Halogenated Fire Retardants (HFRs) in Healthcare

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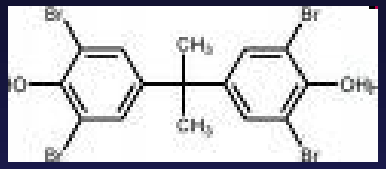
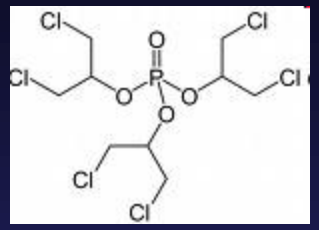
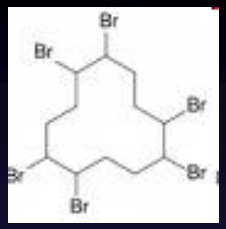
What are Halogenated Flame Retardants (HFRs)?





- Organic chemicals containing a halogen element, most commonly bromine or chlorine.
- Added to products to inhibit ignition or spread of flames.
- Brominated flame retardants most commonly used but some are being replaced by chlorinated chemicals.
- Dozens of halogenated flame retardants currently in use – products containing them are not labeled.

Brominated Flame retardants



- Polybrominated biphenyls (PBBs)
- Polybrominated diphenyl ethers (**PBDE**s)
- Tetrabromobisphenol A (**TBBPA**)
- Hexabromocyclododecane (**HBCD**)
- 1,2-bis(2,4,6-tribromophenoxy) ethane (TBE)
- bis(2,4,6,-tribromphenoxy) ethane (BTBPE),
  2,4,6-tribromophenol (TBP)
- decabromodiphenyl ethane (DBDPE),
- brominated components in Firemaster 550 (FM 550):
  - 2-ethylhexyl 2,3,4,5-tetrabromobenzoate (TBB)
  - Bis (2-ethylhexyl) tetrabromophthalate (TBPH)
- Brominated Tris (Tris (2,3-dibromopropyl) phosphate)
- 1,2-Dibromo-4-(1,2-dibromoethyl)cyclohexane (TBECH)

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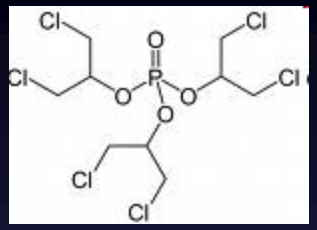
Chlorinated Flame Retardants



- Tris (1,3-dichloro-2-propyl) phosphate (TDCP)
- Tris(2-chloroisopropyl phosphate) (TCPP)
- Tris(2-chloroethyl) phosphate (TCEP)
- Chloroparaffins
- Bis(hexachlorocylocpentadieno)cyclooctane (Dechlorane Plus)

- Hexachlorocyclopentadienyl-Dibromocyclooctane (HCDBCO)

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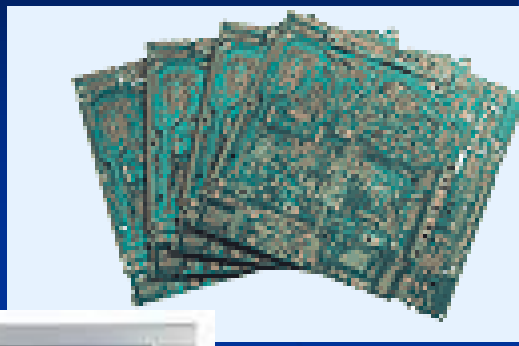
Where are HFRs used?



Polyurethane foam – furniture, mattress pads, carpets
Electronics casings and circuit boards
Building materials
Wiring

Health Care and HFRs

Foams: egg crate pads, chair cushions, insulation board, carpets.

Textiles: curtains, chair covers

Electronic Equipment: TVs, computers, faxes, patient monitors, IV pumps, ventilators, dialysis machines, etc.

HFRs in indoor dust

- BFRs have been found in indoor dust samples
- Sources may include treated carpets, furniture, computers or other electronics.
- Levels in dust are associated with breast milk levels

