associated costs estimated to be around €163 billion or 1·28% of the European Union gross domestic product.[6] Comparison of the European Union with the USA reveals that EDC exposure is much higher for organophosphate pesticides in Europe[7] and for polybrominated diphenyl ethers (PBDEs) in the USA.[8,9] These differences are driven by regulatory divergence. For pesticides and their use in food-destined crops, US regulations have been much more stringent than those in Europe. In particular, the US Food Quality Protection Act of 1996[10] requires additional safety considerations for children before pesticide use in agriculture is approved, but no such strict regulation exists in the European Union, even for pesticides that induce toxic neurodevelopmental effects.[11] For PBDEs, since 1975, California state law has required furniture with

Lancet Diabetes Endocrinol 2016

Published **Online** October 17, 2016 http://dx.doi.org/10.1016/S2213-8587(16)30275-3

See **Online/Comment** http://dx.doi.org/10.1016/S2213-8587(16)30279-0

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Research in context

Evidence before this study

Endocrine-disrupting chemicals (EDCs) have been documented to contribute substantially to disease and dysfunction in Europe, having a probability of disease contribution greater than 99%, and incurring a probable annual cost of €163 billion. Policy is, therefore, important to shape prevention of exposure. We searched PubMed for relevant studies that estimated the economic costs associated with EDC exposure in the USA, using the terms "EDCs exposure", "burden of disease", "economic costs", and "economic impacts". We placed no restrictions on the year or language of publication. The latest search was done in January, 2016. We identified no relevant estimates for EDC-attributable burden of disease or dysfunction or economic costs in the USA. Analysis of disease burden and costs attributable to EDC exposures for the USA is especially relevant because comparing Europe with the USA might reveal differences that affect the degree of EDC exposure and, thus, the probability of disease contribution.

Added value of this study

Comparisons between countries with different regulatory environments are important, and in this analysis we identified substantial differences between the European Union and the USA, including in costs (US$217 *vs* $340 billion annually), that seem to be directly linked to policy actions in the two contexts. The USA is about to implement revisions to the main regulation for synthetic chemicals (the revised Toxic Substances Control Act 1976) that will lead to greater scrutiny of the synthetic chemicals they review. Cost–benefit analyses of chemical regulation often consider costs to manufacturers but do not capture benefits of prevention. Therefore, estimates of the disease burden and economic costs of EDC exposure represent important tools for policy makers to inform decision making.

Implications of all available evidence

Regulatory action to limit the most widely prevalent and potentially hazardous EDCs could produce substantial economic benefits, and the costs of regulatory actions, for example to the producing industry, should be compared with the costs of inaction—ie, substantial disease burden and the associated economic costs. Given that some EDCs have transgenerational effects, especially through neuroendocrine disruption of reproduction, inadequate regulation of EDCs could have serious adverse consequences for future generations.

foam filling to undergo open-flame ignition testing, which has been easiest to pass by using chemical flame retardants. Owing to worries about the toxicity of chemical flame retardants and their increased use to pass this test, the law was revised in 2013 to focus on smouldering ignition tests for fabric, which can be passed without using chemical flame retardants.[12] Voluntary commitment by manufacturers to phase out the most highly brominated PBDEs, deca-PBDEs, over 3 years, with sales to cease in 2013, was encouraged but was not formally regulated. By contrast, Europe designated deca-PBDE a hazardous substance and restricted its use in 2008.[13]

In the USA, under the revised Toxic Substances Control Act 1976, chemicals need not be studied for endocrine toxic effects in laboratory studies before widespread use.[14] The US Environmental Protection Agency (EPA) has established the Endocrine Disruptor Screening Program, but has screened only 52 chemicals for endocrine activity, and testing has been based mainly on animal data. Although the EPA has developed the ToxCast and Tox 21 High Throughput Screening programmes in an effort to accelerate screening for endocrine disruption, flaws in the ability of the former to detect synthetic chemical obesogens have been exposed.[15] Furthermore, ambiguities in the system lead to broad interpretations of which chemicals fall into high priority and low priority groups. Thus, some new substances might be potentially harmful but not tested before approval, and some will be tested unnecessarily. Analyses of disease burden and costs attributable to EDC exposures in the USA are especially relevant given impending changes in regulation that will lead to greater scrutiny of synthetic chemicals for their toxicity in terms of human health, and could represent an important tool for policy makers to inform decision making. We aimed to quantify disease burdens and related economic costs due to EDC exposures in the USA to compare with the costs previously identified in Europe.

