

Breast milk contamination: considerations & challenges



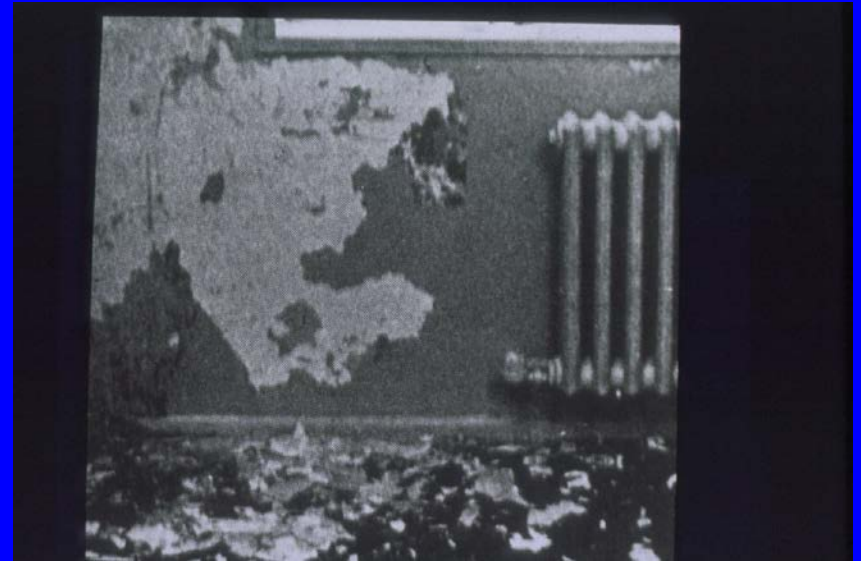
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<http://depts.washington.edu/pehsu/index.html>

CASE #1: Lead Exposure

- 22 yo Mexican woman at 28 weeks gestation with BLL – 38 ug/dl. Repeat 1 wk later – 33 ug/dl;
- No current sources of lead exposure found; patient came to U.S. from Mexico 6 weeks ago;
- Call from Ob/gyn – should the patient breastfeed?



Case #2: Electronics Worker

- 26 year old woman breastfeeding 7 mo. old child
- Mom works in a silicon wafer fab. for at least 2 hrs/day
- Exposures to acetone, isopropyl alcohol, xylene, phenol
- Uses gloves, hood, no respirator
- Is it safe to go back to work and continue breastfeeding?



WHO YOU GONNA CALL?

UW Pediatric Environmental Health Specialty Unit (PEHSU)

Free telephone consultation
Clinical referrals as required
Outreach & Education
1-877-KID-CHEM



<http://depts.washington.edu/pehsu/>

Supported by U.S. EPA/CDC-ATSDR

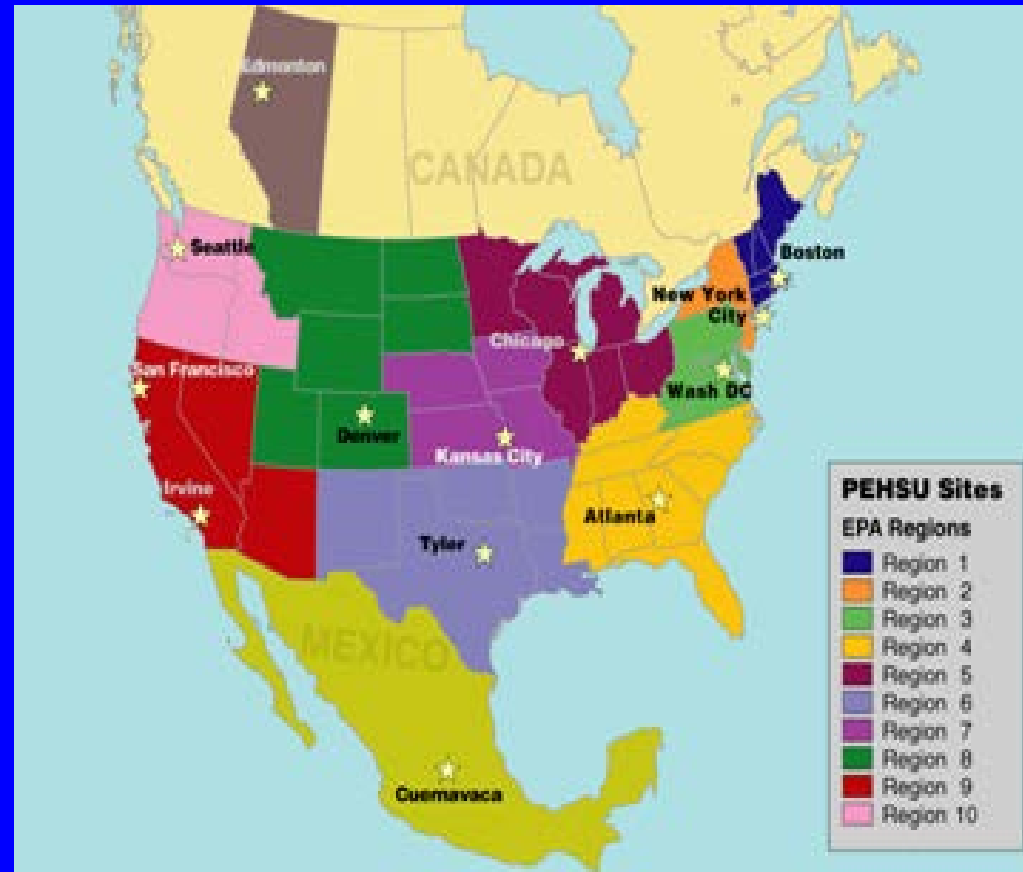
PEHSU: Pediatric Environmental Health Specialty Unit

Serve health care providers,
public health professionals,
communities, and families

Unique interface of pediatric
medicine-toxicology-
teratology-epidemiology-
exposure sciences

Evidence-based Consultation
and Education

UW PEHSU: OR, ID, AK, WA



NW PEHSU

- Currently, a very small percentage of our consultation requests (<5%) are related to breast milk contaminants
- PEHSU network includes expertise in breastmilk contamination
 - UCSF PEHSU, Dr. Gina Solomon
 - UW PEHSU partner, Dr. Janine Polifka
- Much of this presentation attributable to Dr. Solomon/Polifka!

WHO YOU GONNA CALL?

Care Northwest

CARE NW – Counseling and Advice on Reproductive Exposures (est 1994), part of the OTIS umbrella (Organiz of Teratogen Info Services)

Also serves WA (65%), AK, ID, OR

(The primary user group is patients, although serve health care practitioners and genetic counselors.)

