

Bob Herrick

herrick@hohp.harvard.edu

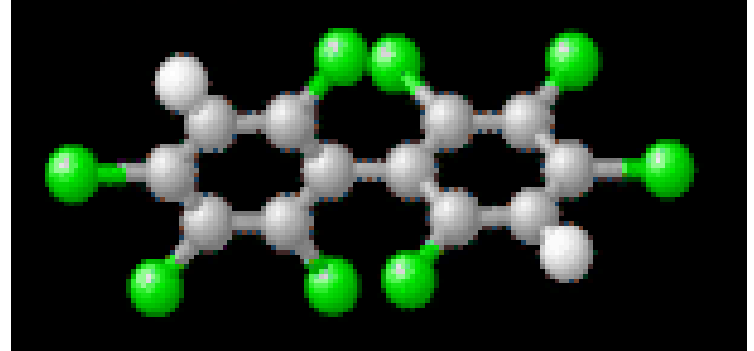
May 8 2012

Presentation Outline

A Story in Four Chapters

- PCBs are present in building materials and lights
- These sources can release PCBs to the environment
- People who live, work or go to school in these buildings can have elevated serum PCB levels
- The significance of this risk is...?

What are PCBs?



- Class of 209 synthetic organic chemicals- they do not naturally occur in the environment
- PCBs are either oily liquids or waxy solids and are colorless to light yellow and may exist as a vapor in air
- PCBs are among the most persistent non-natural chemicals - often residing in terrestrial and aquatic ecosystems, and the tissue of animals and humans for decades
- Manufactured in US for commercial use in 1929 - banned in 1977 by TSCA - as evidence of adverse environmental and potential harmful health effects accumulated

- The principal use of PCBs was in “closed systems”, such as electrical transformers, capacitors, and other equipment where the PCB was encased
- PCBs were also used in “open system” products, including building materials, such as the caulking used to seal joints between masonry units, and around windows.



Industry Use of PCBs (1929 – 1975)

PCB Use	Pounds (millions)	Percentage of Total
Capacitors	630	50.3%
Transformers	335	26.7%
Plasticizer uses	115	9.2%
Hydraulics and lubricants	80	6.4%
Carbonless copy paper	45	3.6%
Heat transfer fluids	20	1.6%
Petroleum additives	1	0.1%
Miscellaneous industrial uses	27	2.2%
TOTALS	1,253	100.0%





In the US, 24 buildings were sampled, and 13 contained caulking material with detectable levels of PCBs.