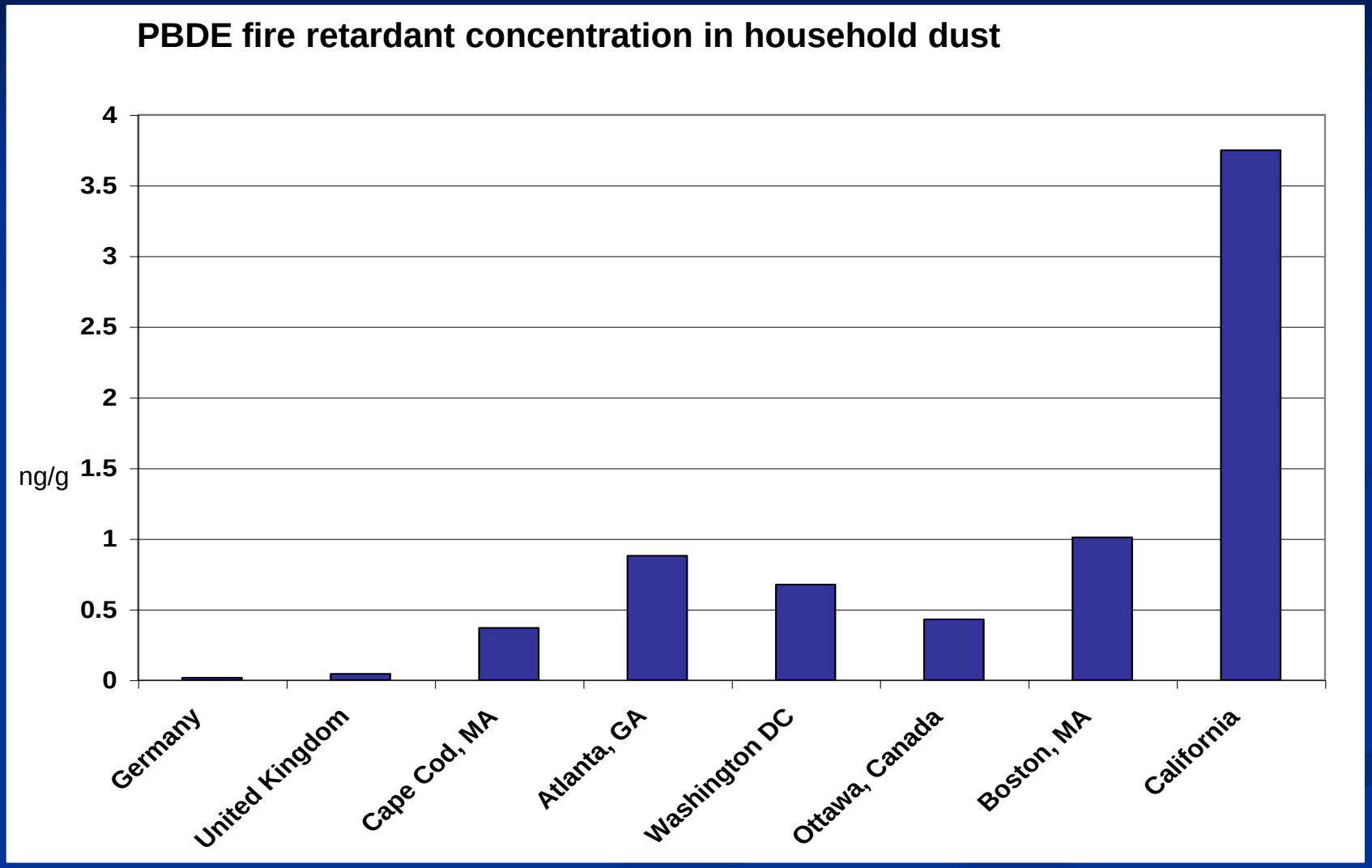
(Source: Butt, 2004; Rudel, 2003, Stapleton, 2005)

HFRs in people

- PBDEs have been measured in serum, breast milk, placenta and cord blood.
- HBCD has been found in blood, breast milk
- TBBPA has been found in serum, cord blood, and breast milk.

• (Frederikson, 2009; Kakimoto, 2008; Eljarrat, 2009; Thomsen, 2008; Cariou, 2008)

California residents most highly exposed



Source: Zota et al., Environ. Sci. Technol., 2008,

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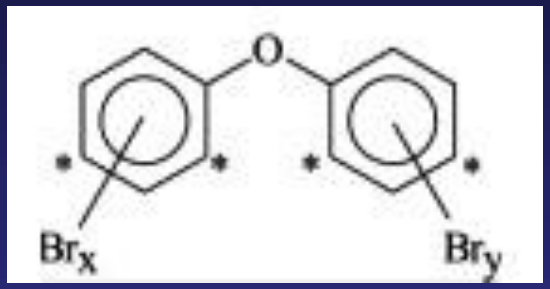
Toddlers have about three times the flame retardant level of their parents

Lunder et al, 2010, Significantly Higher PolybrominatedD iphenyl Ether Levels in Young U.S. Children than in Their Mothers, ES&T, Jul 1;44(13):5256-62.