Toll free phone number **1-888-616-8484**

<http://depts.washington.edu/terisweb/teris/cnw.htm>

CARE NW calls 2000-2005

- 57% pregnancy concerns, **30% lactation**, 13 % other (adoption, pre pregnancy)
- 58% medication, **10% occupational**, **7% environmental**, 25% other (CAM, substance of abuse, vaccine, illness)

Breast milk: Consider the benefits

Immune system benefits

Lower Incidence or Severity in Breastfed Infants than in Formula-fed Infants

Diarrhea

Respiratory tract infection

Otitis media

Pneumonia

Urinary infection

Necrotizing enterocolitis

Invasive bacterial infection

USDHH. HHS Blueprint for Action on Breastfeeding, Washington, D.C., US Department of Health & Human Services, Office on Women's Health, 2000

Benefits of Breastfeeding

Complete nutrition – economic – practical advantages

Improved behavioral/learning outcomes

Cancer prevention?

Obesity prevention?

Other adult onset chronic dz prevention?
(IDDM, heart dz, MS)

Breast milk: consider the alternative

Formula Feeding

Water contamination

Pathogens, nitrates, pesticides, industrial chemicals

Contaminants from processing or containers

Pathogens, lead, bisphenol-A

Manganese

Phytoestrogens (soy)

Increased mortality compared with breastfed babies

Improper mixing

AAP Policy Statement on Breastfeeding

“Exclusive breastfeeding is ideal nutrition and sufficient to support optimal growth and development for approximately the first 6 months after birth.”

“It is recommended that breastfeeding continue for at least 12 months, and thereafter for as long as mutually desired.”

But what about breastmilk contamination?

BIOMONITORING STUDIES show:

Most breast-feeding mothers have detectable levels of several environmental agents in their milk....

Levels reflect geography, diet, regulatory controls, birth order, timing of breastfeeding....

Chemicals Reported in Breast Milk

Organochlorine pesticides

(Persistent Organic Pollutants
POPs)

- **Compounds are characteristically stable, fat-soluble and bioaccumulate**

DDT/DDE

Dieldrin, Aldrin, Endrin

Chlordane

Hexachlorocyclohexane
(Lindane)

Heptachlor

Mirex

Toxaphene



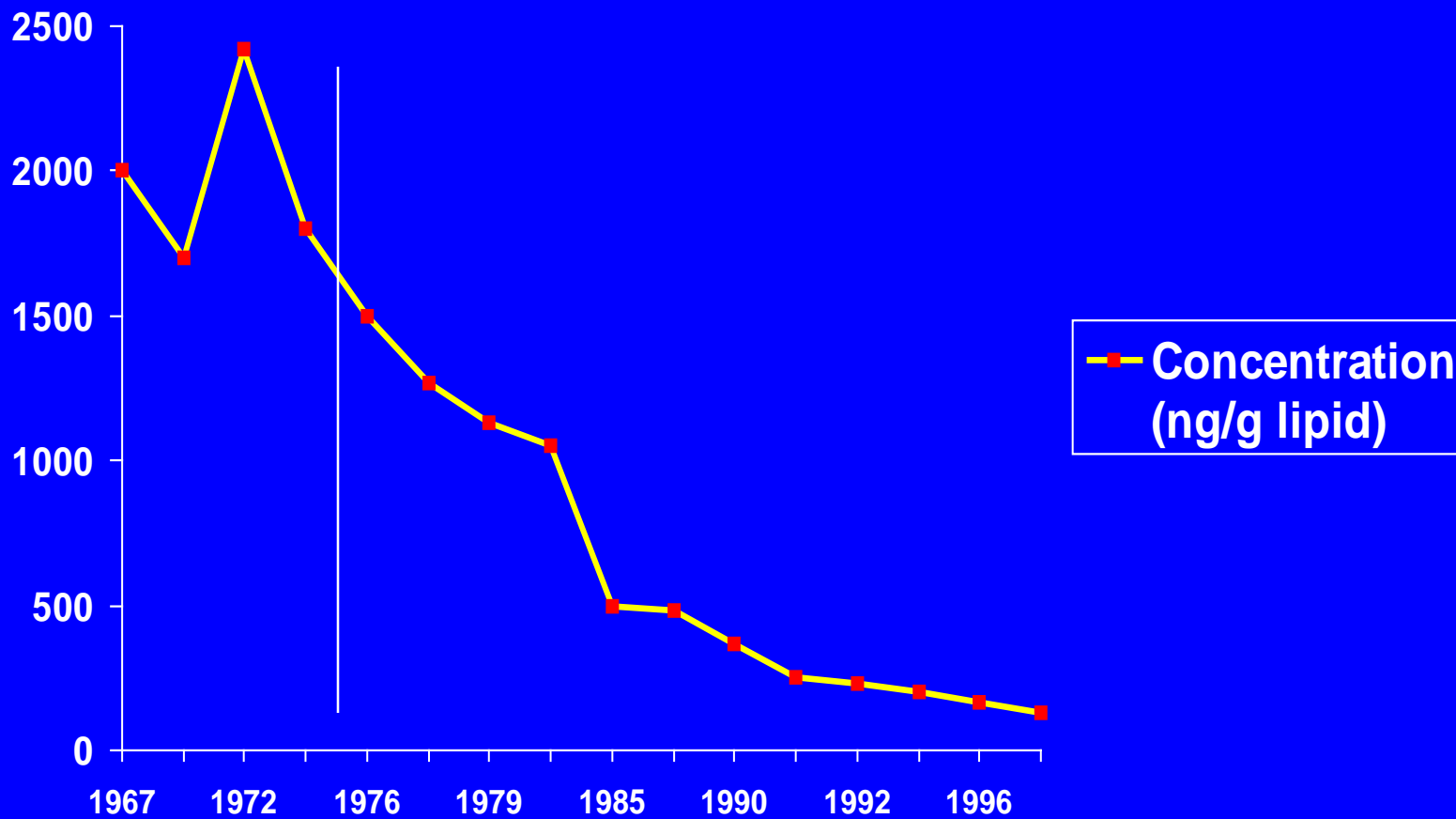
Chemicals Reported in Breast Milk: Industrial POPs

- Hexachlorobenzene
- Polychlorinated biphenyls (PCBs)
- Polychlorinated dibenzodioxins (dioxins)
- Polychlorinated dibenzofurans (furans)
- Polybrominated diphenylethers (PBDEs)
- Musk xylenes, Nitro musks
- Perfluorooctanoic acid (PFOA)