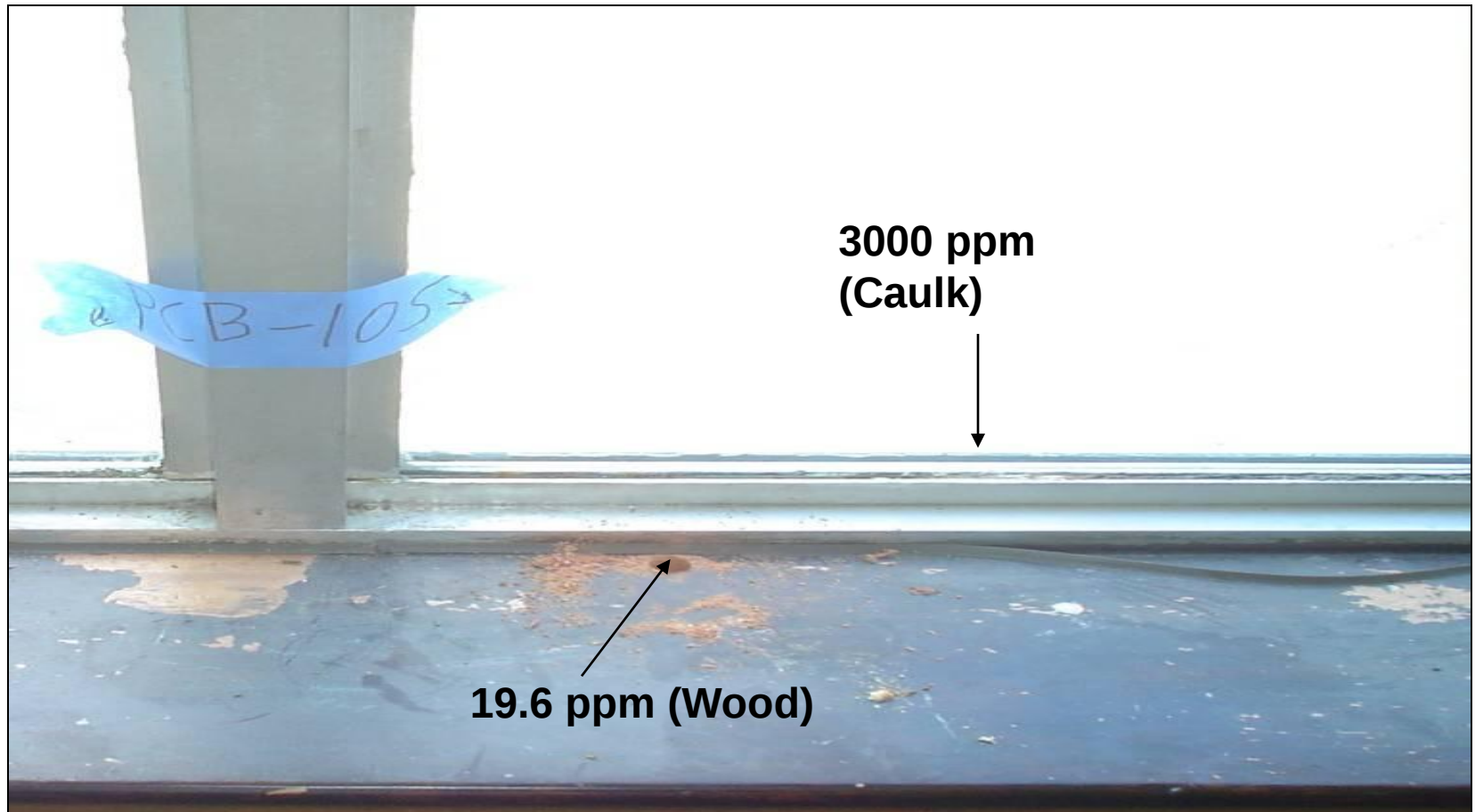
Of these 13, eight buildings contained caulking that exceeded the 50 ppm EPA criteria, in some cases by a factor of nearly 1000 (range 70.5-36,200 ppm; mean 15,645 ppm).

The buildings include schools, university buildings, and other public buildings.

PCBs in Building Materials – Boston Area

Building Type	Aroclor 1254 (ppm) in Caulking
Government office	35,600
Government office	25.2
University housing	36,200
University dorm	70.5
University classroom	26,400
Elementary school	7,740
Middle school	5,010
High School	5,970
Synagogue	8,240

