INNOVATIVE APPROACHES TO TEACHING GREEN CHEMISTRY TO WORKERS

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AGENDA

- Overview of Green Chemistry curriculum
- Module 5: Chemical Policy Framework
  - Regulatory programs & policy gaps
  - Case studies on chemicals of concern
- Module 7: What can I do?
  - Participation activity: Using the PLUM database
- Feedback
ACKNOWLEDGEMENTS

This curriculum was developed with a grant from NIEHS and the American Reinvestment and Recovery Act (ARRA) and was jointly developed by LOHP and LOSH.
GREEN CHEMISTRY CURRICULUM

1. How this applies to me
2. Timeline of chemical production & policy
3. Sustainability: environment, economy & health
4. Chemical hazard awareness: case study, MSDSs
5. How chemicals are regulated: TSCA, HazCom, CA green chemistry initiatives
6. Green Chemistry: product life cycle, hierarchy of controls, the precautionary principal, success stories
7. Green chemistry and workers: what can I do?
LEARNER GOALS AND TRAINING OUTCOMES

- Ownership → connect with first hand experience
- Awareness → protect self
- Authority → protect others
- Speak out → tell personal story
- Participation → get involved in policy process

Green Chemistry
Module 5: Chemical Policy Framework
**Government Regulation of Chemicals: How It Works**

<table>
<thead>
<tr>
<th>OSHA Workers</th>
<th>EPA Env. &amp; HH</th>
<th>FDA Consumers</th>
<th>CPSC Consumers</th>
</tr>
</thead>
</table>
| • Workplace exposures | • Toxic Substances Control  
• Pesticide Safety | • Food additives  
• Drugs  
• Cosmetics PCPs | • Product safety |
**Government Regulation of Chemicals: How it **doesn’t** Work**

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| • Workplace exposures | • Toxic Substances Control  
|             |   • Pesticide Safety       | • Food additives          | • Product safety (recalls) |

**Exposures from consumer products?**

**Household Workplaces?**

**Workplace exposures to new chemicals?**

**Chemicals in food containers?**
EPA ‘Gatekeeper’ Programs: Toxic Substance Control Act

- New chemical review process: Pre-Manufacture Notice
  - ~15,000 new applications/year
  - 90 day review period
  - 15% have toxicity testing: any H&S data is allowable

- Substance specific rules:
  - PCBs – effective market ban; detailed rule
  - Asbestos – limited ban, overturned

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EPA

- TSCA review
- Pesticide Safety
What happened to TSCA?

- TSCA product ban for asbestos in progress
- Corrosion Proof Fittings v. EPA (1991)
  - Asbestos brake pad manufacturers sued EPA for their alternatives assessment methods
  - Contested:
    - more traffic related deaths with non-asbestos brake pads
    - EPA had no methodology to evaluate the safety of alternatives.

Outcome: House Committee Report on TSCA

- Burden placed on EPA to “balance the probability, magnitude and severity of harm against the effectiveness of control”
- EPA never developed model for evaluating alternatives
What about OSHA?

- Hazard Communication Standard requires manufacturers to provide:
  - MSDS with health hazard info
    - Acute symptoms from over exposure
    - Long term (cancer) risk
  - Warning language on label
- New PELs are reviewed for ‘economic feasibility’
  - Only 16 new PELs since 1971
  - Healthy worker bias: risk model less protective than EPA’s
# Workplace Exposures & Chronic Disease

Deaths in US from occupational disease: 60,000/yr

<table>
<thead>
<tr>
<th>Usage</th>
<th>No. on the Market</th>
<th>No. w/ PELs</th>
</tr>
</thead>
<tbody>
<tr>
<td>High production volume chemicals (&gt;1M lbs/yr)</td>
<td>3,000</td>
<td>193 (6%)</td>
</tr>
<tr>
<td>Chemicals used in qty’s &gt;10,000 lbs/yr</td>
<td>8,300</td>
<td>453 (5%)</td>
</tr>
</tbody>
</table>
# Human and Economic Costs of Occupational Disease

**Figure 1. Disease Cases and Costs Attributable to Chemical Exposures in the Workplace, California 2004**

<table>
<thead>
<tr>
<th>Disease</th>
<th>Cases</th>
<th>Costs ($millions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Disease</td>
<td>Hospitalizations</td>
</tr>
<tr>
<td>Cancer</td>
<td>113,999</td>
<td>8,700</td>
</tr>
<tr>
<td>COPD</td>
<td>42,606</td>
<td>1,145</td>
</tr>
<tr>
<td>Asthma</td>
<td>45,856</td>
<td>460</td>
</tr>
<tr>
<td>Pneumoconiosis</td>
<td>1,710</td>
<td>171</td>
</tr>
<tr>
<td>Chronic renal failure</td>
<td>2,854</td>
<td>128</td>
</tr>
<tr>
<td>Parkinson’s disease</td>
<td>699</td>
<td>27</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>207,724</td>
<td>10,631</td>
</tr>
</tbody>
</table>

University of California, Berkeley and Los Angeles
# Exposures that affect Everyone

## Consumer Products
- Informal workplaces
- Domestic workers
- Light industry

## Home environment
- Families
- Children
- Where we spend most of our time

<table>
<thead>
<tr>
<th>FDA</th>
<th>CPSC</th>
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</thead>
<tbody>
<tr>
<td>• Food additives</td>
<td>• Product safety (recalls)</td>
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<tr>
<td>• Drugs</td>
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</tr>
<tr>
<td>• Cosmetics PCPs</td>
<td></td>
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</tbody>
</table>
CHEMICALS OF CONCERN IN CONSUMER PRODUCTS