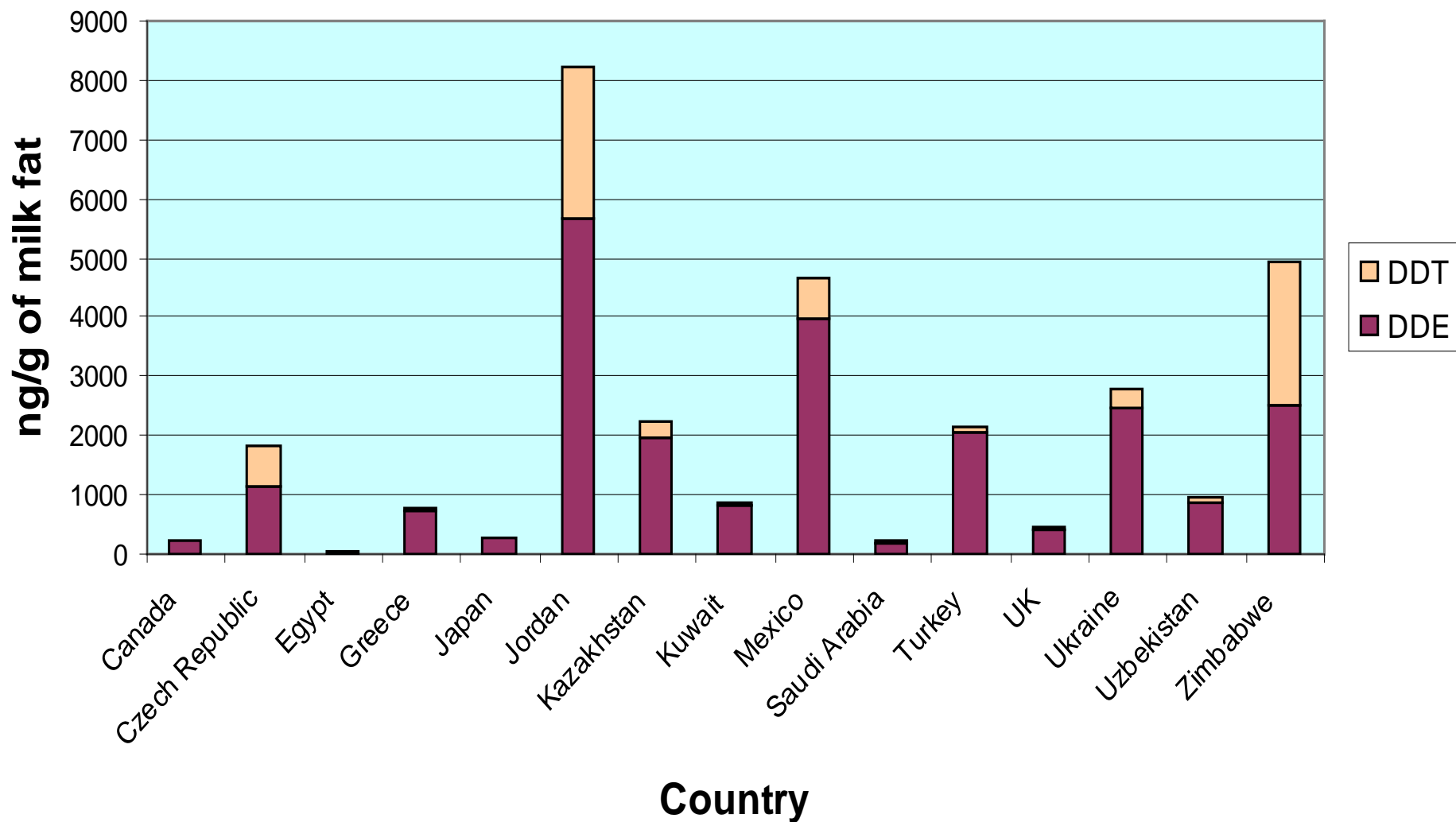
Health Effects of POPs

- Some are known or likely human carcinogens (eg. dioxins, furans, PCBs, PFOA)
- Most are known endocrine disruptors
- Many are neurotoxins
- DDT shortens duration of lactation