PCBs in Caulking



Actual site data – Caulking and Wood samples

Tainted Soil to Be Removed Next to Westchester School

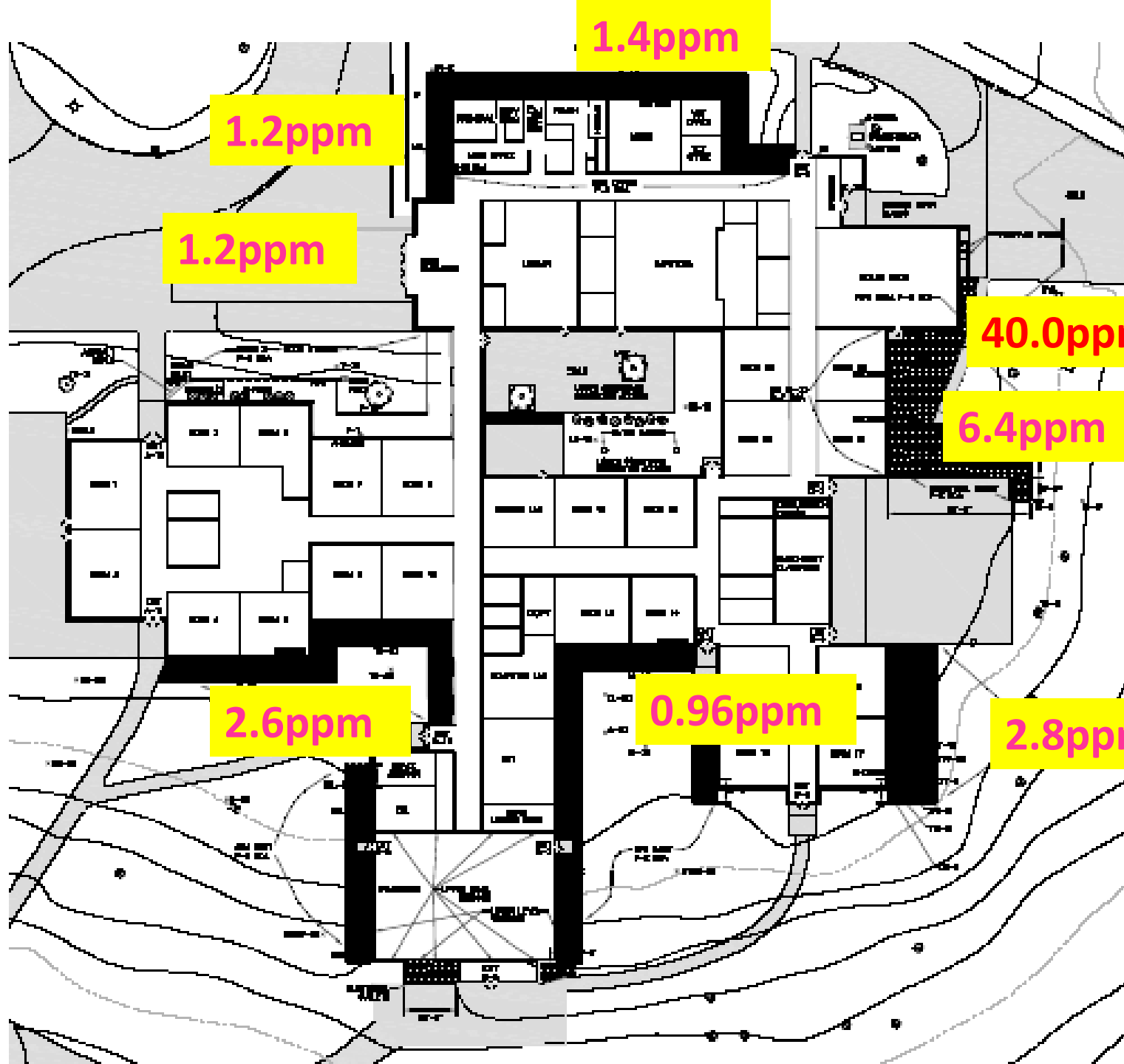
By [BARBARA WHITAKER](#) for The New York Times

Published: July 4, 2005

In what state health officials call the first cleanup of its kind in the state, a school district in Westchester County is planning to remove soil next to an elementary school in Yorktown Heights because the soil is contaminated by PCB's from caulking in the school's windows.

Dr. Daniel Lefkowitz requested tests on scraps of caulk left after maintenance at French Hill Elementary School, where his son, Evan, is a student. The tests found PCB's at 350 times above the federal limit.