See **Online** for appendix

Methods

Study design

We obtained ranges for probabilities of causation which had been previously developed by expert panels assembled under the auspices of the Endocrine Society to evaluate burden of disease and costs attributable to EDCs in Europe.[16] The probabilities had been based on assessment of the toxicological and epidemiological evidence for 15 exposure–response relations between EDCs (PBDEs, organophosphate pesticides, dichlorodiphenyltrichloroethane, di-2-ethylhexylphthalate, bisphenol A, benzylphthalates and butylphthalates, and exposures to combinations of these substances; appendix) and disorders (loss of intelligence quotient [IQ] points and consequent intellectual disability, attention deficit hyperactivity disorder, autism, adult and childhood obesity, adult diabetes, cryptorchidism, testicular cancer, male factor infertility, early cardiovascular mortality due to reduced testosterone, leiomyomas, and endometriosis) with use of a modified Delphi approach to achieve consensus.[17] The Danish Environmental Protection Agency criteria were used to assess the toxicological evidence, and the GRADE

Working Group criteria to assess strength of the epidemiological evidence.[18,19] A steering committee of scientists used an adapted version of the approach first developed by the Intergovernmental Panel on Climate Change to create ranges for probability of causation based on the strength of both sets of evidence.[20]

We applied a model first used by the Institute of Medicine[21] to estimate the cost of environmentally mediated disease, described by the equations below:

attributable disease burden = increment in disease / dysfunction × attributable fraction × population size

and

attributable costs = increment in disease / dysfunction × attributable fraction × population size × cost per increment.

The attributable fraction of a risk factor can be defined as the proportional decrease in the number of cases of ill health or deaths due to reducing the risk factor,[22] and can be estimated by the following equation:

$$\text{attributable fraction} = \frac{\text{prevalence}_{\text{exposure}} \times (\text{RR}-1)}{[1 + (\text{prevalence}_{\text{exposure}} \times (\text{RR}-1))]}$$

where RR represents the relative risk of morbidity associated with the specific exposure.

Cost per case, derived from published estimates of per-case direct or indirect costs, or both, was used to calculate overall costs (adjusted with the Medical Care Consumer Price Index[23] to reflect the cost in 2010 if the estimates referred to another year), according to the incidence or prevalence of a disease and the size of the population at risk. US 2010 census estimates[24] were used to convert the prevalence or incidence values to the appropriate population size. The first equation was also used to calculate discrete increments in disease or dysfunction in the exposed group over a comparison unexposed group, as described in the European Union analysis.

To create comparable estimates for the USA, we used the exposure–response relations established for Europe and obtained nationally representative human biomonitoring data from the Centers for Disease Control and Prevention's National Health and Nutrition Examination Surveys (NHANES), which measures EDCs in nationally representative samples. NHANES is a continuous, multicomponent, nationally representative survey of the non-institutionalised US population, and is administered by the National Centers for Health Statistics of the Centers for Disease Control and Prevention. Institutional review board was not needed because of the non-human nature of this study, and LT completed an attestation form developed by the New York University School of Medicine Institutional Review Board to document this exemption.

We applied the exposure–response relations to the US population, based on biomarker data on PBDEs, dichlorodiphenyltrichloroethane, and organophosphate pesticides extracted from the 2007–08 NHANES, and on bisphenol A

	Target population	Exposure–outcome relation (base case estimates)*	Exposure–outcome relation (sensitivity analyses)
PBDE and IQ points loss and intellectual disability	All neonates	11 million IQ points lost and 43 000 cases	19 million IQ points lost and 99 000 cases
Organophosphate pesticides and IQ points loss and intellectual disability	All neonates	1·8 million IQ points lost and 7500 cases	587 000–2·0 million IQ points lost and 2000–10 000 cases
Dichlorodiphenyltrichloroethane and childhood obesity	Children aged 10 years	857 cases	NA
Dichlorodiphenyltrichloroethane and adult diabetes	Adults aged 50–64 years	243 900 cases	191 000 cases
Di-2-ethylhexylphthalate and adult obesity	Women aged 50–64 years	5900 cases	NA
Di-2-ethylhexylphthalate and adult diabetes	Women aged 50–64 years	1300 cases	NA
Bisphenol A and childhood obesity	Children aged 4 years	33 000 cases	NA
PBDE and testicular cancer	All boys and men	3600 cases	NA
PBDE and cryptorchidism	All male neonates	4300 cases	NA
Benzylphthalates and butylphthalates and male infertility resulting in increased assisted reproductive technology	Men aged 20–39 years	240 100 cases	NA
Phthalates and low testosterone resulting in increased early mortality	Men aged 55–64 years	10 700 attributable deaths	NA
Multiple exposures and ADHD	Children aged 12 years	4400 cases	79 000 cases
Multiple exposures and autism	Children aged 8 years	787 cases in boys, 754 in girls	315–1573 cases in boys, 302–1508 in girls
Dichlorodiphenyltrichloroethane and fibroids	Women aged 15–54 years	37 000 cases	NA
Di-2-ethylhexylphthalate and endometriosis	Women aged 20–44 years	86 000 cases	NA

