PDHonline Course C639 (6 PDH)

PCBs in Building Materials – Into the Limelight

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PCBs in Building Materials

Into the Spot Light….

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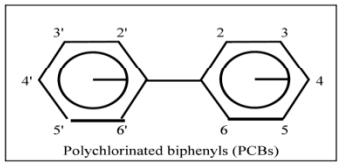
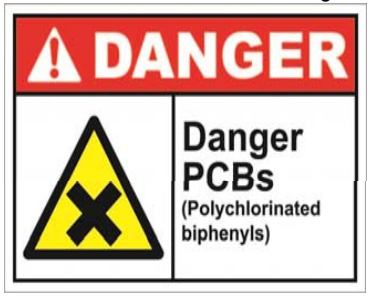
PCB History - What are they?

- A class of manufactured organic compounds consisting of:
  - Two benzene rings (biphenyl)
  - Various # of chlorine atoms that can attach at up to 10 locations
- Each unique configuration is a separate congener
- There are 209 PCB congeners
- Homologues are groups of individual PCB congeners having the same "number" of chlorines
  - Since there are 10 available chlorine positions, there are 10 homologues
  - Aroclor is a trade name of Monsanto products, each made up using a specific "recipe" of PCB congeners
  - Aroclor name (with the exception of 1016) refers to number of carbons on the biphenyl skeleton (12) and % of chlorine mass in the mixture (e.g., Aroclor 1260 contains 60% chlorine by mass)



Polychlorinated biphenyls (PCBs)

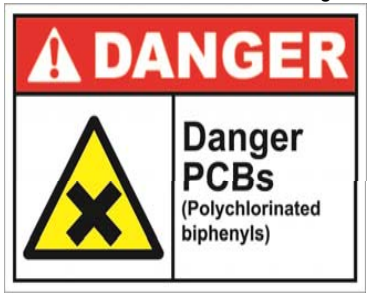


PCB History

- PCBs first synthesized 1881
- PCBs were first manufactured commercially by the Anniston Ordinance Company, in Anniston, Alabama
- Anniston Ordinance changed its name to the Swann Chemical Company in 1930
- Monsanto Chemical Company bought Swan Chemical Company in 1935
- Monsanto was the US producer under the trade name "Aroclor"
- They have a range of toxicity and vary in consistency from thin, light-colored liquids to yellow or black waxy solids
- They have no smell or taste. Because they do not easily burn and are good insulators, PCBs have been used widely as coolants and lubricants.

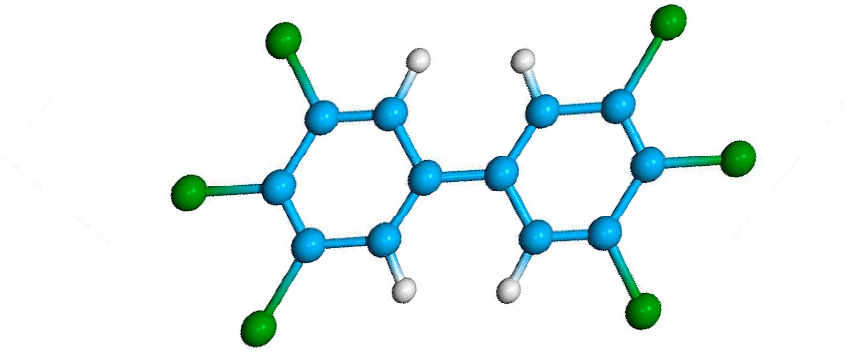
PCB History

- Numerous studies on PCB toxicity dating back to the 1930s.
  - Causes chloroacne
  - Found to cause cancer in lab rodents in 1970's, classified as "probable" human carcinogens
  - PCBs are also endocrine disruptors based on rodent studies
- No major environmental laws prior to 1970s
  - Significant historical dumping of PCBs and PCB containing oils
  - EPA considers PCBs to be persistent, bioaccumulative and toxic (PBT) pollutants that have been targeted by them



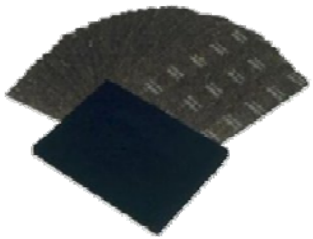
PCB History

- Their manufacture was banned in 1979, and all uses were banned except "totally enclosed" (i.e. PCBs used for dielectric fluid in existing transformers/capacitors)
- Although no longer commercially produced in the United States, PCBs may be present in non-liquid products and materials produced before the 1979 PCB ban.