PCB
Soil
Levels
Around
French
Hill
School



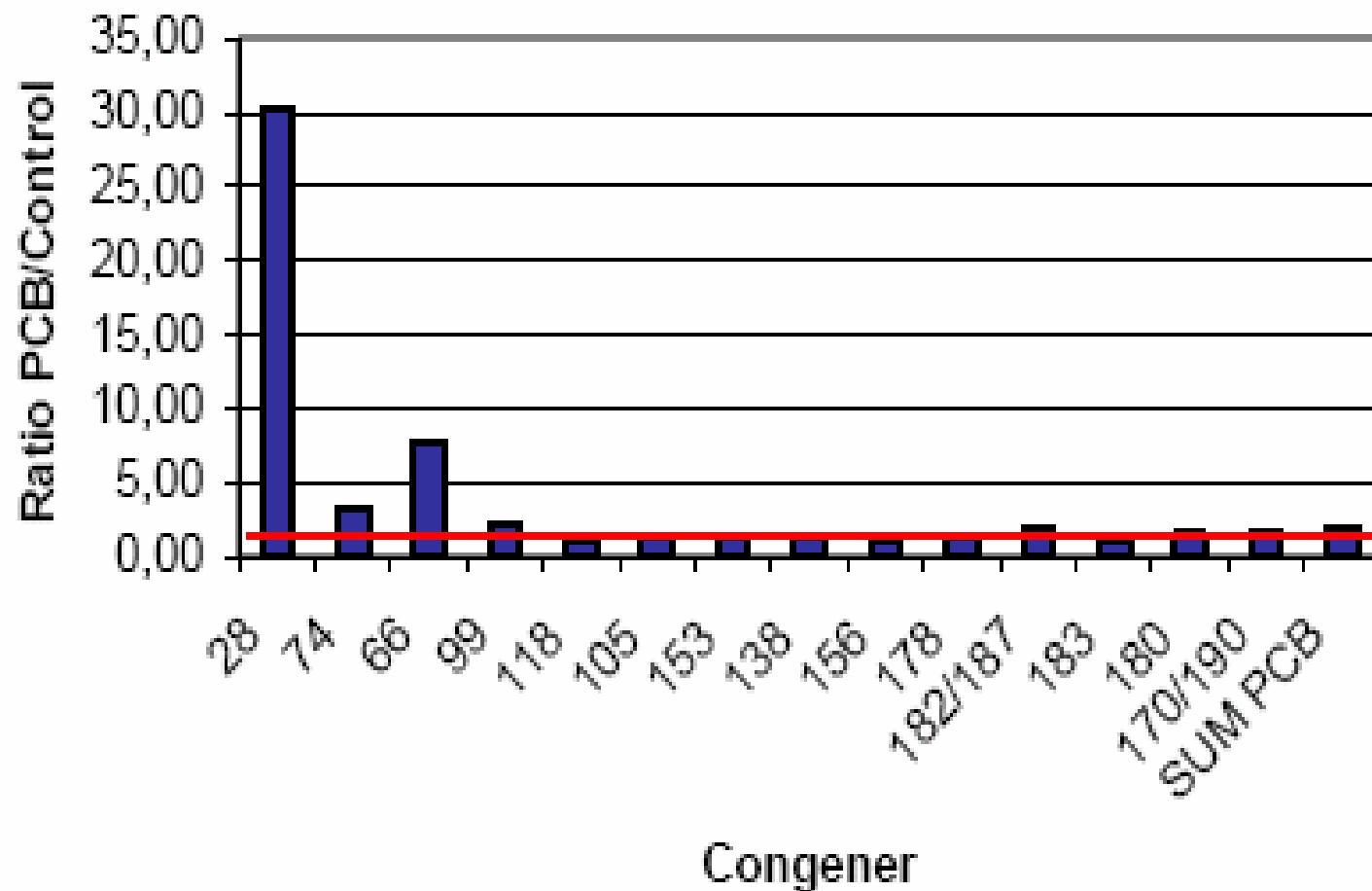
School officials have fenced off parts of the school outside near many of its windows and are seeking bids from contractors to clean up the contaminated soil. They hope the work can be completed by the time the children return in September.