PBDE=polybrominated diphenyl ethers. IQ=intelligence quotient. ADHD=attention deficit hyperactivity disorder. NA=alternative inputs not available to do sensitivity analyses. *Annual estimates.

Table 1: **Attributable burden of disease in the USA for 15 exposure–response relations**

	Base case estimate (US$)	Low-end estimate (US$)	High-end estimate or alternative scenario (US$)
PBDE and IQ points loss and intellectual disability	208 billion and 58·2 billion	NA	367 billion and 133 billion
Organophosphate pesticides and IQ points loss and intellectual disability	34·6 billion and 10·1 billion	11·3 billion and 3·0 billion	45·5 billion and 14·0 billion
Dichlorodiphenyltrichloroethane and childhood obesity	29·6 million	NA	57·3 million
Dichlorodiphenyltrichloroethane and adult diabetes	1·8 billion	NA	13·5 billion
Di-2-ethylhexylphthalate and adult obesity	1·7 billion	NA	NA
Di-2-ethylhexylphthalate and adult diabetes	91·4 million	NA	NA
Bisphenol A and childhood obesity	2·4 billion	NA	NA
PBDE and testicular cancer	81·5 million	24·8 million	109·3 million
PBDE and cryptorchidism	35·7 million	NA	NA
Benzylphthalates and butylphthalates and male infertility resulting in increased assisted reproductive technology	2·5 billion	NA	NA
Phthalates and low testosterone resulting in increased early mortality	8·8 billion	NA	NA
Multiple exposures and ADHD	698 million	568 million	1·95 billion
Multiple exposures and autism	1 billion for boys, 984 million for girls	410 million for boys, 393 million for girls	2·1 billion for boys, 2·0 billion for girls
Dichlorodiphenyltrichloroethane and fibroids	259 million	NA	595 million
Di-2-ethylhexylphthalate and endometriosis	47 billion	NA	NA

All estimates are for 2010. Estimates are conditional on certainty of causation. PBDE=polybrominated diphenyl ethers. IQ=intelligence quotient. NA=alternative inputs not available to do sensitivity analyses. ADHD=attention deficit hyperactivity disorder.

Table 2: **Annual costs for disorders associated with exposure to endocrine-disrupting chemicals in the USA**

and phthalates extracted from the 2009–10 NHANES. The values were separated into quintiles (0–9th, 10th–24th, 25th–49th, 50th–74th, 75th–89th, and 90th–99th).

Economic estimates

To estimate the total costs incurred for a disorder, we used a cost-of-illness approach that encompassed direct costs (those for which payments are made, such as medical treatment) and indirect costs (those for which resources are lost, such as loss of productivity or output).[25] We followed the guidelines provided by the Panel on Cost Effectiveness and Medicine[26] and used US data sources and published US cost estimates (appendix). Additionally, we did a series of 1000 Monte Carlo simulations to generate realistic ranges of aggregate cost estimates across all the exposure–outcome relations while accounting for probability of causation.[16]

Statistical analysis

We did a descriptive analysis with Stata 12.0, following the National Center for Health Statistics guidelines. For dichlorodiphenyltrichloroethane and PBDEs, a weighted pooled-sample design was implemented in NHANES 2007–08. Sample weighting was incorporated into the pooled-sample design, and we did the descriptive analyses with the final adjusted summed sampling weights. For the other EDCs (all individual samples) the specific environmental sample weights included in each subsample were used for the descriptive analyses.

Role of the funding source

The funders of the study had no role in study design, data collection, data analysis, data interpretation, or writing of the report. The corresponding author had full access to all data in the study and had final responsibility for the decision to submit for publication.