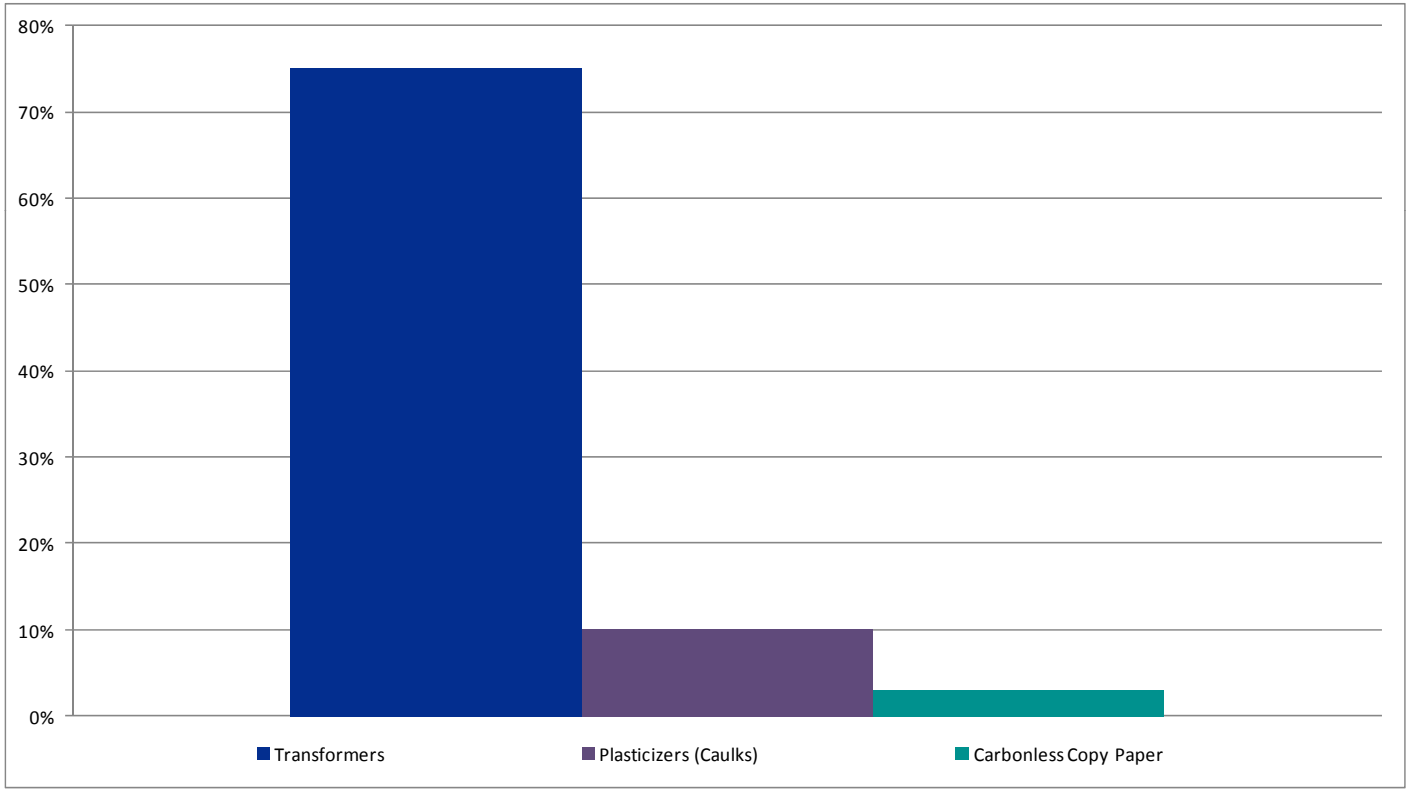


Historical PCB Uses

- Historical products that may contain PCBs include:
  - Cable insulation
  - Thermal insulation material including fiberglass, felt, foam, and cork
  - Caulks and Glazings
  - Adhesives and tapes
  - Oil-based paint
  - Plastics
  - Carbonless copy paper
  - Floor finishes