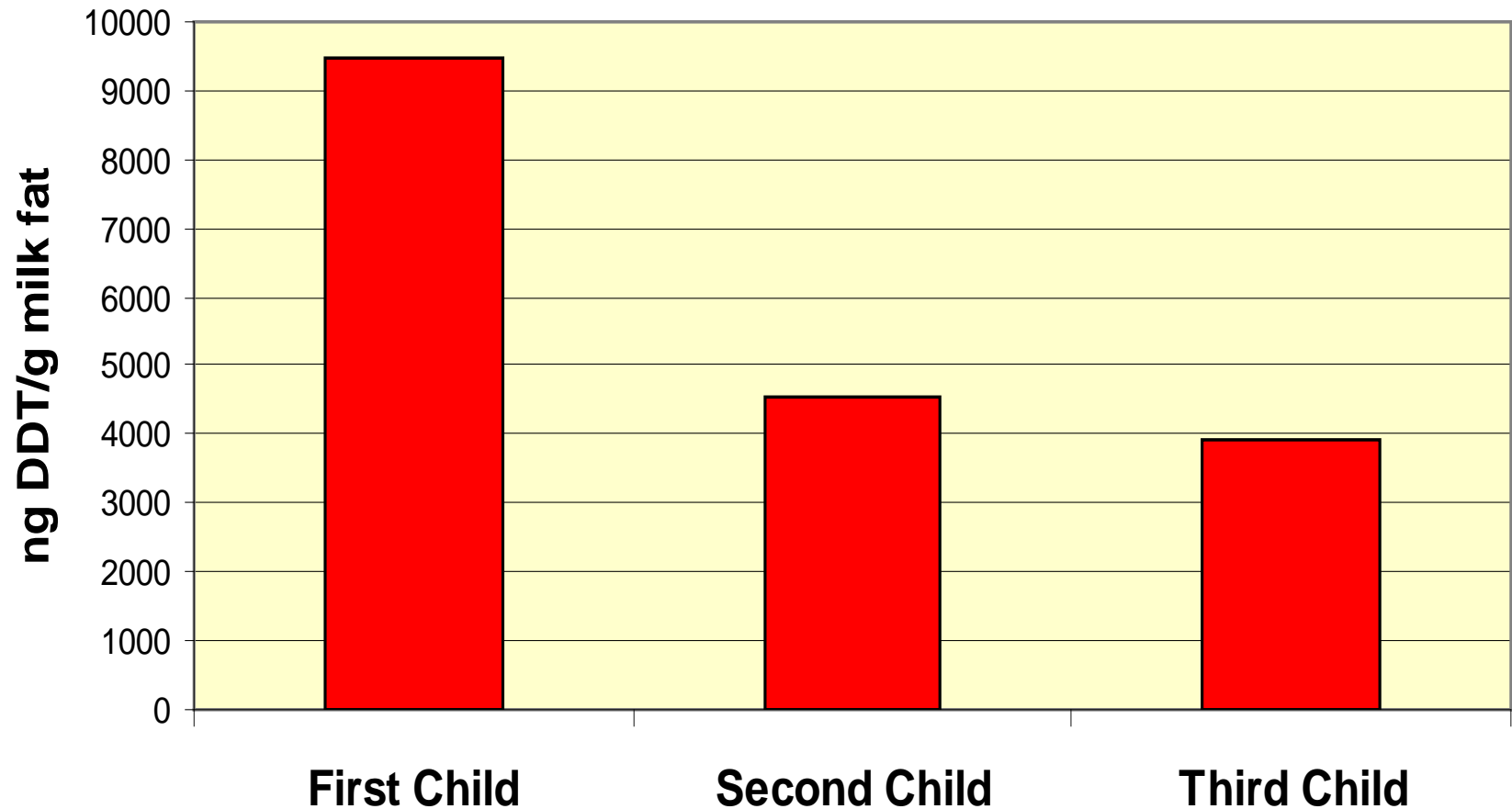
DDE in Breastmilk Sweden



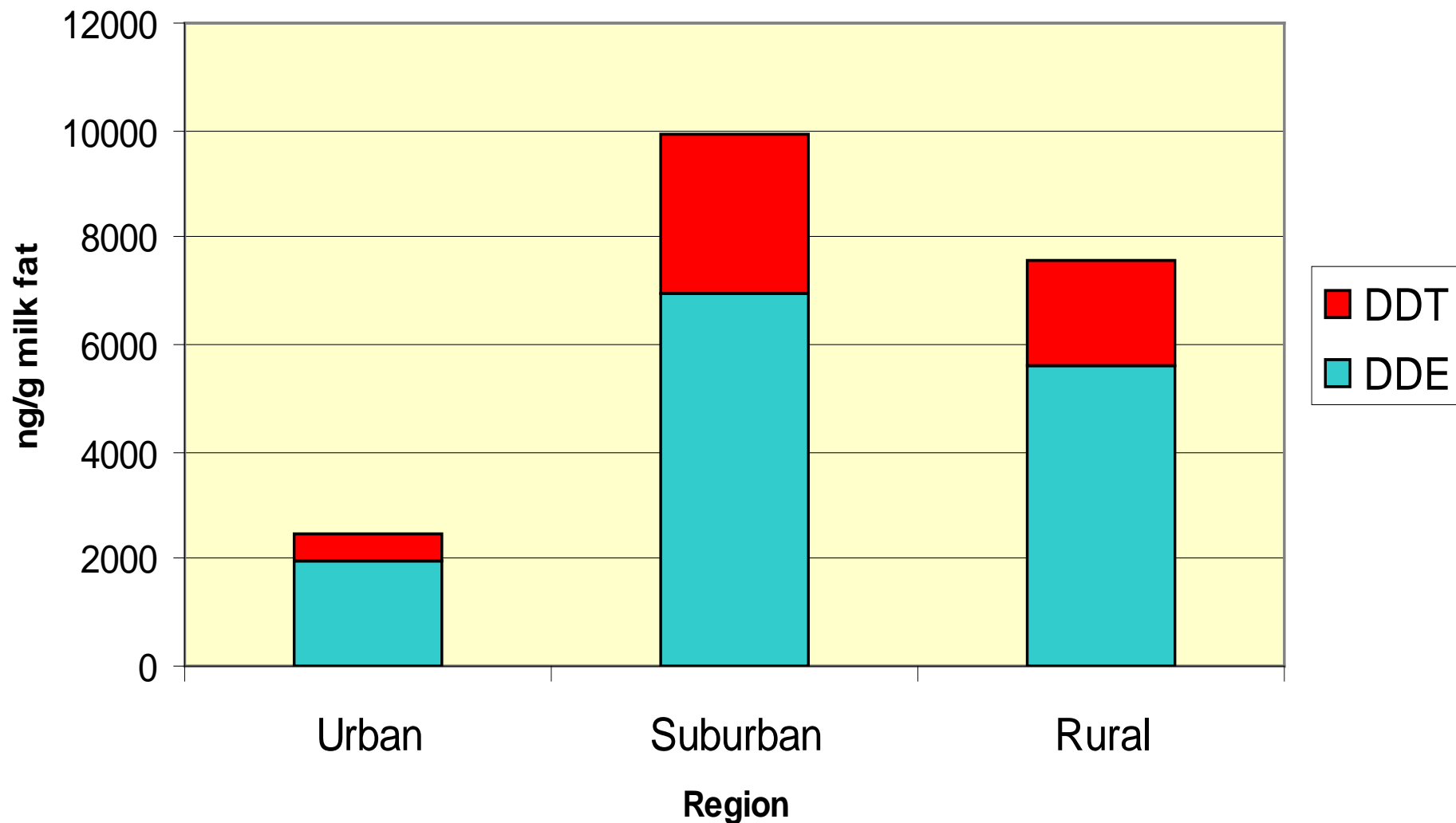
DDT and DDE in Breast Milk Around the World (1990s)



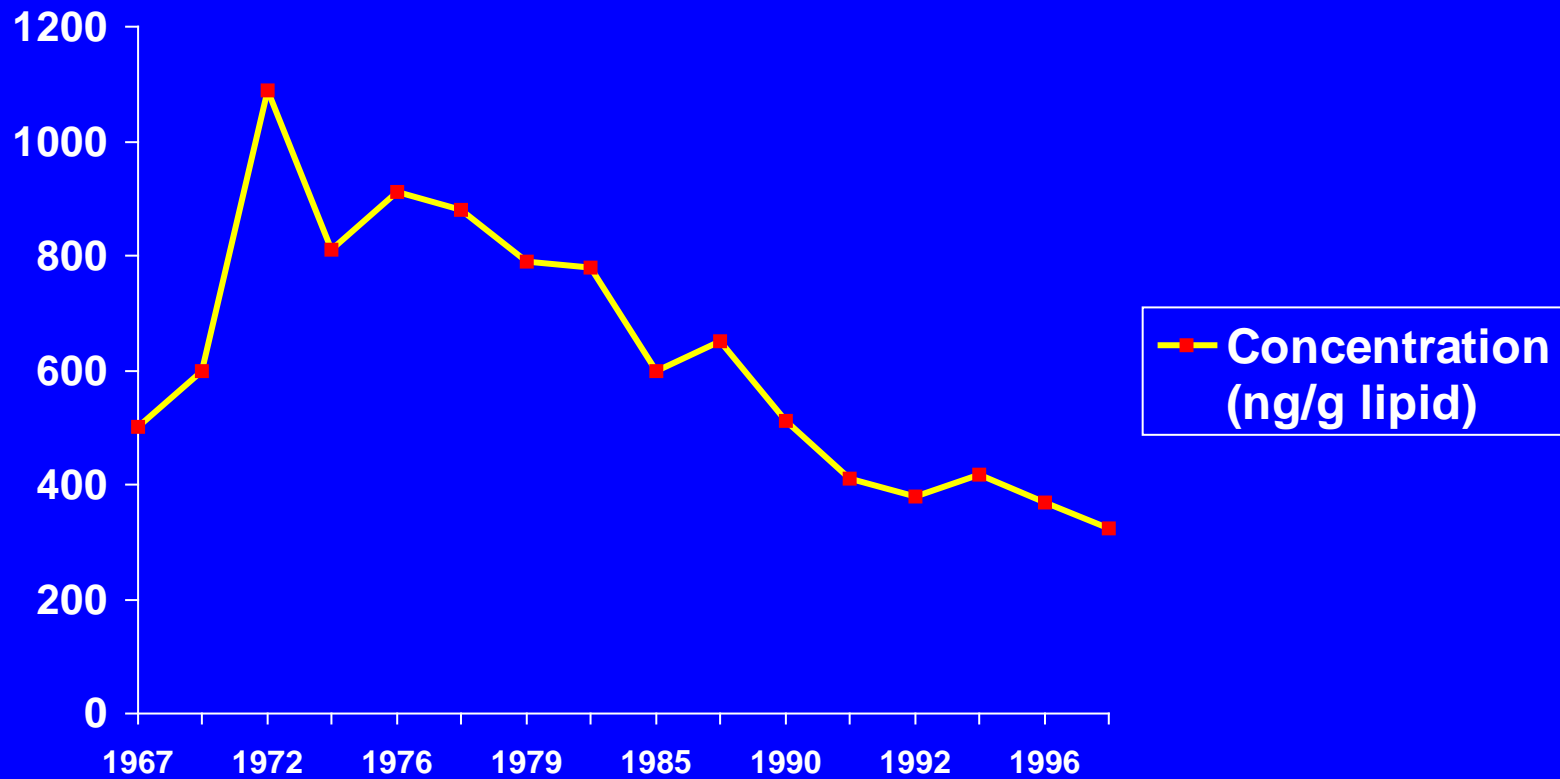
Higher DDT Contamination Levels in Breast Milk of Mothers Nursing their First Child Veracruz, Mexico 1994-95