Presentation Outline

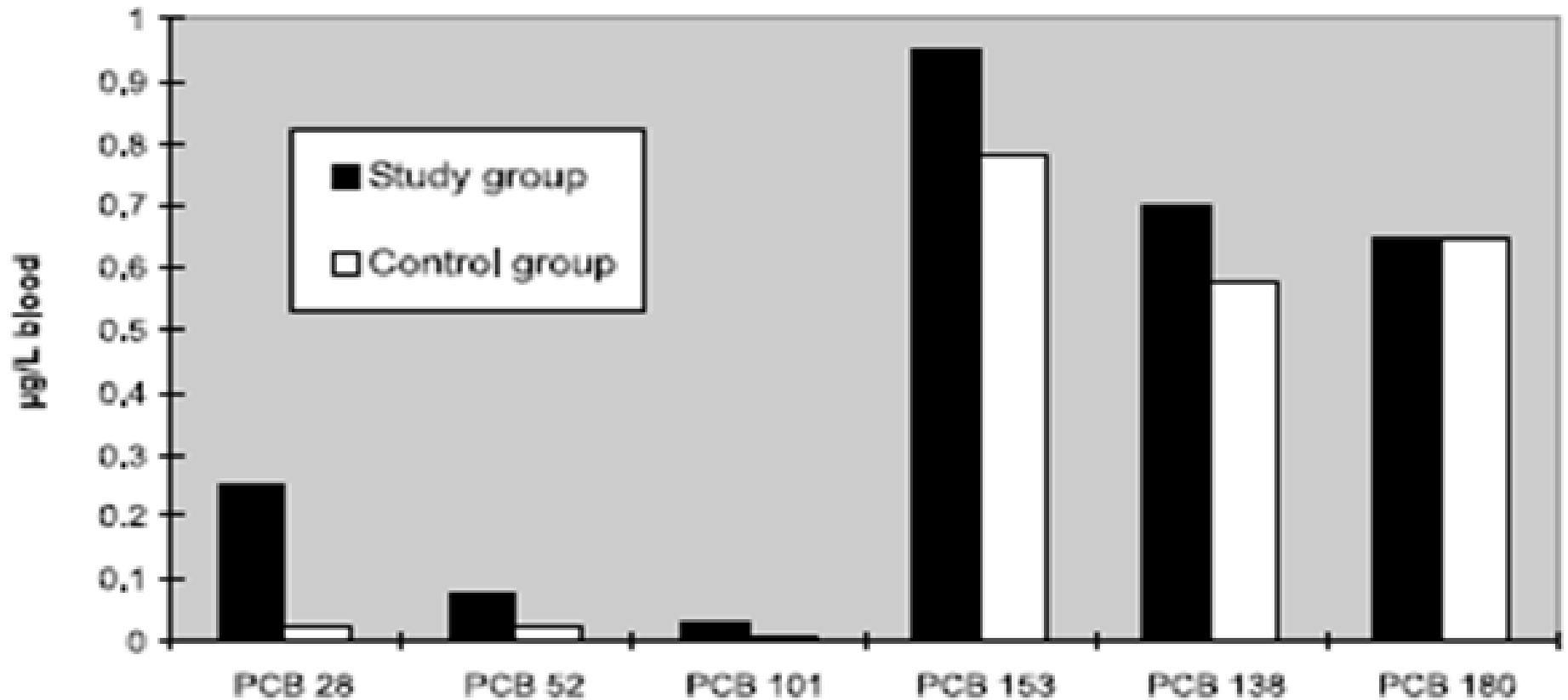
A Story in Four Chapters

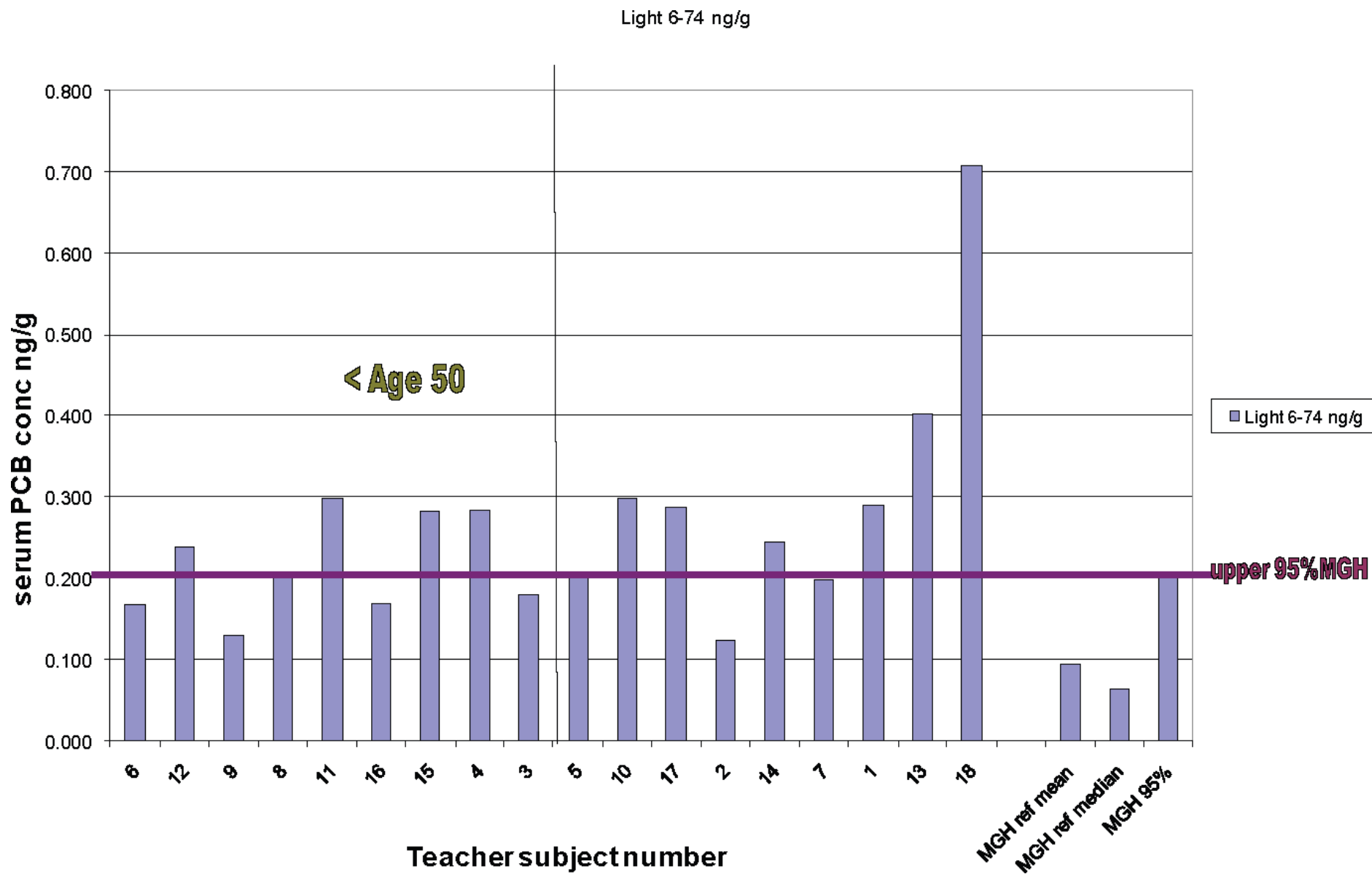
- PCBs are present in building materials and lights
- These sources can release PCBs to the environment
- People who live, work or go to school in these buildings can have elevated serum PCB levels
- The significance of this risk is...?