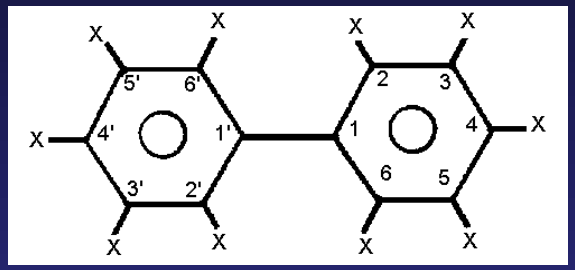
Potential Routes of Exposure

- Inhalation or ingestion of contaminated dust particles.
- Ingestion of contaminated food, especially fish.
- For fetuses and infants, absorption across the placenta or ingestion of contaminated breast milk.
- Occupational exposure

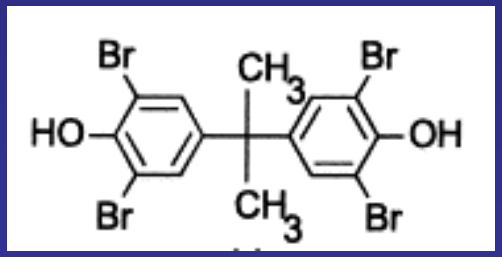
Structural similarities



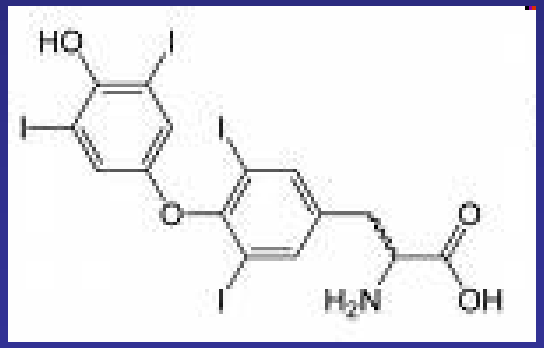
PBDEs



PBB/PCBs

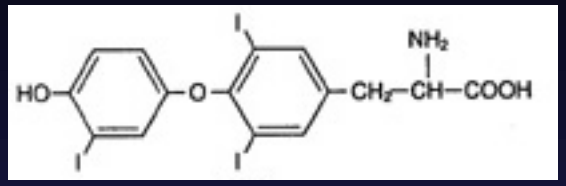


TBBPA



Thyroid hormone

Endocrine Disruption: Interference with Thyroid Hormone Action



- Interference with thyroid hormone function in fetuses and young children up to age 2-3 can affect brain development.

- Historically, exposures to PCBs, has been associated with alterations in thyroid hormone function and lower IQ, lower reading comprehension, and behavioral abnormalities in children

- Exposures to some BFRs has been shown to cause alterations in thyroid hormone function.

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PBDE ANIMAL HEALTH EFFECTS

- Endocrine disruption – thyroid hormone
- Neurodevelopment impacts: Decreased memory, learning deficits, altered motor behavior, hyperactivity
- Reproductive system effects: Abnormal gonadal development, reduced ovarian follicles, reduced sperm count
- Cancer
- Immune suppression

PentaBDE Human Health Associations

- **Neurological Effects**
  Herbstman et al, 2010
  Decreased IQ
- **Cryptorchidism**
  - Main et al, 2007
- **Reproductive Hormone Effects**
  - Meeker et al., 2009 –
    Decrease in Androgens and LH; Increase in FSH and Inhibin
  - Meijer et al, 2008
    Decrease in Testosterone
- **Reproductive Effects**
  -- Eskenazi et al., 2009, 2011
  Low Birth Weight;
  Altered Behaviors
  -- Harley et al, 2010
  Increased time to pregnancy

Decreased Sperm Quality

- Akutse et al, 2008

Diabetes?

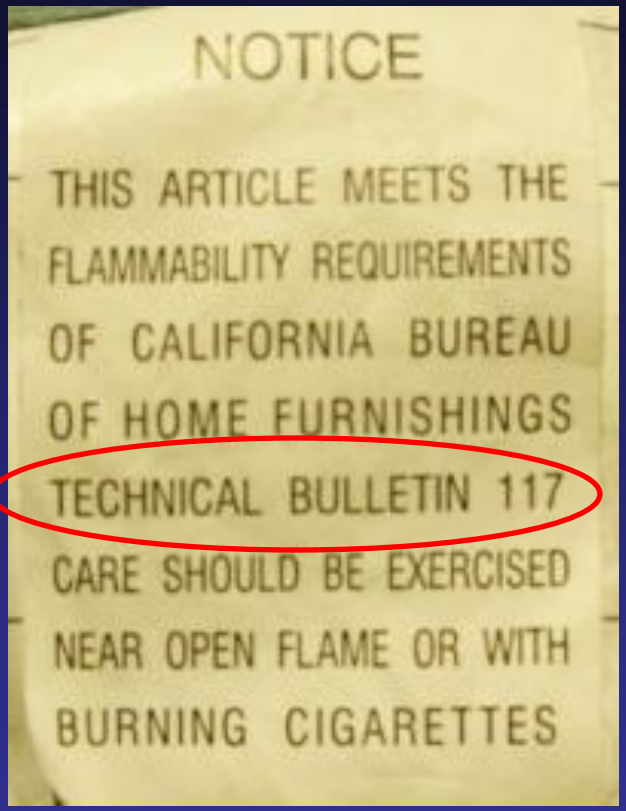
- Lim et al, 2008
- Turyk et al, 2009 (only in hypothyroid subjects)

