INDUSTRIAL ECOLOGY APPLICATIONS:
Contaminant Sources and Fate in the NY-NJ Harbor Watershed

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NY-NJ Harbor & its watershed
Why use Industrial Ecology?

- **Systems-based approach** – concerned with the interrelationships of anthropogenic systems and their impact on the environment:
  - Model interactions among and between industries and consumers based upon a natural analogue (Descriptive)
  - Seeks to optimize the total industrial materials cycle from virgin material to finished product to waste disposal in order to lessen the impact of these processes on the environment (Prescriptive)

- **Goal: materials and energy optimization**
  - De-materialization: minimize extraction & use
  - Material integration: reuse; recycling
  - Cradle to cradle approach

- **Analytical tools:**
  - Material flows, mass balance, life cycle analysis

Overall Goals of Project:

- **Identify** the locations in five toxicant cycles (Hg, Cd, PCBs, dioxins and PAHs) where pollution prevention (P2) would most efficiently contribute to long-term reductions in loadings to the harbor

- **Develop with a stakeholders consortium** practical P2 strategies that address toxicant releases / emissions.

- **Encourage implementation** of the recommended actions by integrating stakeholders into the research and policy making process
Research

- **Identify sources**, flows and sinks for contaminants through the region including products, processes and sectors that produce, use and/or release these contaminants.

- **Develop a Substance Flow Assessment**, quantifying contaminant flows and transformations (from extraction, production, consumption, to post-consumption, including disposal rates) [Industrial Ecology assessment]

- **Quantify contaminant flows in and out of the Harbor** – through air, water and land [Harbor Mass Balance]

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The Industrial Ecology Approach: Understanding contaminant movements (PCBS)

**Closed Applications:**
- Dielectric Fluids, Light Ballasts, Electromagnets

**Partially closed Applic.:**
- Fluids (hydraulic, Heat transfer) Switches,

**Open Applic.:**
- Inks, Lubricants, Wax, Flame Retard., Adhesives, Surface coatings.

**Inadvertent Production**

**Waste:**
- Spills, Dredging, Decommissioned Equip., Building demolition

**Recycling Operations:**
- Products made with recycled materials

**Industrial Dumpsites & Reservoirs**
- Interim Storage & Permanent Disposal

**Landfills & POTWs WTE**

**Soil**

**Air**

**Water**

**Food**
Mass balance for the Harbor

Atmospheric flows

Deposition → Emissions

River Input*

Runoff

Wastewater/CSO

Landfill leachate

*includes indirect deposition

Harbor Estuary

Burial → Resuspension

Sediment flux

Advection

Tidal Exchange

Seawater Incursion

Modeling system interactions

The Environment

Waste Output

The Economy

Production (Ind./Comm. Services)

Household Sector

Recycle

Reuse

Material Input

Air

Land

Water

Harbor
Evaluating the impact of “legacy” sites

- **Estimating contaminant remobilization:**
  The amount of dioxins (or other contaminants), mobilized annually by soil runoff from a given site or area can be calculated as:
  
  \[ \text{Dioxins in Runoff} = \text{Soil Loss} \times \text{Contaminated Area} \times \text{Dioxin Concentration in Soil} \]

- **Soil Loss – USLE = R x K x LS x C x P**

- **RUSLE2** - software and databases for different geographical areas are available for download at the USDA-ARS National Soil Erosion Research Laboratory, Purdue University website
  
  [http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm](http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm)
Stakeholder involvement

- Develop P2 Strategies with Consortium of stakeholders
  - Continually present findings to Consortium for decision-making and recommend P2 strategies
    - Find leverage points for intervention. Identify economic sectors, substitute materials, technologies and/or alternative practices that provide effective leverage for policy tools.
    - Public Opinion Survey / Sector meetings
    - Determined total costs associated with P2 plan

- Implementation
  - Identifying implementers (relevant actors and sectors)
  - Partner with action oriented groups
  - Monitoring results

Why a Stakeholders’ Consortium?