PCB Use, Prior to 1979

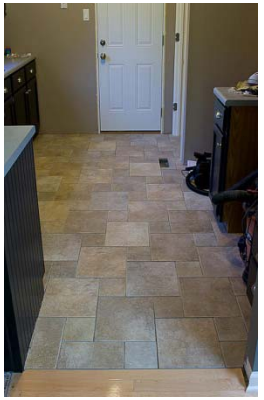


EHS Issues Related to PCBs in Building Materials

- The use of PCBs in non-liquid manufactured building products at >/= 50 ppm is prohibited under TSCA.
- States may have specific requirements that go beyond Federal EPA (e.g., in CT, the use of PCBs in non-liquid building products at > 1 ppm is prohibited).
- The use of PCBs in caulks/glazings (and other products) was in the commercial realm for buildings built between 1950 and 1978.
- Older buildings that were renovated between 1950 and 1978 might also have PCBs in caulks/glazings.

EHS Issues Related to PCBs in Building Materials

- When PCBs are present in caulks/glazings, the levels of PCBs varies considerably, with high end levels in the % range (EPA states 100,000 ppm or higher…one lab reported a high of 28%)
- The PCBs in the caulk migrate to surrounding materials (air, soil, masonry and wood)
- Typical renovation procedures can increase exposures to workers and building residents, including children. Worker exposure can also be an issue for demolition activities.



EHS Issues Related to PCBs in Building Materials

- Example #1
  - UMASS Amherst MA, 2007 to 2012
- In 2007 routine tests that accompanied a $4.2 million waterproofing project at the Lederle Graduate Research Center found PCBs.
- PCBs discovered in the caulking surrounding the concrete slabs encasing Tower A of the Lederle complex. PCBs were found at 133,000 to 723,000 ppm in the sealant on the Lederle building, and in the soil around the building at 1 to 42 ppm
- EPA approved a $2 million cleanup project that will decontaminate the building's outdoor caulking, replace contaminated carpeting in the building's library and remove PCBs that have seeped into the asphalt and soil below the tower. UMASS spent $4 million.
- Adding salt to wound…in same building UMASS found 900 windows needing replacing in 2009 due to PCBs in window glazing. Settlement with EPA reached in September 2012. Estimated cost $3,000,000 + EPA penalties

EHS Issues Related to PCBs in Building Materials

- Example #2
  - Chaffe Social Science Center URI - 2011
- URI's largest campus building
- PCB-contaminated air
- Source linked to window caulking and gaskets
- Sections of the building closed up to 2 years
- Estimated $3.8 million cleanup cost
  - Replacing 220 windows
- URI offered medical testing to all Chafee employees (back to construction in 1972)
  - Approximately 300 people total

EHS Issues Related to PCBs in Building Materials

- Example #3
  - Kennedy and DePaolo middle schools in Southington, CT
- In 2011, an initial PCB screening was performed at DePaolo to assist in planning for the $85 million renovations project at the two schools.
- Levels of PCBs were found in both schools. PCBs at Kennedy Middle School were well above 50 mg/kg, particularly within the calking used in areas such as windows, along the wooden portions of the floors and within the walls.
- Remediation costs in millions. School budgeted $1.2 million. November figures $6 to 14 million.

PCB Concentrations in Indoor Air

- **Lederle Graduate Research Center, U-Mass Amherst** – 220 to 640 ng/m3 (2006)
- **Estabrook School, Lexington, MA** – 300 to 1,800 ng/m3 (July 2010)
- **Burke School, Peabody, MA** - 260 to 740 ng/m3 (October 2011)
- **Public buildings in Germany** - 720 to 4,200 ng/m3 (Kohler *et al. 2002)*

Public Health Levels of PCBs in School Indoor Air (ng/m3)

Assuming a background scenario of no significant PCB contamination in building materials and average exposure from other sources, these concentrations should keep total exposure below the reference dose of 20 ng PCB/kg-day.