Thyroid Homeostasis

- Turyk et al, 2007 – elevated T4
- Meeker et al, 2009 – elevated T4, TBG
- Dallaire et al, 2009 -Elevated T3 ~BDE47
- Eskenzai et al, 2009 – Low TSH
- Chevrier et al 2010 -**Changes during pregnancy**

Courtesy, Linda S. Birnbaum, Director, NIEHS and NTP

How has this happened?

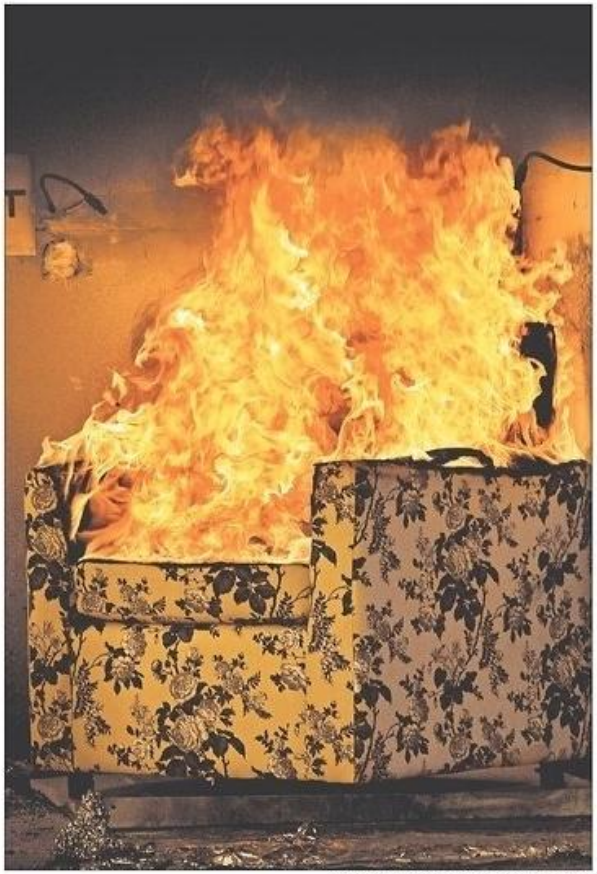


Technical Bulletin 117 (TB117):

Twelve second small open flame and smolder standard for filling materials used in upholstered furniture.

Playing with fire

A deceptive campaign by industry brought toxic flame retardants into our homes and into our bodies. And the chemicals don't even work as promised.



CONSUMER PRODUCT SAFETY COMMISSION PHOTO

UP IN FLAMES: Government scientists found that chairs containing flame retardants, like the one being tested above, burned just as fast as identical chairs without them. **Story, Page 22**

BY PATRICIA CALLAHAN AND SAM ROE
Tribune reporters

Dr. David Heimbach knows how to tell a story.

Before California lawmakers last year, the noted burn surgeon drew gasps from the crowd as he described a 7-week-old baby girl who was burned in a fire started by a candle while she lay on a pillow that lacked flame retardant chemicals.

"Now this is a tiny little person, no bigger than my Italian greyhound at home," said Heimbach, gesturing to approximate the baby's size. "Half of her body was severely burned. She ultimately died after about three weeks of pain and misery in the hospital."

Heimbach's passionate testimony about the baby's death made the long-term health concerns about flame retardants voiced by doctors, environmentalists and even firefighters sound abstract and petty.

But there was a problem with his testimony: It wasn't true. Records show there was no dangerous pillow or candle fire. The baby he described didn't exist.

Neither did the 9-week-old patient who Heimbach told California legislators died in a candle fire in 2009. Nor did the 6-week-old patient who he told Alaska lawmakers was fatally burned in her crib in 2010.