- Emphasizes public involvement and communication:
  - New Paradigm: Inform, Include, Decide
- Involves stakeholders in research, development of P2 strategies & implementation
  - Participants guide research and provide key data
  - Opportunity for mutual understanding
  - Buy-in from participants results in higher implementation rates
- Open process acts as educational forum
- Alternative valuation tool
- Diversity of sponsors
Developing P2 Action plans

- **Find all leverage points for intervention**
  - Identify economic sectors, substitute materials, technologies and/or alternative practices that provide effective leverage for policy tools.
  - Determine costs (when feasible) associated with P2 plan

- **Setting priorities for action – multi-criteria:**
  - total ongoing releases
  - fate and transport
  - toxicity of the contaminant in relation to receptors

- **Promoting implementation**
  - Identify implementers (relevant actors and sectors)
  - Partner with action oriented groups
  - Monitoring results

**CASE STUDIES:**

research findings & policy recommendations
Research Findings:
Hg initial releases to all media (kg/yr), by sector

Mercury Inputs to the Harbor

Proportion of Mercury Contributed by Each Pool

Proportion of Methylmercury Contributed by Each Pool
Sectors Contributing Hg to Wastewater

- **Dental Facilities**: silver amalgam
- **Hospitals**
  - measuring devices instruments
  - laboratories
  - dental clinics
- **Laboratories**
  - Chemicals
  - reagents vaccines
- **Household**: Thermometers
  - Human & product waste (e.g., cleansing agents)

Share of Actual Hg Releases via Wastewater:

- Hospitals
- Labs
- Thermometers
- Dental Facilities
- Waste

Primary vs. Final Wastewater Releases - combined sewer system

- **Fertilizer, burial, WTE**
- **Sludge (70-85%)**
- **HARBOR**
  - 15-30% outflows
- **Sanitary system**
- **Combined sewer overflow**
- **Storm water system**
- **Tributary**
Mercury key findings:

- IE inventory helpful to identify all contaminant sources, including the cumulative impact of small quantity generators (SQG)
- Using material flow analysis helps regulatory agencies identify all sources of potential concern, not just large ones
- IE demonstrates the need to follow materials from primary to secondary sources, to pools and sinks
- MFA metrics (mass) modified to integrate risk into P2 prioritization
- Use of indicators (economic, environmental) to inform policy debate

Estimated total Cadmium Releases

<table>
<thead>
<tr>
<th>Products</th>
<th>(kg/yr)</th>
<th>Confidence</th>
<th>Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>Battery disposal</td>
<td>120,000</td>
<td>L</td>
<td>air/landfills</td>
</tr>
<tr>
<td>Other products disposal</td>
<td>40,000</td>
<td>L</td>
<td>air/landfills</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Processes</th>
<th>(kg/yr)</th>
<th>Confidence</th>
<th>Release</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phosphate Fertilizer Applctn</td>
<td>500</td>
<td>M</td>
<td>soil</td>
</tr>
<tr>
<td>Sewage Sludge Land Applctn</td>
<td>500</td>
<td>M</td>
<td>soil</td>
</tr>
<tr>
<td>Metal Plating Production</td>
<td>400</td>
<td>L</td>
<td>air, water</td>
</tr>
<tr>
<td>Cement Production</td>
<td>300</td>
<td>M</td>
<td>air</td>
</tr>
<tr>
<td>Fossil Fuel Combustion</td>
<td>200</td>
<td>M</td>
<td>air</td>
</tr>
<tr>
<td>Tires</td>
<td>100</td>
<td>L</td>
<td>soil</td>
</tr>
<tr>
<td>Plastic Additives Production</td>
<td>80</td>
<td>M</td>
<td>air</td>
</tr>
<tr>
<td>Petroleum Refineries</td>
<td>50</td>
<td>M</td>
<td>air</td>
</tr>
<tr>
<td>Secondary Steel Production</td>
<td>40</td>
<td>M</td>
<td>air</td>
</tr>
<tr>
<td>MSW Incineration</td>
<td>40</td>
<td>H</td>
<td>air</td>
</tr>
</tbody>
</table>
Cadmium: Key Findings

- Use of cadmium has changed dramatically over the last 20 years – (75% used for Ni-Cd batteries)
- Cd flows through the economy larger than inputs to the harbor – discrepancy between IE & MB assessments
- Assumption that discrepancy could be explained by battery recycling put to the test (survey)
  - Survey finding: low recycling rates for region
  - Discrepancy explained by MSW management practices – NYC exports to other regions; NJ does not
- Campaign to increase battery recycling rates based on precautionary principle

System boundary - Impacts are not always regional
Impacts on Harbor depend on current practices