Results

The greatest burden identified in the USA due to exposure to EDCs was neurobehavioural dysfunction resulting from in-utero exposure to PBDEs, illustrated by IQ points loss and intellectual disability (table 1). A substantial loss in IQ points and increase in the number of intellectual disability cases were also associated with exposure to organophosphate pesticides. Over 1500 cases of autism and 4400 cases of attention deficit hyperactivity disorder were also attributed to EDC exposure (table 1).

Of the phthalates, di-2-ethylhexylphthalate was estimated to be among the most substantial contributors, being associated with high numbers of cases of adult obesity and diabetes and endometriosis (table 1). Phthalates were associated with 10 700 early cardiovascular deaths due to reductions in serum testosterone. Bisphenol A exposure was associated with childhood obesity. Lower numbers of cases were associated with dichlorodiphenyltrichloroethane, exposure to which was also associated with adult diabetes and uterine fibroids requiring surgical intervention (table 1).

The estimated annual economic costs of EDC-attributable disorders were greatest for neurocognitive dysfunctions associated with PBDEs (table 2). Phthalates comprised the second-leading driver of estimated costs through the association with endometriosis, male fertility factors, adult obesity, and adult diabetes (table 2).

A comparison of costs in the USA and European Union revealed the effects of policy differences on exposure (table 3). The estimated number of PBDE-induced neurobehavioural deficits was much greater in the USA than in Europe, whereas we found the opposite for organophosphate pesticides. The estimated exposures for organophosphate pesticides and PBDE in the USA and the European Union are shown in table 4. In general, disease burdens for phthalates were larger in Europe than in the USA, where substantial decreases in these metabolites between 2001 and 2010 have been documented.[27] Detailed results are provided in the appendix.

Monte Carlo simulations yielded non-zero costs across all 1000 simulations, even under the most conservative assumptions about probability of causation, when the lowest ends of the ranges identified for each of the 15 exposure–response relations were used (figure).

We estimated that there was 5% probability that costs of EDC exposures are less than $43·3 billion annually, 90% probability that costs are at least $67·7 billion, 75% probability that costs are at least $303 billion per year, 25% probability of costs being at least $427 billion per year, and 10% probability of costs being over $512 billion per year. Notably, using the lowest end of the probability range for each relation in the Monte Carlo simulations produced a range of $259 million–608 billion (median $306 billion), which differed slightly from those obtained with the base case probability inputs (median $340 billion, range $668 million–612 billion). There was 5% probability that costs of EDC exposures are less than $11·7 billion annually, 90% probability that costs are at least $28·6 billion, a 75% probability that costs are at least $64·4 billion per year, 25% probability of costs being at least $363 billion per year, and 10% probability of costs being more than $463 billion per year. By applying the lowest end of the probability range and assuming that all relations are independent, multiplying each of the probabilities for the exposure–outcome relations suggests probability of more than 99·9% (=1−0·3×0·3×0·6×0·8×0·6×0·6×0·8×0·6×0·6×0·6×0·6×0·8×0·8×0·8×0·8) that EDCs contribute to disease. If the highly probable costs related to developmental neurotoxic effects from organophosphate pesticides and brominated flame retardants are excluded, probability remains at 99·3% that one or more of the other exposure–outcome relations are causal. Use of the highest end of the probability ranges yielded a median cost of $365 billion (range $287 billion–611 billion). Overall, of the median $340 billion cost of EDCs, $282 billion are due to neurological effects, $43 billion to endometriosis and fibroids, and $7·9 billion to early cardiovascular mortality. Also included are $5·4 billion for costs attributable to obesity and diabetes and $2·4 billion attributable to male reproductive conditions. PBDEs contribute most of the costs (around $240 billion), with phthalates and bisphenols contributing $56 billion, pesticides another $42 billion, and mixtures $2·4 billion.