Elevated levels of different PCB congeners found in blood from individuals living in houses where PCB containing sealant was used



Comparing PCB blood levels between teachers in PCB vs control schools



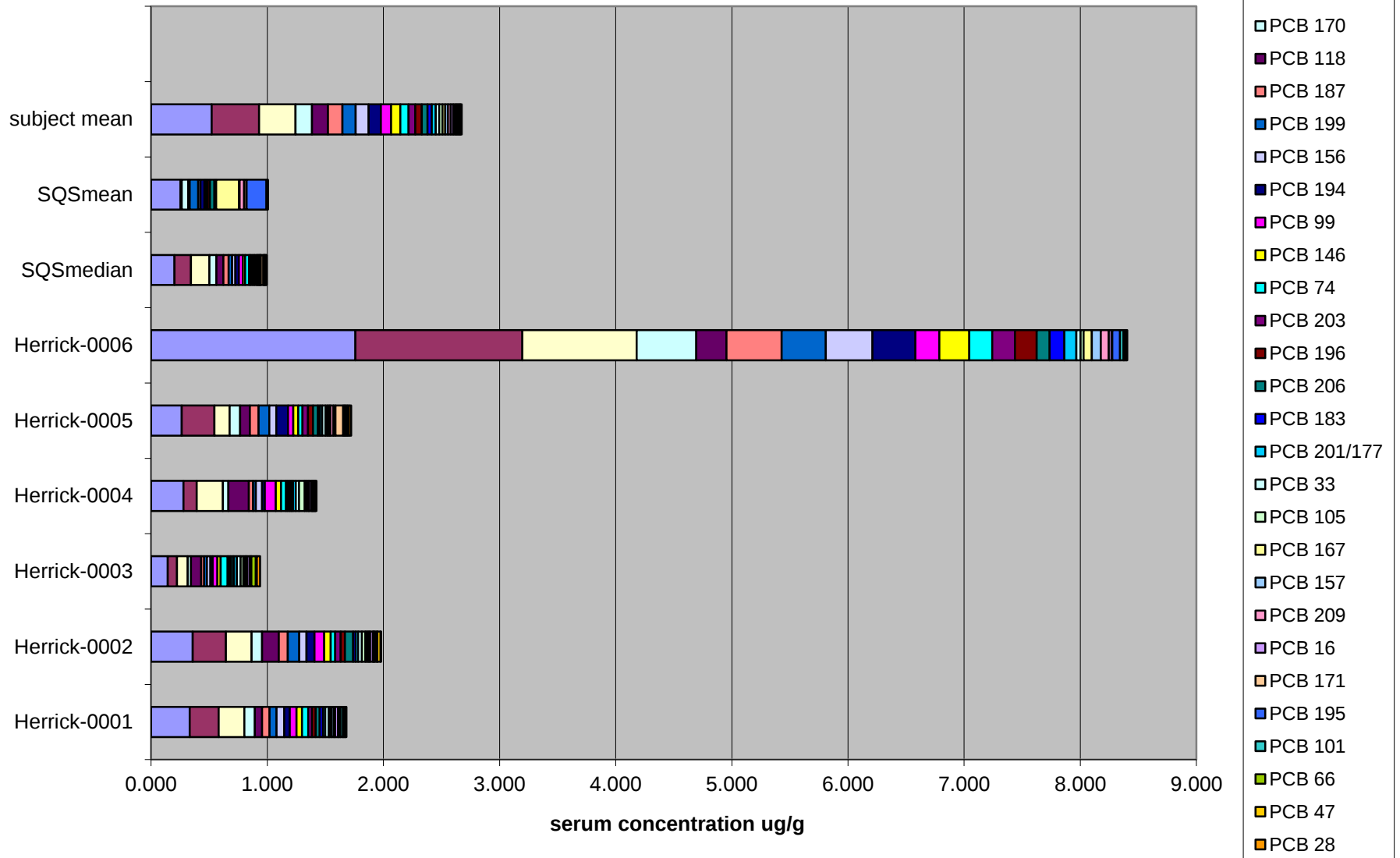


Exposure of Workers

Grinding of old
seam exposes
workers to
high
concentrations
of PCB
containing
dust



PCB Principal Components by subject (congeners >0.01ug/g)

