Potential health risk from inhaled PCBs and Radon in US schools

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Protecting kids from dangers in the air

How a Legislator can look at science that may have policy importance
Two issues

• University of Iowa College of Public Health
  – Environmental Health Sciences Research Center
    • Radon in the Midwestern states
    • Probable cancer causing agent
  – Superfund Basic Research Center
    • PCBs in hazardous waste sites and environment
    • Airborne PCBs is our specialty
    • Probable cancer causing agent(s)
  – Both Centers funded by NIH
History of PCB use in U.S.

- Manufactured from 1929 to 1977
- Peak production in 1970 (85,000,000 lbs)

**Uses:**
- Dielectric fluid in transformers
- Oil used in motors and hydraulic systems
- Electrical devices/appliances containing PCB capacitors
- Fluorescent light ballast capacitors**
- Adhesives and tapes
- Oil-based paints
- Plasticizer in caulk and window glazing**
- Carbonless copy paper
- Floor finish
- Ceiling tiles*
- Microscope oil

*Has been found in school buildings

**Commonly found in school buildings built 1950s – 1970s
Characterizing PCB Sources

<table>
<thead>
<tr>
<th>Primary Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Products manufactured containing PCBs</td>
</tr>
<tr>
<td>➢ Caulk, window glaze, light ballasts, ceiling tiles, others</td>
</tr>
<tr>
<td>➢ Often high concentration, low surface area</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Secondary Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>➢ Materials in schools that have absorbed PCBs over time</td>
</tr>
<tr>
<td>➢ Paints, tiles, foams, finishes, masonry, wood, carpet, others</td>
</tr>
<tr>
<td>➢ Often low concentration, high surface area</td>
</tr>
<tr>
<td>➢ Not well characterized</td>
</tr>
</tbody>
</table>
Exposure assessment in schools

- Populations
  - Students
  - Teachers/staff
  - Custodial worker

- Exposure routes
  - Oral (e.g., food)
  - Inhalation (e.g., indoor air)
  - Dermal (e.g., contact with dirt and dust)

- Exposure Scenarios (Students)
  - Assumptions
    - Body weight
    - Inhalation rate
    - Fraction of time spent in school
    - Total daily dust and soil ingestion
    - Dermal exposure to indoor dust
    - Relative absorption factors
  - Background exposures
    - Dust and soil ingestion
    - Indoor (non-school) and outdoor air inhalation
    - Dermal exposure to indoor dust
    - Dietary background (U.S. FDA Market Basket Study 1997)
Characterizing PCB Sources

- Occurrence and extent of primary sources in schools
- Relative magnitude of emissions from different sources
- Occurrence and extent of secondary sources
- Transport from sources to air, surfaces, dust, soil
- Need for chamber testing and indoor models

Very Complex!
Do PCBs in school air pose a health risk?
Inside and Outside Schools

PCBs in NW Indiana
Harbor, Canal and Disposal Facility

Lake Michigan
Indiana Harbor
Indiana Harbor Canal
Grand Calumet River Branch
Lake George Branch
Confined Disposal Facility
East Chicago
SCHOOLS
Contaminated Sediment is Dredged and Placed on a Barge
Barges are Docked near the Confined Disposal Facility for Offloading

Offloading represents the greatest risk for exposure to airborne PCBs.

The sediment will be kept wet at all times to minimize airborne movement of PCBs.
Building the Confined Disposal Facility
Building the Confined Disposal Facility
Air is Monitored Over Time to Protect Human Health
Samplers in schools

Hi-Vol Sampler

Passive Sampler

~4.5 feet tall

~1 foot tall

~1.5 feet x 1.5 ft square base
Another Type of Sampler Measures PCBs in Indoor Air Over Time

A sampler like this installed in about 50 homes in East Chicago, IN and Columbus Junction, IA.
Another cancer causing agent related to schools

RADON
222Radon

• Colorless, odorless gas
• Second leading cause of lung cancer
• Small amounts of naturally radioactive nuclides are present in soil, rock and building materials
  • $^{238}\text{Uranium} \rightarrow ^{226}\text{Radium} \rightarrow ^{222}\text{Radon} \rightarrow \text{radon daughters}$
• Radon emits radioactive alpha particle, radon daughters emit beta and gamma radiation
• U.S. action level is 4 pCi/L
U.S. Radon Levels

Zones indicate counties with a predicted average indoor radon screening level as indicated (pCi/L = pico curies per liter)

Iowa – All homes should be tested for Radon
EPA Documents
http://www.epa.gov/iaq/radon/pubs/

What it is & how to test

How to fix radon
New Homes Can Be Built With Radon Control Systems
Schools want to protect their children.

Schools don’t have a budget for testing for possible air contaminants? And they are concerned they may find something.

Iowa law requires that registered day care centers test for Radon and if the levels are high they must mitigate. There is no requirement for k-12 schools.

Why?
Half-hour and running mean indoor radon concentration in a school room over 12 days

Source: Grodzins, 1990
Testing is the first step

The second step, might require actions that will cost big $ BUT maybe not.