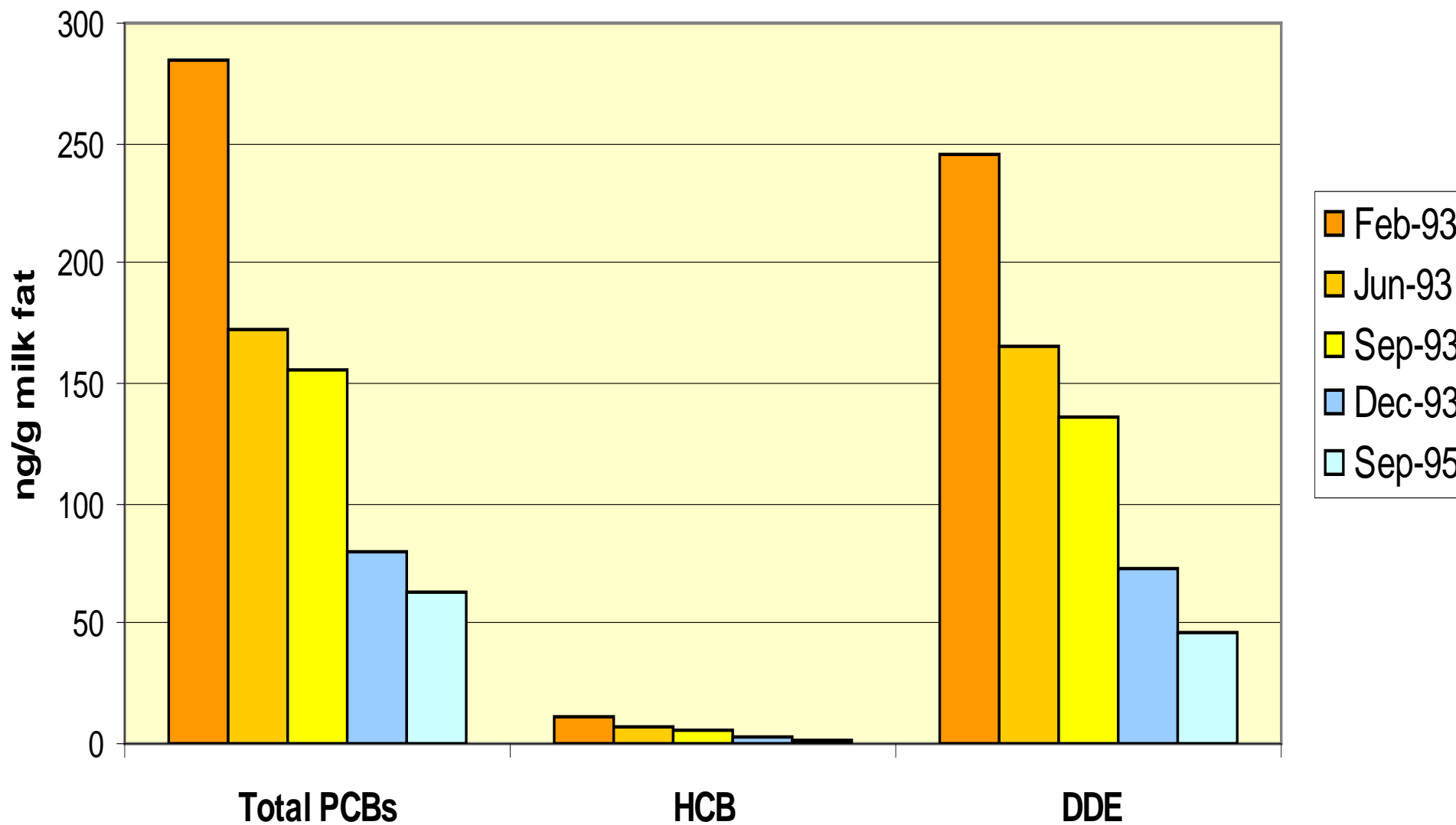
DDT and DDE in Breast Milk, Mexico (1996-1997)