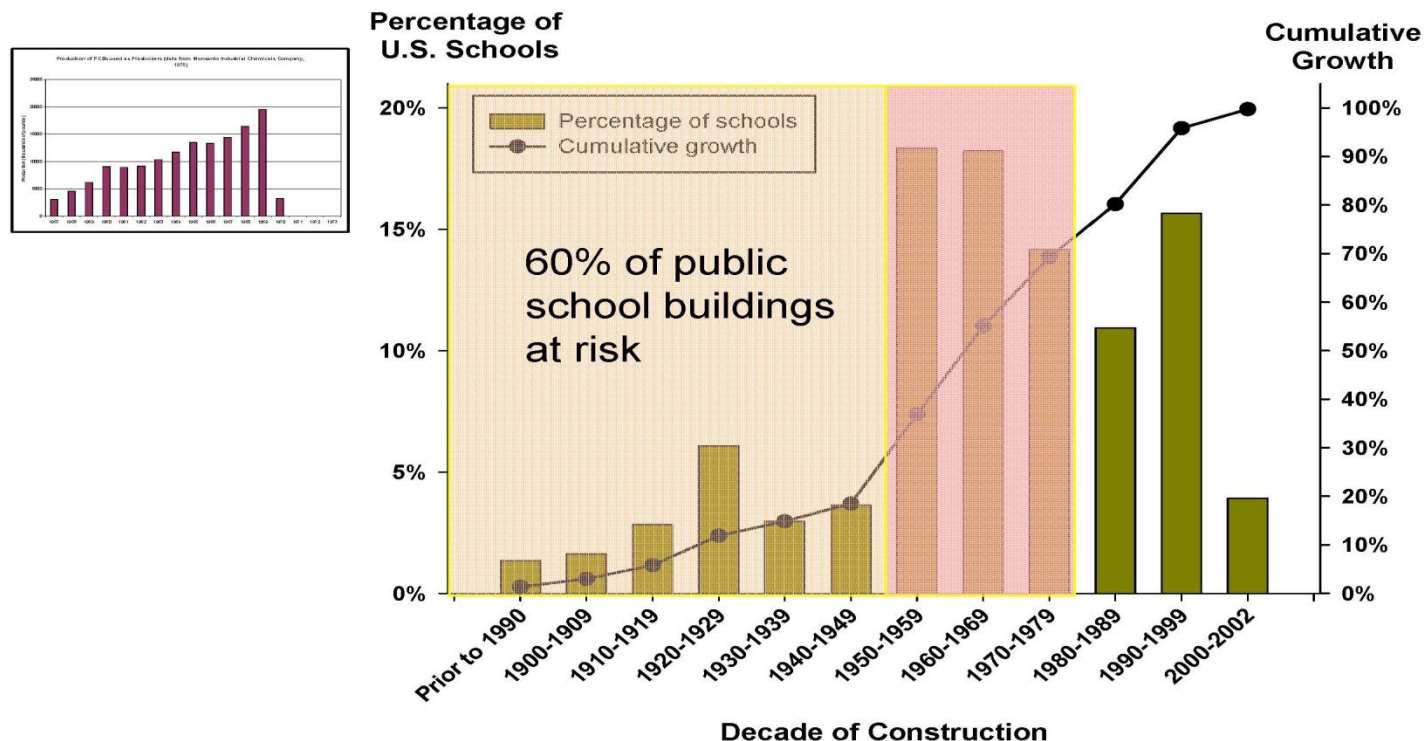


Presentation Outline

A Story in Four Chapters

- PCBs are present in building materials and lights
- These sources can release PCBs to the environment
- People who live, work or go to school in these buildings can have elevated serum PCBs
- The significance of this risk is...?

Potential Extent of PCB-Caulk in Public Schools



Source: EH&E survey of indoor air quality programs in U.S. schools; Moglia et al. 2006, *Environmental Health Perspectives*, 114(1):141-146.

Source: John F. McCarthy, President, EH&E,
EPA briefing, 21 October 2009

Health Effects

- Clear evidence that PCBs cause cancer in animals, and they are considered probable human carcinogens. (USEPA, 1996).
- PCBs have significant toxic effects on the immune system, the reproductive system, the nervous system and the endocrine system.
- EPA concluded in animal studies there was no lower level of PCB exposure that did not disrupt the immune system

Routes of Exposure

- Inhalation
- Ingestion
- Dermal
- Half-life in humans ranges from about 1 week to 25 years, depending upon the specific PCB congener

East Blue Lake Rainbow Trout



PUBLIC HEALTH ADVISORY



**Do Not Eat
BASS, CATFISH OR CRAPPIE
FROM THESE WATERS.**

Do not eat
Bass and
Catfish in area
between
Riverside and
Logan Martin
Dam.

Do not eat
Crappie in area
between
Choccolocco
Creek and
Clear Creek.

For further information call the
Alabama Department of Public Health
1-800-201-8208.

Vulnerable Populations

- ATSDR (2000) concluded younger children may be particularly vulnerable to PCBs
- Compared to adults, children are growing more rapidly and generally have lower and distinct profiles of biotransformation enzymes
- Children also have much smaller fat depots for sequestering PCBs.

Approx 400 publications in PubMed since Jan 1 2012

Polychlorinated biphenyls and their different level metabolites as inhibitors of glutathione S-transferase isoenzymes.

Current Status of the Epidemiologic Evidence Linking Polychlorinated Biphenyls and Non-Hodgkin Lymphoma, and the Role of Immune Dysregulation.

PCB 95 Modulates Calcium-Dependent Signaling Pathway Responsible for Activity-Dependent Dendritic Growth.

Application of Neurochemical Markers for Assessing Health Effects after Developmental Methylmercury and PCB Coexposure

Effects of polychlorinated biphenyls on the development of neuronal cells in growth period; structure-activity relationship.

Alteration of serotonin system by polychlorinated biphenyls exposure.

Glutathione transferase polymorphisms and risk of endometriosis associated with polychlorinated biphenyls exposure in Italian women: a gene-environment interaction.

Mitigation of building-related polychlorinated biphenyls in indoor air of a school.

Macintosh DL, Minegishi T, Fragala MA, Allen JG, Coghlan KM, Stewart JH, McCarthy JF. Environ Health. **2012** Apr 10;11(1):24. [Epub ahead of print

CONCLUSIONS:

Increasing outdoor air ventilation, encapsulating caulk, and constructing a physical barrier over the encapsulated material were shown to be effective at reducing exposure concentrations of PCBs in indoor air of a school and also preventing direct contact with PCB caulk