	USA*	European Union†	US costs (2010 US$)	EU costs[16] (US$‡)
PBDE and IQ points loss and intellectual disability	11 million IQ points lost and 43 000 cases	873 000 IQ points lost and 3290 cases	266 billion	12·6 billion
Organophosphate pesticides and IQ points loss and intellectual disability	1·8 million IQ points lost and 7500 cases	13 million IQ points lost and 59 300 cases	44·7 billion	194·0 billion
Dichlorodiphenyltrichloroethane and childhood obesity	857 cases	1555 cases	29·6 million	32·7 million
Dichlorodiphenyltrichloroethane and adult diabetes	24 900 cases	28 200 cases	1·8 billion	1·1 billion
Di-2-ethylhexylphthalate and adult obesity	5900 cases	53 900 cases	1·7 billion	20·8 billion
Di-2-ethylhexylphthalate and adult diabetes	1300 cases	20 500 cases	91·4 million	807·2 million
Bisphenol A and childhood obesity	33 000 cases	42 400 cases	2·4 billion	2·0 billion
PBDE and testicular cancer	3600 cases	6830 cases	81·5 million	1·1 billion
PBDE and cryptorchidism	4300 cases	4615 cases	35·7 million	172·6 million
Benzylphthalates and butylphthalates and male infertility resulting in increased assisted reproductive technology	240 100 cases	618 000 cases	2·5 billion	6·3 billion
Phthalates and low testosterone resulting in increased early mortality	10 700 attributable deaths	24 800 attributable deaths	8·8 billion	10·6 billion
Multiple exposures and ADHD	4400 cases	19 400–31 200 cases	698·0 million	2·3 billion
Multiple exposures and autism	787 cases in boys, 754 cases in girls	316 cases	1·0 billion in boys, 984·0 million in girls	265·1 million
Dichlorodiphenyltrichloroethane and fibroids	37 000 cases	56 700 cases	259·0 million	216·8 million
Di-2-ethylhexylphthalate and endometriosis	86 000 cases	145 000 cases	47·0 billion	1·7 billion

The comparison uses base case estimates. Estimates are conditional on certainty of causation. EU=European Union. PBDE=polybrominated diphenyl ethers. IQ=intelligence quotient. ADHD=attention deficit hyperactivity disorder. *2010 population 310 000 000 million †2010 population 501 000 000 million. ‡Exchange rate used €1=US$1·33.

Table 3: **Comparison of attributable disease burden and costs in the USA and European Union**

	10th–24th percentile of exposure (10)*	25th–49th percentile of exposure (25)*	50th–74th percentile of exposure (50)*	75th–89th percentile of exposure (75)*	90th–99th percentile of exposure (90)*
Total urinary dialkyl phosphate concentration (nmol/L)					
USA	13·17	13·17	22·40	112·89	322·42
European Union	79·92	175·55	280·58	741·31	1160·78
Total PBDE 47 concentration in serum (ng/g)					
USA	15·8	19·7	23·1	41·6	68·5
European Union	0	0	2·60	4·61	6·27

PBDE=polybrominated diphenyl ether. *Numbers in brackets show the assumed percentile.

Table 4: **Modelled exposures to an organophosphate pesticide and a PBDE in the USA and European Union**

Discussion

Disease costs across the human lifespan associated with exposure to EDCs in the USA seem to be hundreds of billions of dollars. To place such amounts in perspective, the median annual cost of $340 billion per year that we identified represents 2·33% of the 2010 US gross domestic product ($14·582 trillion).[28] By comparison, EDC costs in the European Union were estimated to be 1·28% of the gross domestic product ($17·0 trillion).[16] Regulatory action to limit exposure to EDCs is likely to produce substantial economic benefits, which should be taken into account when considering the costs of safer alternatives. In particular, some of the main economic benefits of regulating hazardous chemicals would be related to the decreased health costs. Increased production of alternatives could ensure that substances are truly safer alternatives and not replacements with equally hazardous compounds, as was the case when bisphenol A was replaced by bisphenols S and F.[29]