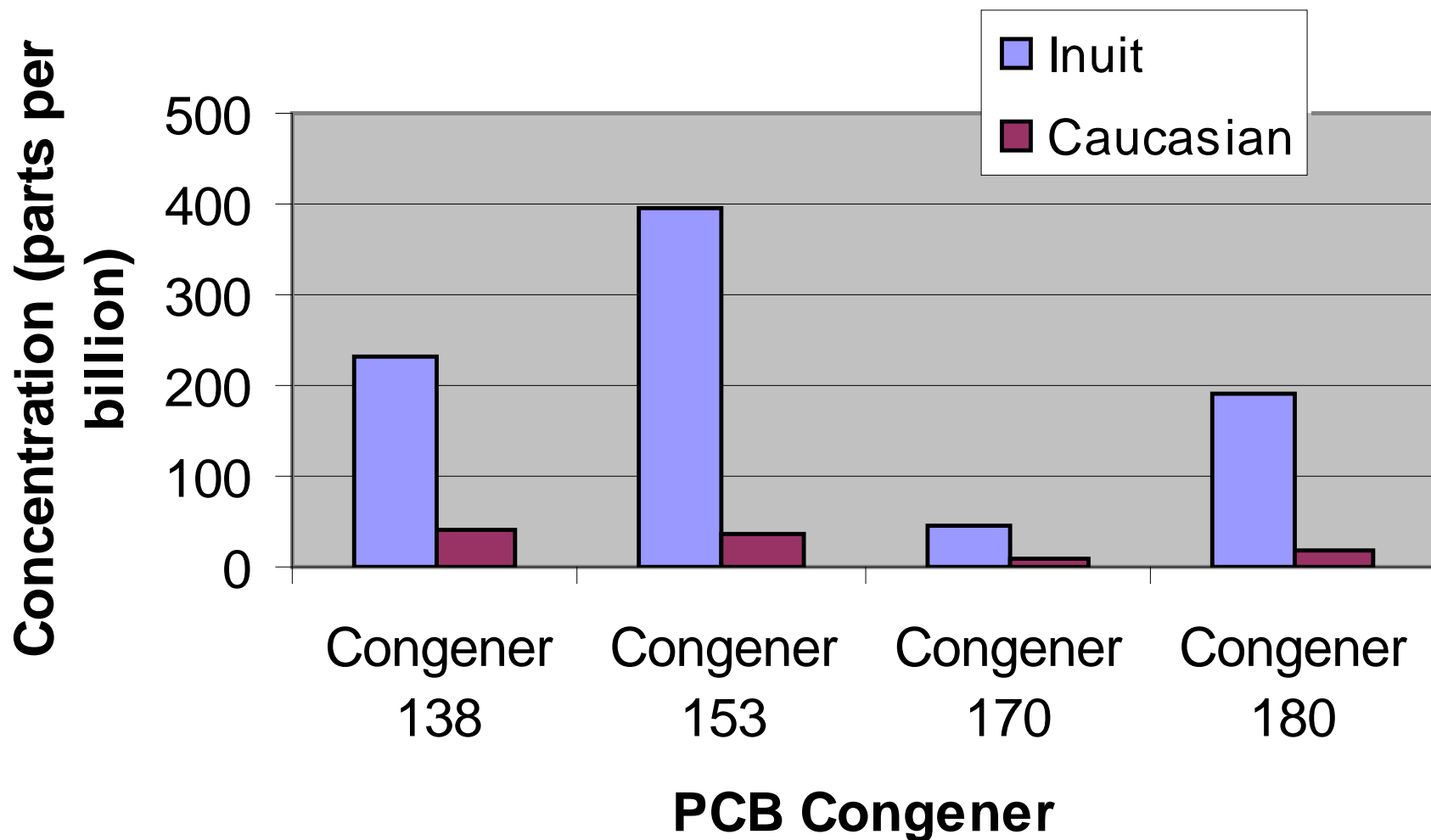
PCBs in Breastmilk Sweden



Reductions in Breast Milk Pollutant Concentrations Over a 38-Month Period of Breast Feeding Twins



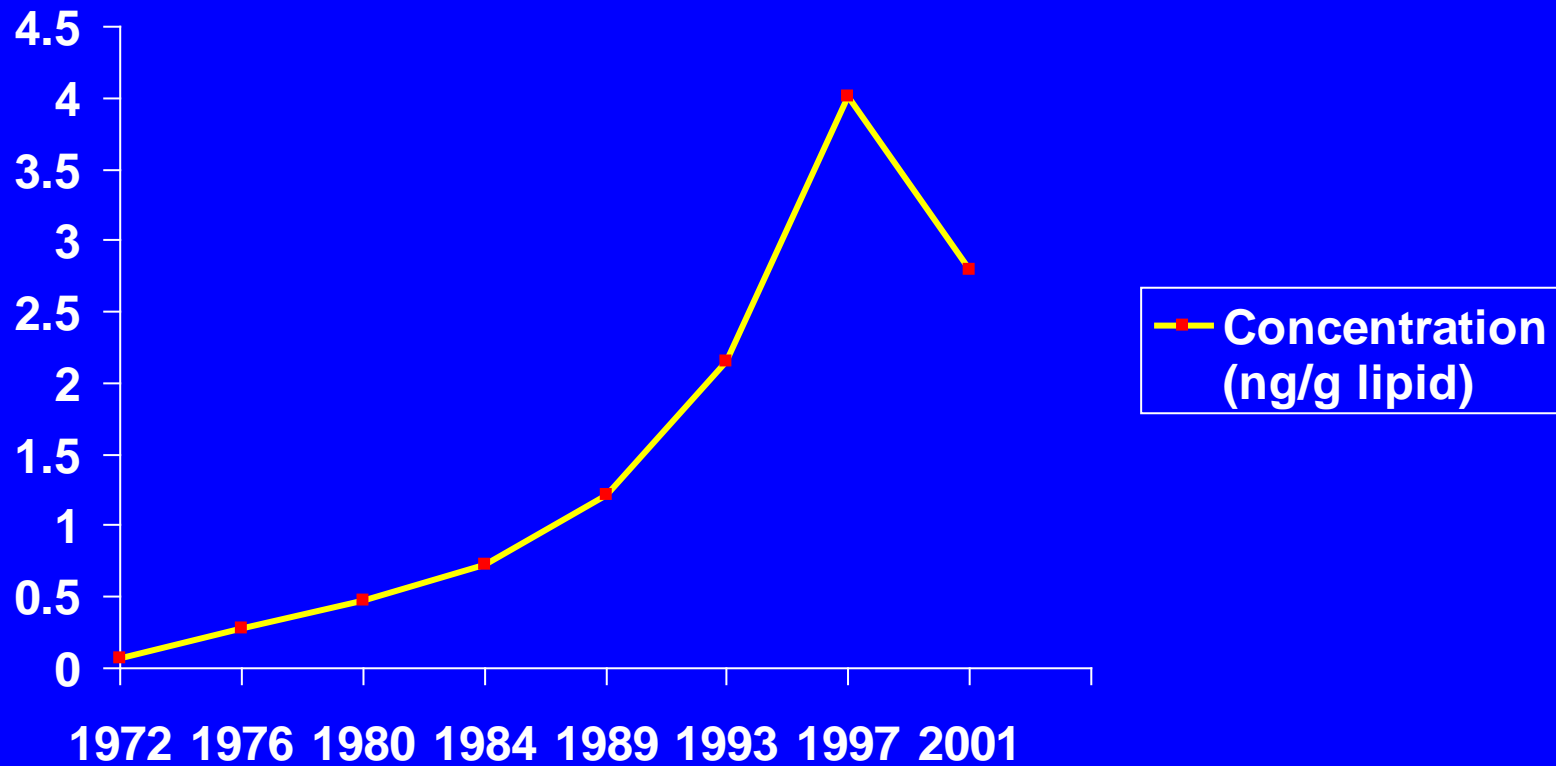
Specific PCB Congeners in Canadian Breastmilk, 1989-90



Polybrominated Diphenyl Ethers (PBDEs)