Age 1-<2 yr	Age 2-<3 yr	Age 3-<6 yr	Age 6-<12 yr Elementary School	Age 12-<15 yr Middle School	Age 15-<19 yr High School	Age 19+ yr Adult
70	70	100	300	450	600	450

Regulations

- Removal / disposal of PCB caulking or other PCB bulk product waste, and subsequent consideration of remaining PCB remediation waste, typically performed under:
  - 40 CFR §761.62 – PCB bulk product waste

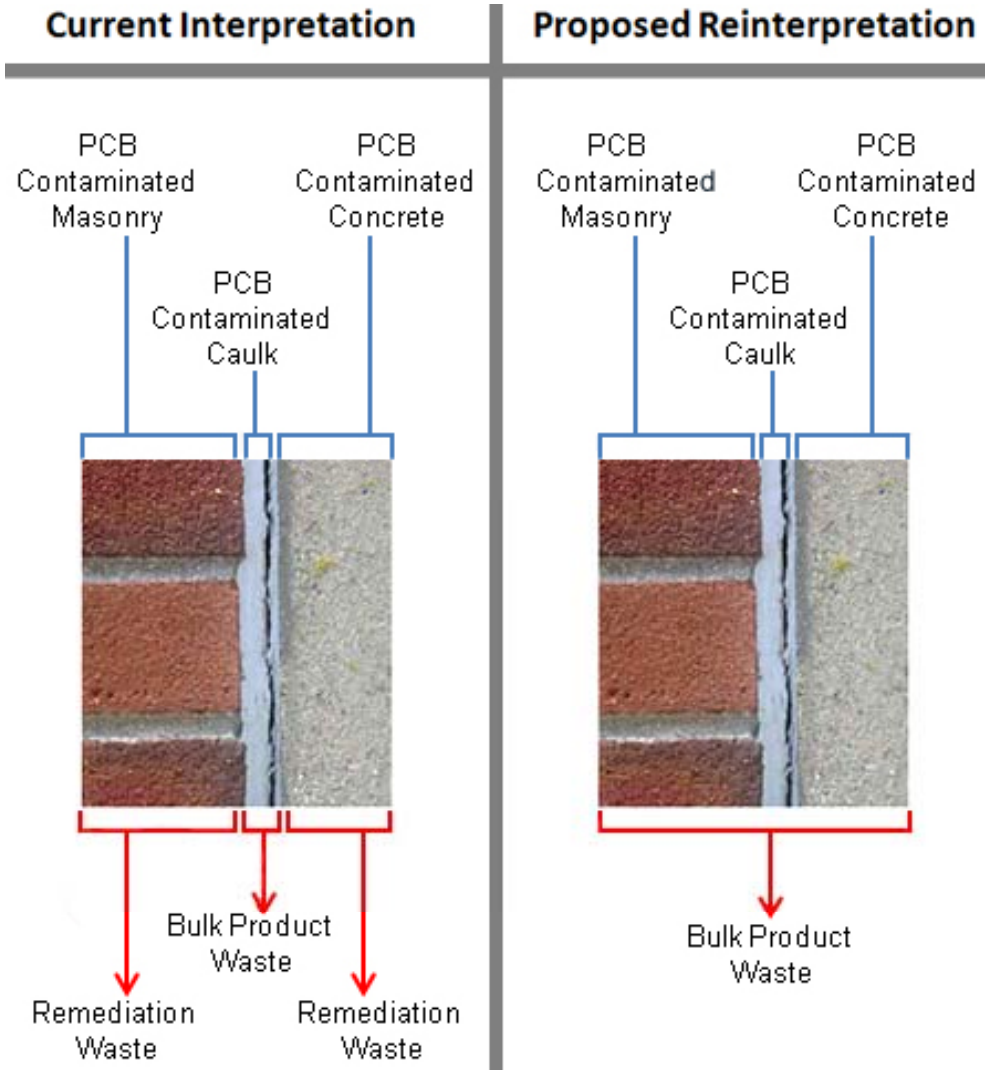
    Examples- caulk, glazing, etc. that contains PCBs at >50 ppm
  - 40 CFR §761.61(a) or (c) – PCB remediation waste

    Examples- adjacent materials into which PCBs have leached and are present at >1 ppm; includes concrete, brick, etc., but also soils

- State Regulations may have specific requirement

Recent Changes to Regulations

- In February 2012, EPA solicited comment on a draft reinterpretation of its position regarding the status of PCB-contaminated building materials under the definition of PCB bulk product waste. In association with the proposed reinterpretation, EPA identified several guidance documents that would be changed to reflect this reinterpretation.
- EPA recently issues their reinterpretation on Oct 24, 2012
- Allows for certain contaminated building materials (i.e. contaminated substrates) to be managed and disposed of as PCB bulk product waste if removal is at the same time as the original source PCB bulk product waste (i.e. caulk or glazing)
- Why is this important?
    - Complexity
    - Cost