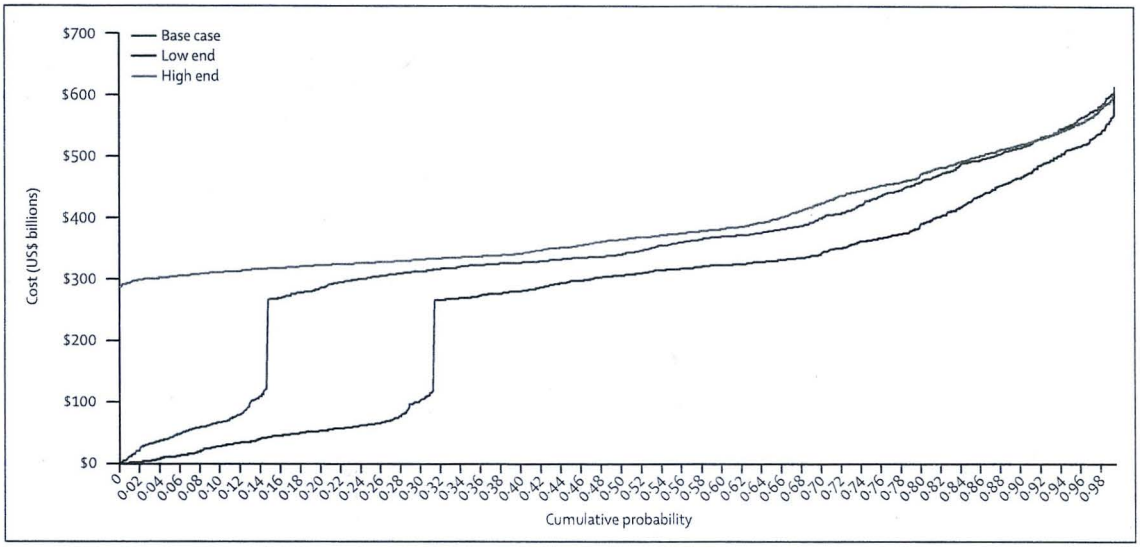

Figure: **Results of Monte Carlo analyses**
1000 simulations done to generate realistic ranges of aggregate cost estimates across all 15 exposure–outcome relations, while taking into account probability of causation.

Calculations of the health and economic benefits associated with reducing exposure to environmental chemicals have proven extremely informative in regulatory decision making. We used rigorous approaches with proven strengths[6,16] to assess the epidemiological and toxicological literature. We acknowledge that expert opinion is, of course, not a substitute for solid epidemiological evidence about the relations between EDCs and disease or for systematic toxicological documentation on endocrine disruption and the specific mechanistic pathways. However, while the mechanisms are important, they have no bearing on the end results—disease and associated economic costs for society.

The EDCs we assessed represent an extremely small subset (<5%) of all EDCs,[30] but there is a paucity of data (exposure, toxicity, and epidemiological), especially robust data, as was required by our methods. The costs also represent a small subset of diseases that has the strongest evidence for causation for the EDCs assessed. We excluded chemicals no longer used, such as some persistent organic pollutants known to contribute to diabetes and obesity,[31] although we included some chemicals (PBDEs) that are being phased out in the USA to ensure a proper comparison with the European Union. Additionally, although use of some PBDEs is being limited, not all uses have been banned, and it remains to be seen whether remaining potential sources of contamination will need action. We also acknowledge that costs of chronic diseases can change over time, and for some disorders, such as obesity, we did aggregate lifetime cost estimates from annual data. Our approach is not unique and we are aware of this potential limitation. Finally, we only used published, peer-reviewed data on the costs of illnesses and dysfunctions; we could not account for suffering and other intangible costs that might arise from the exposure–response relations we studied. Thus, the costs and numbers of cases we calculated probably underestimate the true values associated with the use of EDCs in the USA, which will accumulate if efforts to prevent these exposures are not implemented.

Differences between the USA and European Union in the regulation of flame-retardant chemicals and the use of these chemicals in furniture and other products were drivers of the much greater exposure to PBDE in the USA than in Europe. We note that our models of disease burden extrapolate from a lesser-brominated form of PBDE, which was banned in the USA and the European Union much earlier than the more highly brominated PBDEs. However, deca-PBDEs are debrominated by ultraviolet rays and microbial and vertebrate organisms,[32] and commercial mixtures that contain only lower-brominated congeners might represent relevant sources of exposure. We anticipate that use of PBDEs in the USA will decrease after the requirement for flame-retardant chemicals in furniture is removed in California, although substantial decreases in exposure might lag due to continued use of treated furniture.

We emphasise that our estimates are based on more nationally representative data than those used to estimate burden of disease and disability in the European Union. Although we endeavoured to select the most representative exposure data for Europe, differences in data sources might have exacerbated the disparity between the USA and European Union in disease burden and costs due to EDCs (table 3). Of note, however, the differences in exposure to organophosphate pesticides and PBDEs between the USA and European Union have

been consistently documented in multiple independent samples, which supports our interpretation of our results. A quantitative comparison was not the main objective of this analysis, though, and would be better addressed in future analyses.

The 1976 Toxic Substances Control Act was updated with the Frank R Lautenberg Chemical Safety for the 21st Century Act in 2016.[33] Although praised as a bipartisan effort, the Act makes no mention of endocrine disruption. Thus, although it provides the US EPA with long overdue authority to intervene and limit production of chemical hazards and protect vulnerable populations, it makes no provision for urgently needed testing programmes. The cost of required testing is likely to be small when weighed against the $340 billion in costs we have identified as being related to exposure to EDCs.