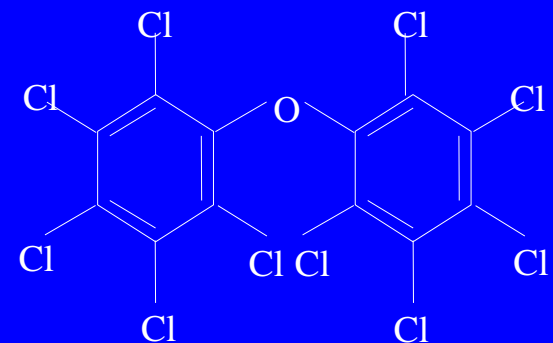
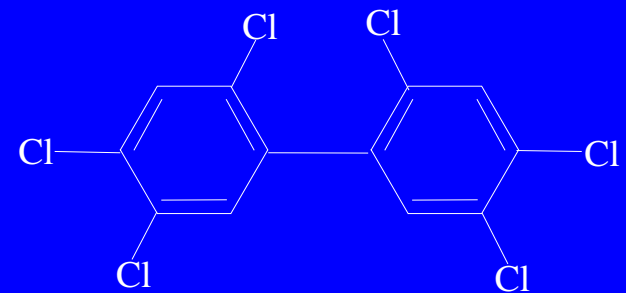
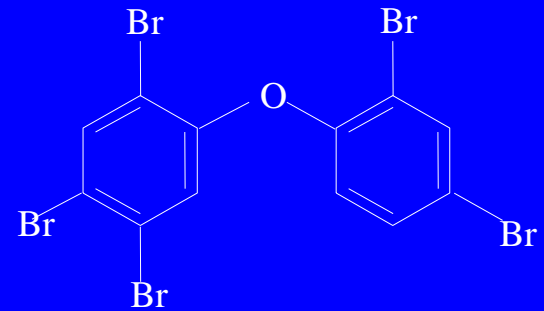
- **PBDE levels showed an exponential increase in human fat, blood, and milk levels over the period of 1972-1997**
 - **0.07ng/g to 4.02 ng/g in human milk, doubling about every 5 years**

Brominated Diphenylethers in Breastmilk Sweden

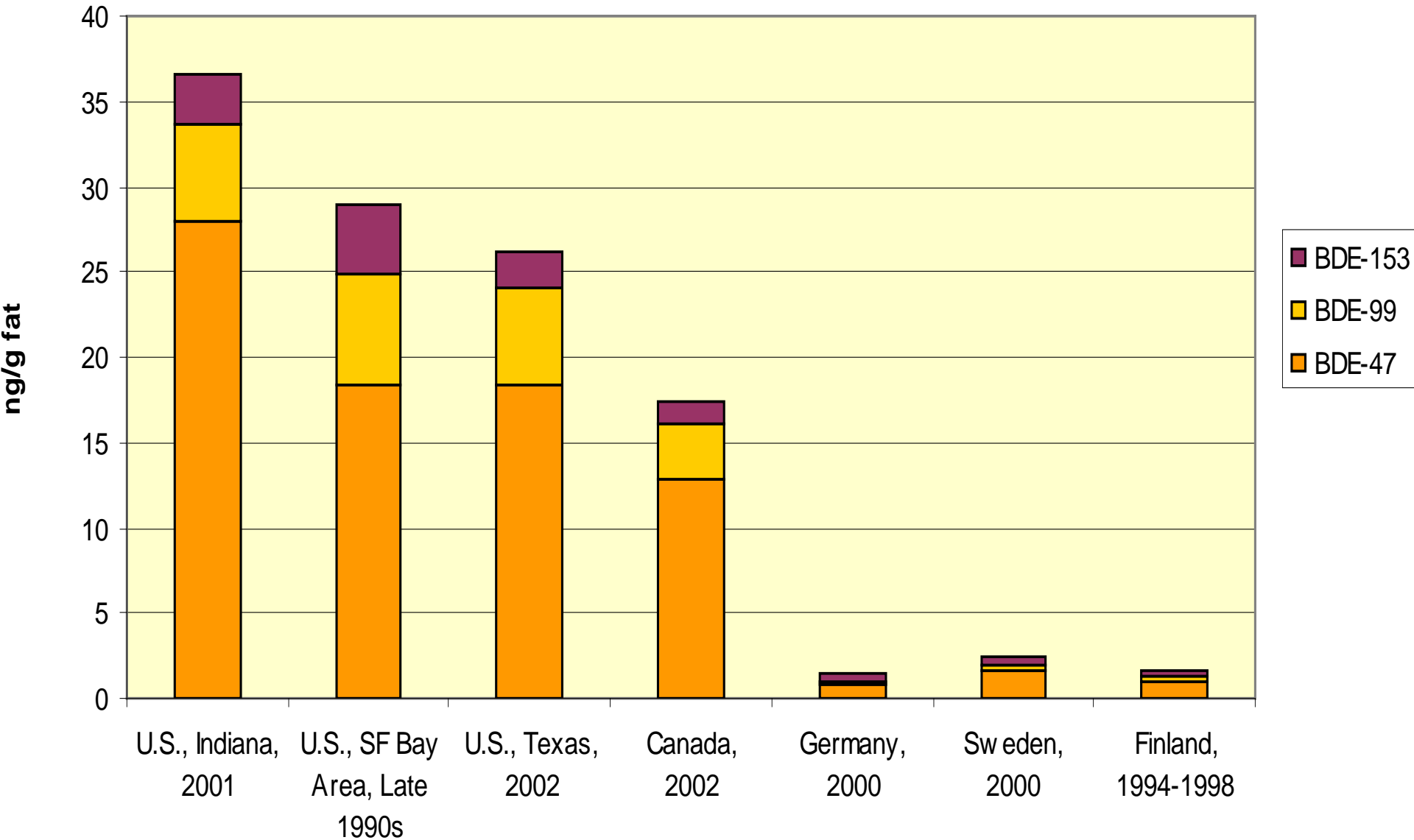


Polybrominated Diphenyl Ethers (PBDEs)

- Flame retardants used in polyurethane foam and plastic electronics casings;
- Structurally similar to PCBs and dioxins;
- Persistent, lipophilic, bioaccumulative;
- Interfere with thyroxin, neurodevelopmental toxicants in lab animals;
- Not yet tested for carcinogenicity.



Median Levels of 3 Abundant PBDE Congeners in North American and European Breast Milk, Blood, and Adipose Tissue



Chemicals Reported in Breast Milk: Metals

- Lead
- Mercury
- Cadmium
- Can be a problem in milk
- Higher in blood
- Worse prenatally

Neurotoxicity is the biggest problem



How About 2014 ?
Will the houses you are building today last one hundred years?

NEW YORK CITY has over a score of frame houses built before 1800. "Well built," you say. True, but well painted, too, and almost uniformly with

Dutch Boy White Lead

and Dutch Boy linseed oil. Such paint, tinted any color, is so fine that it sinks into every joint and wood pore. It is just elastic enough to prevent cracking, to keep the wood thoroughly covered and hence perfectly preserved.

Write for
PAINT FOLDER B
Tells how to mix materials for any surface or weather condition; how to choose back-sets and last-longest colors; how to estimate quantity of paint and probable cost.