PCBs: Industrial Ecology analysis

- US PCB production (1929-1975) = 568,000 T
  - 77% of PCBs produced for use in closed systems (transformers, large & small capacitors)
  - 10% semi-open applications (hydraulic, heat transfer fluids)
  - 13% open applications (paint, carbonless paper)
- Production generally prohibited since 1977
- PCB in closed applications – use permitted
- Last account of PCBs in use conducted in 1980s:
  - 70% of PCB transformers at non-utility facilities ~ 79,000 T
  - 30% of PCB transformers at utilities ~ 34,000 T
  - 80% of PCB contaminated transformers at utilities ~ 120 T
  - 85% of PCB large capacitors at utilities ~ 40,000 T
  - Small capacitors: 870M in 1977 (ea. w/ 0.05 lb; total = 20,800 T)
### Estimating # of Transformers & Capacitors

<table>
<thead>
<tr>
<th></th>
<th>Nationwide</th>
<th>Estimates for the Harbor Watershed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Inventory</td>
<td>Reported (registry)</td>
</tr>
<tr>
<td>Numbers of Transformers</td>
<td>1985/8</td>
<td>1985/8</td>
</tr>
<tr>
<td>Total - 1988</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCB transformers (≥500ppm)</td>
<td>358,000</td>
<td>20,750</td>
</tr>
<tr>
<td>PCB contaminated (&gt;50-&lt;500ppm)</td>
<td>(108,000)</td>
<td>(250,000)</td>
</tr>
<tr>
<td>Non-substation units only, 1985</td>
<td>106,294</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total - both PCB &amp; PCB</td>
<td>200,000</td>
<td>11,600</td>
</tr>
<tr>
<td>contaminated units – 1994</td>
<td></td>
<td></td>
</tr>
<tr>
<td>NYC DEP &amp; Con Edison, 1998</td>
<td></td>
<td></td>
</tr>
<tr>
<td>US EPA national inventory, 1994</td>
<td>1,400,000 - 1,480,000</td>
<td>72,800 to 76,900 units</td>
</tr>
</tbody>
</table>

### Contaminated Mineral Oil Transformers

<table>
<thead>
<tr>
<th>Owner</th>
<th>Location</th>
<th>Units</th>
<th>ppm (avg)</th>
<th>Lbs. PCB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Con Ed</td>
<td>Manhattan</td>
<td>8,588</td>
<td>28.8</td>
<td>1,547.4</td>
</tr>
<tr>
<td>Staten Is.</td>
<td>10,817</td>
<td>1.0</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Bronx</td>
<td>5,522</td>
<td>8.8</td>
<td>236.4</td>
<td></td>
</tr>
<tr>
<td>Brooklyn</td>
<td>13,104</td>
<td>12.4</td>
<td>799.2</td>
<td></td>
</tr>
<tr>
<td>Queens</td>
<td>9,968</td>
<td>13.7</td>
<td>676.0</td>
<td></td>
</tr>
<tr>
<td>ConEd total</td>
<td>48,000</td>
<td>12.6</td>
<td>3,263.6</td>
<td></td>
</tr>
<tr>
<td>Keyspan</td>
<td>Rockaway</td>
<td>2,072</td>
<td>50.0</td>
<td>20.2</td>
</tr>
<tr>
<td>Total NYC utilities (lbs)</td>
<td>50,072</td>
<td>31.3</td>
<td>3,284</td>
<td></td>
</tr>
<tr>
<td>Total NYC utilities (tons)</td>
<td>1.5 tons PCB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Utilities (assuming all&lt;50ppm)</td>
<td>3.6 tons PCB</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL estimate for Utilities</td>
<td>5.1 tons PCB</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Small PCB Capacitors

- Over 100 million small PCB capacitors produced in US
  - PCB capacitors sold in the watershed: 5.2M – 5.8M
  - Average quantity: 24 grams each
  - ~ 120 - 140 tons PCBs in small capacitors in watershed
- High uncertainty about their fate
  - If only 10%-30% still in use - 12-14 tons PCBs
- Small PCB capacitors are not regulated as hazardous waste and may be sent to landfills or municipal waste incinerators
- Landfills that accept “fluff” material (e.g. metal shredding) have higher concentrations of PCBs in leachate
- Limited funding for PCB small capacitors collection programs
- Limited public awareness about household products containing PCBs

Products containing PCBs

- Small capacitors in:
  - Fluorescent lamp ballasts
  - Certain household appliances such as old refrigerators & microwave ovens
- Paints – old
- Carbonless paper – old
- Certain pigments and dyes
- Glossy papers with special inks
- Kaofin
- Certain flocculants used at POTWs
Inadverted Production of PCBs:

- PCB 11 or 3,3'-dichlorobiphenyl is a significant congener in ambient waters in the NY/NJ Harbor, Long Island Sound, and the New York Bight. PCB 11 is estimated to represent 10 to 20% of total PCBs entering the NY/NJ Harbor.
- Inadvertent production of PCB 11 is related to pigment manufacturing.
- The effluent at various NY & NJ wastewater treatment facilities are dominated by PCB 11.
  - Federal rules state that non-Aroclor PCB concentrations discharged to water from manufacturing or processing sites are limited to less than 0.1 ppm for any resolvable gas chromatographic peak.

Contaminated Sites: Superfund, Brownfields and Landfills

- 179 Superfund sites in region (64 in NY & 115 in NJ)
- 550 Brownfields sites in NJ (at least 34 sites in NY, but no information to assess whether they have PCBs)
- 60 contaminated landfills in NJ (no information for NY)
- 26 “other contaminated sites” in NJ
- Clean up schedule of Superfund sites has slowed down to less than half the rate of the 1990s when an average of 87 sites were being cleaned each year. In 2003 only 40 Superfund sites were cleaned.
- Funding drying up – taxpayers money being requested to fund Superfund program in 2005.
- Remobilization of PCBs from contaminated sites:
  - Volatilization
  - Runoff
  - Leachate
  - Groundwater
PCBs: Mass balance findings

- Ongoing releases from upriver (including the Hudson River Superfund Site) account for ~50-55% of PCB inputs to the Harbor.
- The remaining 45-50% is local inputs and the homolog distributions are different than the upstream source.
- Stormwater runoff (17%); CSO (17%); WWTP are minor input (5-10%);
- Inadvertent ongoing production/use (10-15%); PCB 11, 35, 77, 209

PCBs - key findings

- HR Upstream and downstream PCB inputs – different homologue patterns
- SQG: cumulative impact of small capacitors overlooked:
  - US (2004): 40M – 50M units (960 – 1,200 tons)?
  - Harbor watershed (2004): ~2.5M - 3M (60 – 70 tons)?
    - 10-20% disposal rate/yr: (6 - 14 T/yr)
- Inadvertent production: ~ 10-15% of current PCB loadings
- Usage/disposal:
  - uneven reporting requirements on usage/disposal (large capacitors)
  - Regulatory gap
  - Limited recycling opportunities
- Opportunities for P2 / BMPs
- Impact of 179 Superfund sites in Harbor region
  - 27% - waste storage/treatment & 8% - recycling
  - 26% - manufacturing/industry
  - 23% - unknown; other – 9%
  - mining/extracting/processing – 3%
  - Government – 3%; residential – 2%
PAHs – Summary of estimated releases to all media

<table>
<thead>
<tr>
<th>Source Type</th>
<th>Estimate (kg/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Fuel Combustion</td>
<td>345,800</td>
</tr>
<tr>
<td>Products with Naphthalene (e.g., Mothballs)</td>
<td>288,100</td>
</tr>
<tr>
<td>Mobile and Stationary Combustion Sources</td>
<td>136,300</td>
</tr>
<tr>
<td>Industrial Sources</td>
<td>31,800</td>
</tr>
<tr>
<td>Oil Spills and Dumping</td>
<td>14,700</td>
</tr>
<tr>
<td>Open Burning</td>
<td>14,400</td>
</tr>
<tr>
<td>Natural Sources</td>
<td>700</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>839,300</strong></td>
</tr>
</tbody>
</table>

kg/year in the watershed

Estimate PAH Emissions from Each Sector (kg/yr)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Estimate (kg/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential Fuel Combustion: Wood Stoves and Fireplaces</td>
<td>9,000</td>
</tr>
<tr>
<td>Residential Fuel Combustion: Mothballs</td>
<td>2,800</td>
</tr>
<tr>
<td>Metal Coating: On-Road Vehicles</td>
<td>97,700</td>
</tr>
<tr>
<td>Metal Coating: Non-Road Vehicles</td>
<td>286,000</td>
</tr>
<tr>
<td>Tire Wear</td>
<td>341,200</td>
</tr>
<tr>
<td>Natural Sources: Other Sources</td>
<td>4,500</td>
</tr>
<tr>
<td>Natural Sources: Road Vehicles</td>
<td>7,500</td>
</tr>
<tr>
<td>Natural Sources: Off-Road Activities</td>
<td>1,300</td>
</tr>
<tr>
<td>Natural Sources: Miscellaneous</td>
<td>1,100</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,650,000</strong></td>
</tr>
</tbody>
</table>
Estimated PAH Releases to Each Media