The Act also requires review of at least ten chemicals within 1 year and 25 by the end of 3·5 years by the EPA. However, there are no new funds provided to the EPA to increase the pace of its regulatory reviews. Therefore, even assuming that there would be only 500 potentially hazardous substances among the thousands of chemicals currently in use that lack toxicity testing data, it would take 100 years to review them all. Investments are also needed to improve toxicological testing methods, which at present do not accurately detect synthetic chemical obesogens.[15]

Given the known transgenerational effects of EDCs,[34] continuing not to regulate EDCs adequately could have consequences for subsequent generations of US children. Our findings build upon those made by the Endocrine Society[5] and WHO and UNEP[3] that document the urgent public health threat posed by EDCs. The health and economic stakes involved in implementing the Frank R Lautenberg Chemical Safety for the 21st Century Act are high. For instance, various items in the Act are open to broad interpretation, such as the framework for the screening and classification of chemicals into high-priority and low-priority groups. Classification of chemicals as low priority by the EPA could preclude states from applying their own prohibitions or restrictions (eg, on production, processing, distribution, or use) owing to new pre-emption rules. The unfunded EPA mandate, therefore, raises the possibility that chemicals will not be adequately reviewed for endocrine disruption and will simply be approved for use until observational data from human beings and randomised laboratory studies accumulate.

A further concern relates to the ongoing international trade treaty negotiations between the USA and the European Union. Europe's regulatory framework, described in the Regulation, Evaluation and Authorisation of Chemical Hazards could increase protection from EDCs. How the Transatlantic Trade and Investment Partnership might handle differences in regulation of EDCs in consumer products and foods remains unclear.[35] Implementing the Lautenberg Act and navigating its interaction with this trade agreement is likely to influence future health and economic consequences of EDC exposures.

EDC exposures in the USA are likely to contribute substantially to disease and dysfunction across the human lifespan, with costs being more than 2% of the GDP. Differences in costs of EDCs between the USA and the European Union are likely to arise from regulatory action, which reinforces the need for efforts to screen chemicals for potential toxic effects to endocrine systems and to protect vulnerable populations.

Contributors

TMA and LT conceived and designed the study and did the main analysis and interpretation of the data. TMA was responsible for acquiring the data. RH, SS, PAH, J-PB, JPM, JD, and RTZ made substantial contributions to the study design and analysis of data, interpretation of data, or both, and critically reviewed the report for intellectual content. All authors approved the final version that was submitted for publication.

Declaration of interests

We declare no competing interests.

Acknowledgments

This work was supported by the Endocrine Society, The Ralph S French Charitable Foundation, and the Broad Reach Foundation. We thank the authors of six previous studies that had assessed the economic costs of endocrine-disrupting chemicals, on which we based this work: Anna Maria Andersson, Martine Bellanger, Bruce Blumberg, Barbara Demeneix, Philippe Grandjean, Tony Fletcher, Paul A Fowler, Eva Govarts, Ulla Hass, Jerrold J Heindel, Anders Juul, Juliette Legler, Miquel Porta, Ruthann Rudel, Niels E Skakkebaek, and Jorma Toppari. We also thank Germaine Buck Louis, who provided data on the distribution of time to pregnancy that formed the basis of our infertility estimates.

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ACAT
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HB 27: High Risk Chemicals for Child Exposure
Toxic-Free Children Act

HB 27 protects Alaska children and firefighters from high risk exposure to organohalogen flame retardant chemicals.

> *"An Act relating to chemicals that are of high concern for children and to the manufacture and sale of products containing certain flame retardant chemicals; relating to an interstate chemicals clearinghouse; adding an unlawful act to the Alaska Unfair Trade Practices and Consumer Protection Act; and providing for an effective date."*

Thirteen states have already adopted 33 policies to end the use of toxic fire retardant chemicals.

Toxic Flame Retardants are in Children's Products

These harmful chemicals are in products that children touch directly, such as toys, and in other products including nap mats, changing mats, nursing pillows, upholstered furniture, plastics, paints, sealants, carpet padding, and the plastic casings of some electronics.