NATIONAL LEAD COMPANY
NEW YORK BOSTON BUFFALO CHICAGO CINCINNATI
CLEVELAND ST. LOUIS SAN FRANCISCO
John T. Lewis & Bros. Co., Phila. Nat'l. Lead & Oil Co., Pittsburgh



Solvents

- Easily absorbed by inhalation, skin contact, drinking contaminated water
- Dissolve into fat
- Excreted within about 48 hours
- Do not persist in breast milk
- Acute and chronic neurotoxicity, hepatotoxicity, reproductive toxicity, some are carcinogens



Chemicals Reported in Breast Milk: Solvents

Benzene

Toluene

Xylene

Chloroform

Methylene chloride

Styrene

Perchloroethylene

Trichloroethylene

1,1,1-Trichloroethane

Phenol

Acetone

Found in:

- Glues
- Paints
- Strippers
- Degreasers
- Gasoline
- Dry cleaning solvents



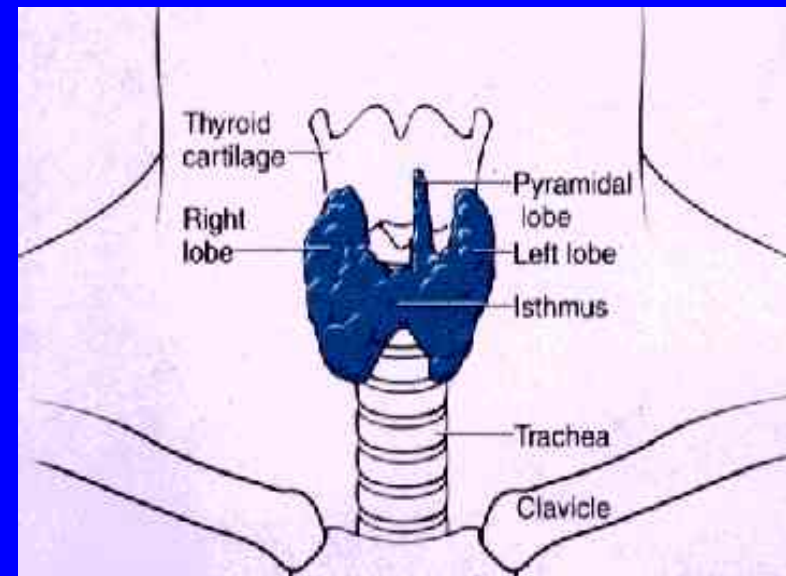
Chemicals Reported in Breast Milk: Perchlorate

- Used in rocket fuel, fireworks, road flares, explosives
- Contaminates hundreds of drinking water sources nationwide, primarily wells & the Colorado River
- Uptake into some crops from irrigation water
- Rapidly absorbed, rapidly excreted



What Perchlorate Does

- Inhibits iodide uptake into the thyroid gland
- Iodide is necessary for normal production of thyroxine (T4)
- T4 is necessary for normal development of the fetal brain



Challenge

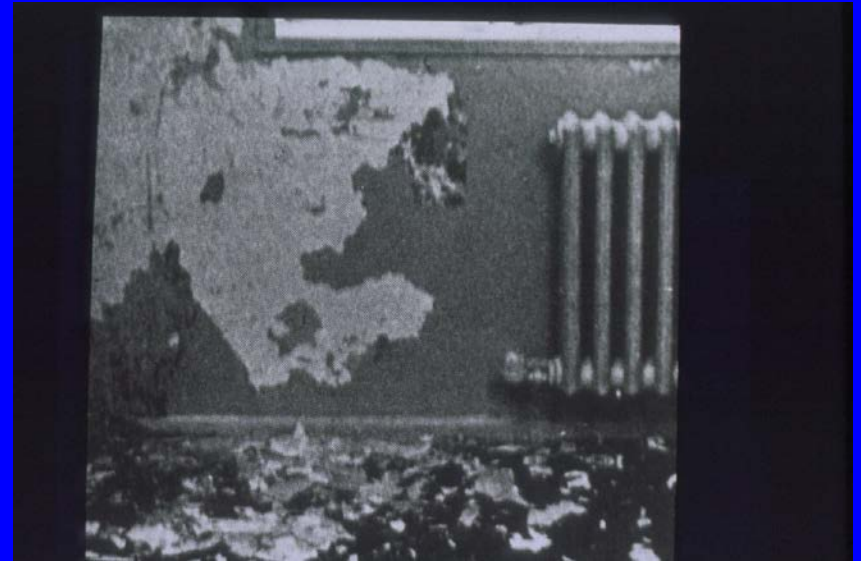
When does contaminant toxicity outweigh the clearly identified benefits of breastfeeding?

THERE ARE NO EVIDENCE BASED HEALTH STANDARDS

There are no established normal or abnormal values for clinical interpretation that are derived from toxicologic or epidemiologic studies; therefore, evidence-based guidance cannot be provided.

CASE #1: Lead Exposure

- 22 yo Mexican woman at 28 weeks gestation with BLL – 38 ug/dl. Repeat 1 wk later – 33 ug/dl
- Lead is mostly a transplacental problem
- If exposure ceases, levels will drop by birth, and be lower in breast milk
- Chelation of the mother?



Case #2: Laboratory Worker

- 26 year old woman exposed to solvents and breastfeeding 7 mo. old child
- Solvents are hepatotoxic, neurotoxic, and developmental toxicants
- Solvents move rapidly across skin and lungs into bloodstream and enter breast milk within minutes
- Are cleared from the body within about 24-48 hours
- Highest levels are in end-of-shift milk



Summary

- Breastfed infants do better than formula-fed in all studies
- No health based standards for guiding clinical decision making regarding breast milk contamination – case by case basis
- In general, promotion of breastfeeding with promotion of prevention/exposure reduction is appropriate



Prevention guidance for women who are pregnant, planning pregnancy, or are breastfeeding

Quit smoking or never start, keep others from smoking in your house/car

Avoid alcoholic beverages

Avoid use of pesticides in the home, garden or on pets

Avoid exposure to solvents, such as paints, non-water-based glues, furniture strippers, gasoline fumes, perfume and nail polish

Avoid dry cleaners and recently dry-cleaned clothes

Eat a balanced diet low in animal fats and high-fat dairy products.
Eat organically grown food if available.

Avoid fish that may have high mercury or PCB levels, such as swordfish, shark, tuna and locally caught fish

Resources

- NW PEHSU/Care Northwest
- www.nrdc.org/breastmilk

References

- Dorea JG. Maternal exposure to endocrine-active substances and breastfeeding. *Am J Perinatol.* 23(5):305-12, 2006.
- LaKind JS, et al. Environmental chemicals in human milk: a review of levels, infant exposures and health, and guidance for future research. *Toxicol Appl Pharmacol.* 198(2):184-208, 2004.
- Solomon GM, Weiss PM. Chemical contaminants in breast milk: time trends and regional variability. *Environ Health Perspect.* 110(6):A339-47, 2002.
- Landrigan PJ, et al. Chemical contaminants in breast milk and their impacts on children's health: an overview. *Environ Health Perspect.* 110(6):A313-5, 2002.