- Atmosphere: 534,700 kg/year in the watershed
- Land: 17,650 kg/year
- Water: 950 kg/year

Not including mothballs

Estimating Transport from Source to Harbor
Fate & Transport via Air

Particulate/Gaseous

Runoff

Particulate/Dissolved

Sediment

Photo oxidation
Advection

Biodegradation
Advection
Dredging

Region I:
(NJ) Bergen, Passaic, Essex, Union, Hudson
(NY) 5 Boroughs NYC

Region II:
(NJ) Sussex, Morris, Somerset, Middlesex, Monmouth
(NY) Rockland, Westchester, Orange, Putnam

Region III: (near Hudson)
Ulster, Dutchess, Greene, Columbia, Albany, Rensselaer
Gas-Particle Partitioning

<table>
<thead>
<tr>
<th></th>
<th>Jersey City (urban)</th>
<th>New Brunswick (urban)</th>
<th>Chester (suburban)</th>
<th>Estimated % gas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naphthalene</td>
<td>nr</td>
<td>nr</td>
<td>nr</td>
<td>99%</td>
</tr>
<tr>
<td>Acenaphthylene</td>
<td>nr</td>
<td>nr</td>
<td>nr</td>
<td>99%</td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>nr</td>
<td>nr</td>
<td>nr</td>
<td>99%</td>
</tr>
<tr>
<td>Fluorene</td>
<td>99.1%</td>
<td>98.2%</td>
<td>99.5%</td>
<td>99%</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>96.0%</td>
<td>97.7%</td>
<td>98.3%</td>
<td>98%</td>
</tr>
<tr>
<td>Anthracene</td>
<td>90.7%</td>
<td>92.3%</td>
<td>87.9%</td>
<td>90%</td>
</tr>
<tr>
<td>Fluoranthene</td>
<td>86.8%</td>
<td>83.9%</td>
<td>86.4%</td>
<td>85%</td>
</tr>
<tr>
<td>Pyrene</td>
<td>80.3%</td>
<td>77.5%</td>
<td>76.4%</td>
<td>78%</td>
</tr>
<tr>
<td>Benz[a]anthracene</td>
<td>4.2%</td>
<td>5.1%</td>
<td>4.3%</td>
<td>4%</td>
</tr>
<tr>
<td>Benzo[b+k]fluoranthene</td>
<td>1.1%</td>
<td>2.4%</td>
<td>0.5%</td>
<td>1%</td>
</tr>
<tr>
<td>Benzo[a]pyrene</td>
<td>1.6%</td>
<td>4.7%</td>
<td>0.7%</td>
<td>2%</td>
</tr>
<tr>
<td>Perylene</td>
<td>1.1%</td>
<td>nr</td>
<td>nr</td>
<td>1%</td>
</tr>
<tr>
<td>Dibenz[a,h+a,c]anthracene</td>
<td>0.5%</td>
<td>2.0%</td>
<td>3.3%</td>
<td>2%</td>
</tr>
<tr>
<td>Benzo[g,h,i]perylene</td>
<td>0.4%</td>
<td>2.5%</td>
<td>0.2%</td>
<td>1%</td>
</tr>
<tr>
<td>Indeno[1,2,3-cd]pyrene</td>
<td>0.4%</td>
<td>2.1%</td>
<td>0.6%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Region I Estimated Particulate Emissions vs. Measured Urban Runoff

- Estimated particulate emission
- Measured urban runoff

kg/year

Estimated particulate emission

Measured urban runoff
Region II Particulate Emissions vs. Measured Inputs from NJ Tributaries

Estimated particulate emission | Measured urban runoff

NY Region II Particulate Emissions vs. Measured Inputs from the Hudson River

Estimated particulate emission | Measured urban runoff
Fate & Transport via Land

- Evaporation/Deposition
- Photo oxidation
- Advection
- Dredging
- Sediment
- Dissolved/Particulate
- Runoff & Leaching

PAH Leaching from Solids

- Desorption
- Leaching
- Bioavailability
- Toxicity

Cumulative Mass Desorbed (as % of total mass)