Heimbach is not just a prominent burn doctor. He is a star witness for the manufacturers of flame retardants.

His testimony, the Tribune found, is part of a decades-long campaign of deception that has loaded the furniture and electronics in American homes with pounds of toxic chemicals linked to cancer, neurological deficits, developmental problems and impaired fertility.

The tactics started with Big Tobacco, which wanted to shift focus away from cigarettes as the cause of fire deaths, and continued as chemical companies worked to preserve a lucrative market for their products, according to a Tribune review of thousands of government, scientific and internal industry documents.

These powerful industries distorted science in ways that overstated the benefits of the chemicals, created a phony consumer watchdog group that stoked the public's fear of fire and helped organize and steer an association of top fire officials that spent more than a decade campaigning for their cause.

Today, scientists know that some flame retardants escape from household products and settle in dust. That's why toddlers, who play on the floor and put things in their mouths, generally have far higher levels of these chemicals in their bodies than their parents.

Blood levels of certain widely used flame retardants doubled in adults every two to five years between 1970 and 2004. More recent studies show levels haven't declined in the U.S. even though some of the chemicals have been pulled from the market. A typical American baby is born with the highest recorded concentrations of flame retardants among infants in the world.

People might be willing to accept the health risks if the flame retardants packed into sofas and easy chairs worked as promised. But they don't.

The chemical industry often

Please turn to **Page 20**

Tribune findings

Four-part investigation

INDUSTRY DECEPTION

Makers of flame retardants wage a deceptive campaign to boost demand for the chemicals even though they don't work as billed and put our health at risk.

TOBACCO'S CLOUT

With cigarettes starting deadly fires, tobacco companies created a new scapegoat — the furniture going up in flames — and invested in a national group of fire officials that would

DISTORTING SCIENCE

Chemical companies say science shows that flame retardants prevent fire deaths and are safe, but the research they often cite is either seriously flawed or grossly

TOXIC ROULETTE

The U.S. government has allowed generations of flame retardants onto the market without thoroughly assessing the risks. One chemical touted as safe is now turning up in wildlife

http://media.apps.chicagotribune.com/flames/index.html

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June 18, 2012

Jerry Brown urges reduction of toxic flame retardants in furniture

Gov. Jerry Brown urged state regulators today to reduce the use of toxic flame retardants in upholstered furniture.

"Toxic flame retardants are found in everything from high chairs to couches and a growing body of evidence suggests that these chemicals harm human health and the environment," the Democratic governor said in a prepared statement. "We must find better ways to meet fire safety standards by reducing and eliminating -- wherever possible -- dangerous chemicals."

Read more here: http://blogs.sacbee.com/capitolalertlatest/2012/06/jerry-brown-urges-reduction-of-toxic-flame-retardants-in-furniture.html#storylink=cpy

Alternatives to HFRs

- Product design plays an important role in fire safety
  - reduce amount of combustible material (plastics)
  - substitute highly flammable components with relatively flame resistant materials (e.g. inherently flame resistant polyester, natural fibers like wool or silk)
    - e.g. Avora and Trevira upholstery for health care use
  - physically separate heat generating components from highly flammable components.
  - lower operating temperature of heat-generating components

Alternatives to HFRs

- Inherently flame-resistant materials are available:
  - Plastics containing sulfur
  - Preceramic polymers
  - Aramide blends (like Kevlar)
  - Melamine
  - Carbonized fibers
  - Natural fibers (wool, silk, hemp, jute)

Alternatives to HFRs

- Materials which are inherently flame-resistant can be substituted for more flammable components.

- Electronics:
  - Toshiba uses an inherently flame-resistant plastic, polyphenylene sulphide, for circuits.
  - Apple uses a chlorine and bromine-free polycarbonate for one version of its computer monitors.
  - NEC has manufactured a bioplastic resin, polylactide for use in electronic products.

Manufacturers who Have Agreed to Phase-out Use of BFRs

Electronics:

Apple
Ericsson
IBM
Motorola
NEC
HP
Panasonic
Phillips
Sony
Toshiba
Dell

Furniture:

IKEA
Crate and Barrel
Eddie Bauer
Comfort Care

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Actions for Healthcare Institutions

- Choose products that meet flame retardant standards without any added chemicals
- Require disclosure of name of all flame retardants used in product purchases
- Express a preference for products made without halogenated flame retardants
- Utilize HCWH resources, "What Health Care Purchasers can do to Reduce Flame Retardants"

More information:

Natural Resources Defense Council

www.nrdc.org/health

Health Care Without Harm:

www. noharm.org

Healthier Hospitals Initiative

www.healthyhospitals.org