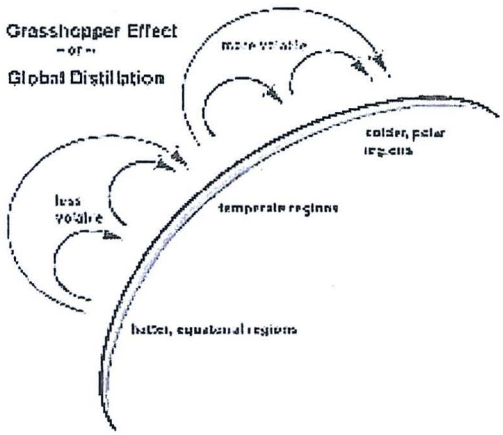

Toddlers Have Higher Levels of Chemicals in Their Bodies Than Their Parents

Toxic flame retardant chemicals can be released from objects such as couch foam and become attached to household dust that people can inhale or ingest. Because children play on the floor and put their hands in their mouths, they ingest these harmful flame retardants. Studies have found 2-5 times higher levels of flame retardant chemicals in toddlers than in their parents.

Flame Retardants are Harmful to Human Health

The United States Centers for Disease Control and Prevention (CDC) has identified harmful flame retardants in the bodies of more than 90% of Americans. Exposure to flame retardants is associated with adverse health effects such as cancer, miscarriages, premature births, neurological and developmental delays, and respiratory problems.

Alaskans are Exposed to Higher Levels of Toxic Chemicals than the Rest of the Nation, because Alaskans spend more time indoors in more insulated areas and homes with less ventilation during the long winter. Also global distillation occurs when persistent chemicals such as flame retardants are transported by atmospheric and marine currents from warmer to colder regions of the Earth and remain there. The cold acts as a hemispheric sink and traps the harmful chemicals in Alaska and other Arctic and sub-Arctic regions.



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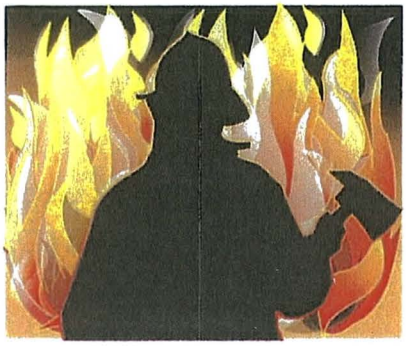
The Children of Alaska are Especially Vulnerable

Birth defects in Alaska are twice as high than in the USA as a whole, and Alaska Native infants have twice the risk of birth defects as white infants in Alaska. The Toxic-Free Children Act will go a long way toward protecting all of Alaska's children.

Flame Retardants Cause More Harm than Good



Highly toxic flame retardants chemicals are in a variety of products we use every day. However, they do not actually provide fire safety benefits. While chemical companies say their flame retardants make our products safer, the truth is that flame-retardants added to polyurethane foam products have been shown to be ineffective in fire protection. They generate excessive smoke and toxic chemical byproducts that expose firefighters to a toxic soup, including cancer-causing dioxins and furans.

There Are No Federal Laws that Protect People from Flame Retardants

Although there are no federal laws that protect people from the unnecessary addition of flame retardants to furniture and children's products, the federal Consumer Product Safety Commission (CPSC) issued a warning about products containing organohalogen flame retardant chemicals.

> *"The known adverse health effects of these chemicals to consumers include: reproductive impairment (e.g., abnormal gonadal development, reduced number of ovarian follicles, reduced sperm count, increased time to pregnancy); neurological impacts (e.g., decreased IQ in children, impaired memory, learning deficits, altered motor behavior, hyperactivity); endocrine disruption and interference with thyroid hormone action (potentially contributing to diabetes and obesity); genotoxicity; cancer; and immune disorders. These chemicals have a disproportionately negative health effect on vulnerable populations, including children."* [September 28, 2017].

At the same time that the CPSC issued this guidance, it began a rulemaking process to ban the use of the entire class of organohalogen flame retardants from 1) children's toys and child care articles, 2) mattresses and mattress pads, 3) upholstered household furniture, and 4) the outer plastic casings for electronics. Because that rulemaking will likely take years to complete, the CPSC issued a public warning to request that manufacturers of the products "eliminate the use of such chemicals in these products." Unwilling to wait for the slow-moving federal process, sixteen states are considering policies in 2018 to ban toxic flame retardants: Alaska, Connecticut, Iowa, Indiana, Massachusetts, Maryland, Mississippi, North Carolina, New Hampshire, New Jersey, New York, Tennessee, Virginia, Washington, and West Virginia.

The Toxic-Free Children Act is Good for Business because it helps Alaskan businesses meet the increasing consumer demand for safer products and encourages innovation and the development of safer alternatives in furniture and other products.