Source: US EPA website at http// www.epa.gov/osw/hazard/tsd/pcbs/pubs/caulk/reinterpret.htm

Recent Changes to Regulations

- PCB Leachability Testing (TCLP)
- TCLP Results <10 ug/L results in exemption from Subparts C, J, & K of the PCB Regs [40 CFR §762.62(b)(6)]
- 15-day written notice to disposal facility
- Maintain written records for 3 years

Enforcement

- PCBs are highly regulated under TSCA
  - EPA Region I (New England) very active
  - Activity starting to spread to other regions

- Push into the commercial realm
  - State or Federal funding
  - Brownfield initiative
  - Other

To Test or Not To Test

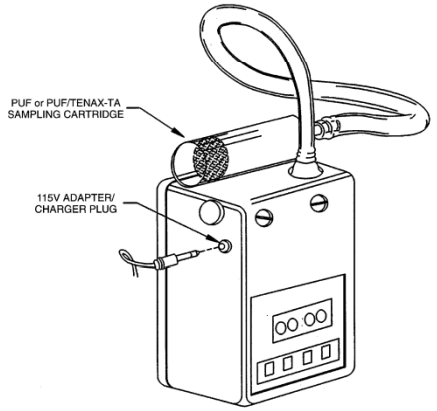
- Testing of caulk/glazing, etc. is not a State or Federal Requirement
- Why Test?

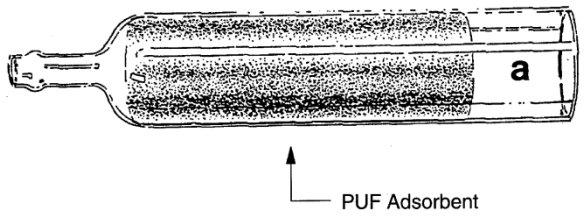
If You are Going to Test

- Tests to determine the concentration of the PCBs:
  - EPA Method 8082 - Organochlorine Pesticides and PCBs
    - The most common analytical method used for the analysis of PCB Aroclors and a short list of PCB congeners in samples of solids, sediments, tissues and liquids.
  - Samples must undergo extraction
    - Four extraction methods commonly used for processing caulk.
    - Soxhlet, sonication, accelerated solvent extraction (ASE) and polytron homogenization.
    - All extractions use 1:1 Hexane/Acetone.
    - Soxhlet takes 16-18 hours (Methods 3540C, 3541)
    - an alternative method validated under subpart Q, for chemical extraction of PCBs.
  - Several cleanup methods were also employed on the sample extracts including: sulfuric acid wash, Florisil slurry, Florisil chromatography columns, and ultrasonication.
  - EPA Method 680 Modified (Homologues)
  - EPA Method 1668a (Congeners)

If You are Going to Test

- Indoor Air Analysis
  - Method TO-10 low- vol
  - Method TO-4 high-vol
    - PUF cartridges
    - Homologs or congeners recommended





Sampling

- Bulk Samples include such materials as caulk, soil, and sand
  - Bulk solid sampling typically include removing a small portion of the potentially contaminated material for analytical testing
- Porous Samples
  - Core samples should be collected on a bulk basis (i.e., mg/kg) to collect the top 0.5 to 2 cm of the porous surface.
  - Chisels, drills, and saws can be used to collect the sample
- Consult with your analytical laboratory on the sample volume needed
- Non-Porous Samples
  - A standard wipe test, as specified in 40 CFR 761.123, uses a 10 cm by 10 cm template to outline the sample area and a gauze pad or glass wool that has been saturated with hexane to collect the sample.
- Indoor Air