<table>
<thead>
<tr>
<th>Compound</th>
<th>Cumulative Mass Desorbed (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H-p Pyr</td>
<td>60</td>
</tr>
<tr>
<td>H-p Chr</td>
<td>50</td>
</tr>
<tr>
<td>H-p BAP</td>
<td>40</td>
</tr>
<tr>
<td>L-p Pyr</td>
<td>30</td>
</tr>
<tr>
<td>L-p Chr</td>
<td>20</td>
</tr>
<tr>
<td>L-p BAP</td>
<td>10</td>
</tr>
</tbody>
</table>

Time (days)

0.01 0.10 1.00 10.00 100.00
Factors Limiting Leaching of HOCs

Properties of Contaminant: Hydrophobicity
Properties of Solid
- Quantity & Properties of organic matter
- Properties of organic matter
- Physical properties (particle size, surface area, porosity)
Properties of Leachant
- DOC concentration
- Flowrate (infiltration rate)

Estimated Stocks of PAHs: Creosote Materials

<table>
<thead>
<tr>
<th>Material</th>
<th>Estimated Stocks of PAHs (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Creosote Marine Piling</td>
<td>19,057,400</td>
</tr>
<tr>
<td>Creosote Railway Ties</td>
<td>16,480,500</td>
</tr>
<tr>
<td>Creosote Utility Poles</td>
<td>35,537,900</td>
</tr>
<tr>
<td>Total</td>
<td>35,537,900</td>
</tr>
</tbody>
</table>

kg PAH
Parking Lot Sealants

Background:

• Sealants used to protect asphalt surfaces (i.e. parking lots and driveways).
• Two types of sealant: Asphalt based and Coal-tar based. (coal-tar sealants predominantly used east of the Rockies)
• Concern with coal-tar and asphalt based sealants:
  • Contain PAHs
  • Abrade from surface over time and are transported via runoff.
• Data:
  • Peter VanMetre, U.S. Geological Survey
  • Robert P. DeMott, Pavements Coating Technology Center

Parking Lot Sealants, cont.

Parking lot Sealants

Can we calculate a release in the watershed?

➢ Coal tar sealant consumed in the watershed area (gallons/yr) = 5,800,000
➢ Yield (µg PAH/m² /rain event) = 946 (according to Mahler et al, 2005)
➢ 25 kg PAH for 1 rain event in the watershed.
  ~118 days of rain per year in watershed area

What if only asphalt based sealant was used?

➢ 11 kg PAH for 1 rain event in the watershed.

Problem: how do yields change over time?
Parking Lot Sealants, cont.

Materials & products containing PAHs

- Used-motor oil
- Driveway sealants (with coal tar)
- Heating oil
- Creosote (wood preservative)
- Dandruff shampoo (with coal tar as ingredient)

Processes that release PAHs:

- Vehicle driving
- Wood Stoves and Outside Boilers, BBQ
- Open burning of waste
- Tire combustion
Data sources & gaps

تفكير
Mercury, Cadmium
- Still commercialized (produced, used)
- National Material Flows Available from US Geological Service
- Industry data by sectors; some data by products

تفكير
PCBs
- Production is banned but still inadvertently produced and used in products/discard
- No regional material flow analysis
- National Inventories of "allowed uses" from 1980s or early 1990s only

تفكير
Dioxin, PAHs
- Not commercialized, (by-product)
- Must rely on emission factors and level of activity
- Some inventories available for certain sectors

Challenges

- How to include small, dispersed sources or SQG:
  - Include representatives of SQG (e.g., trade associations)

- How to balance the leverage of large interest groups

- Disseminating findings widely

- Ensure implementation of all strategies recommended by the consortium
What aids the process?

- **Systems approach (Industrial Ecology)**
  - ID all sources & pathways provides new opportunities for intervention
  - ID all sectors & parties that are stakeholders

- **Stakeholder framework**
  - sets its own learning & policy making dynamic
  - different points of view and interests co-exist
  - flexibility integrating different levels of participants
  - Educational forum

For copies of documents and more information about our project:

http://www.nyas.org/programs/harbor.asp

“Pollution Prevention and Management Strategies for Mercury in the NY/NJ Harbor”

“Survey of Public Opinion: Opinions of Stakeholders on Issues that Concern the Future of the Harbor”

“Pollution Prevention and Management Strategies for Cadmium in the NY/NJ Harbor”

“Pollution Prevention and Management Strategies for PCBs in the NY/NJ Harbor”