Example of PCB Caulk

Removal

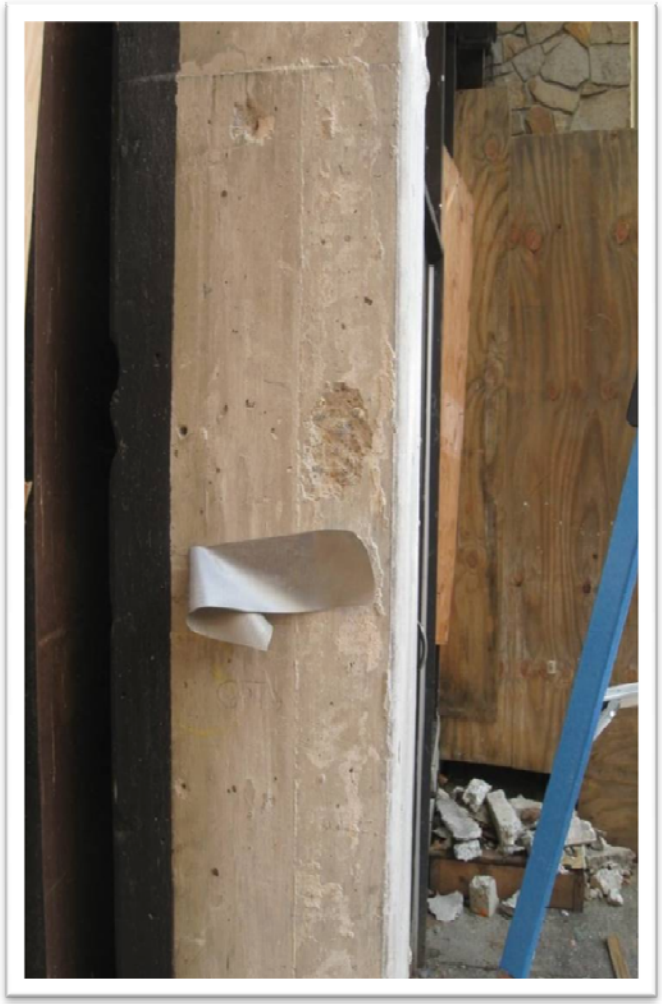
- No use authorization for PCBs in non-liquid manufactured products ≥50 ppm; they must be removed when identified (40 CFR § 761.62)
- Types of removal Processes
  - Caulk removal
  - Strip out
  - Paint removal
  - Abrasives
  - Chemicals
  - Hydroblast

Removal

- Ranges from $20 to $400 per foot of caulk removed (prior to recent reinterpretation)
- Glazing can be less costly if the windows are metal framed and they can be removed intact
- Other contaminants (lead, asbestos) can significantly affect removal and disposal costs

Example of PCB Caulk Abatement

Close-up of Confirmation Sample



Example of PCB Glazing Abatement

Adjacent Surfaces *PCB Remediation Waste*

- Options
  - Grind/cut out areas of contamination beyond “source material”
  - Encapsulate porous surfaces
  - Clean non-porous
- A substrate material contaminated from a >50 ppm PCB source (such as caulk), containing >1 ppm PCBs, is a PCB Remediation Waste. PCB Remediation waste can be disposed as a non-TSCA waste at a facility but the disposal facility may have additional sampling requirements.

Adjacent Surfaces *PCB Remediation Waste*

- PCB Remediation Waste («50 ppm) may be left in place if properly encapsulated. However, this will require an O&M Plan, on-going inspections and air monitoring, and may be a deed restriction.

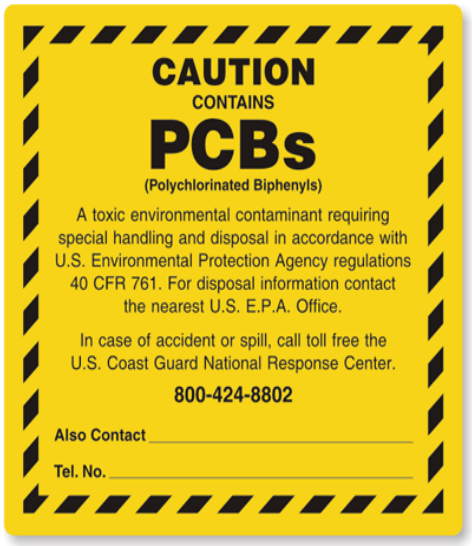
- Notice of sale, lease, or transfer of property may need to be conveyed to EPA prior to transaction

Uncertainties

- PCB in Building Materials illegal, but:
  - No stated duty to test.
  - No stated duty to report.
  - No stated duty to remove or mitigate.
  - Since illegal, current regulations provide no framework for in-place management of PCBs in building materials.
  - EPA enforcement varies from region to region.

Potential Risks

- Enforcement?
- Illegal disposal, future liabilities?
- Contractual violations?
- Occupant injury concerns or claims?
- OSHA violations?
- Impaired property values?
- Cross-contamination from accidental disturbance?
- Risks sometimes lead to self-reporting and remediation?



QUESTIONS?

Thank You

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