Brominated Flame Retardants:

- Reproductive toxin, neurotoxin
- Voluntary ban from mattresses in 2004 (following ban in Europe)
- Still manufactured in hard plastics, furniture foam, electronics
- Detectable in house dust and human blood
CHEMICALS OF CONCERN IN CONSUMER PRODUCTS: BIS-PHENOL A

Timeline

1891
- BPA first synthesized

1930s
- Found to act as artificial estrogen

1953
- Added to polycarbonate plastics

1976
- TSCA grandfathers in BPA

1993
- EPA study: high dose animal testing

1997
- BPA found toxic at low doses
- FDA finds BPA leaching from tin can lining

1999
- Consumer Reports finds BPA leaching from baby bottles

2003
- NTP study (Science Int’l)
- Congressional investigation in 2007

2007
- NIH external review panel: 38 scientists
## BPA Risk Assessment: Conclusions

<table>
<thead>
<tr>
<th>Authority</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>NIH external science panel</td>
<td>‘Clear risk’</td>
</tr>
<tr>
<td>NTP (Science International)</td>
<td>‘Some concern’ neurotoxin, reproductive toxin</td>
</tr>
<tr>
<td>FDA</td>
<td>‘Adequate margin of safety’</td>
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</tbody>
</table>

2009: House Committee urges FDA to re-examine BPA

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*The Washington Post*

**Studies on Chemical In Plastics Questioned**

Congress Examines Role Of Industry in Regulation

By Lyndsey Layton
Washington Post Staff Writer
Sunday, April 27, 2008

Despite more than 100 published studies by government scientists and university laboratories that have raised health concerns about compound that is central to the multibillion-dollar plastics industry, the Food and Drug Administration has deemed it safe largely bec
BPA: Policy Actions

Banned in baby products
- Canada – 2008
- Minnesota – 2009
- City of Chicago – 2009
- Connecticut – 2011

The New York Times

May 14, 2009

Chicago Bans Bottles With BPA Plastic

By KAREN ANN CULLOTTA

CHICAGO — The City Council on Wednesday unanimously adopted a resolution manufactured with a chemical that some studies have linked to disease.

Passage was driven by what officials here call federal regulators’ failure to take action on a grave public health issue.

The chemical, bisphenol-A, or BPA, is commonly employed to harden plastics, among other uses. Of particular concern is that it is used in a microwave oven or cleaned in a dishwasher.

Some animal studies have found that BPA apparently accelerates puberty and poses a cancer risk. A large-scale study from Italy found that women who were exposed to high levels of BPA in the womb had a higher risk of breast cancer.

A 2006 study by Japanese researchers also linked BPA exposure to earlier puberty and potential health problems. In 1996, Canada became the first country to take action to ban the sale of products made with BPA. The United States did not follow suit until this year, when Congress moved to restrict BPA in children’s food packaging.

The European Union (EU) had made a similar announcement earlier this month to make the ban effective in June for EU member countries.

Other countries that have banned the chemical in milk bottles include Germany, France, Denmark, Canada, Australia, New Zealand and the state of New York in the United States.

BPA is said to make baby milk bottles because it is used in polycarbonate to make the plastic transparent and sturdy while those without BPA had a less clear and drier look.

Spot the difference: Model Nisa Kasam showing a polycarbonate feeding bottle (left) and a polypropylene one that contains BPA at the Health Ministry in Putrajaya yesterday.
BPA: Market Response

1. 1st: voluntary ban from baby products

2. Then: voluntary ban from water bottles

3. Still waiting: ban from food product containers
   
   FDA decision by March 31, 2012

4. Next: Heat treated paper
BPA AND RETAIL WORKER EXPOSURES

- Cashiers handle hundreds of receipts daily
- Alcohol hand sanitizer may increase absorption
- Recycled paper contaminated
Dangers of Asbestos

Adverse effects associated with asbestos exposure have been revealed in many well-conducted studies of exposed workers, family contacts of workers, and persons living in close proximity to asbestos mines. The studies have shown a clear correlation between asbestos exposure and lung cancer as well as mesothelioma (a rare form of cancer that develops from the protective lining of the body's internal organs). Asbestos exposure has also been linked to increases in esophageal, kidney and laryngeal cancers. It generally takes 20 years following the first exposure for signs of disease to surface.

Asbestos Related to Vehicles

An estimated 155,000 automotive garage workers are potentially exposed to harmful asbestos materials with a total of 1.3 million American workers still subject to asbestos exposure.

9,700 people die each year from asbestos related cancer

Car Parts that Could Have Asbestos:

- Hood Liners
- Clutch Assembly
- Brake Pads
- Gaskets
- Valve Rings
- Valve Stem Packing

Sources:
- http://www.malignantmesothelioma.org.uk/asbestos.htm
CONSUMER CLEANING PRODUCTS: CLEAN HOUSE = DIRTY LUNGS?

Common cleaning products found to generate hazardous air pollutants:

- **Benzene**, a carcinogen (Comet Disinfectant Powder Cleanser)
- **Chloroform**, a carcinogen & developmental toxin (Comet Disinfectant Powder Cleanser)
- **Formaldehyde**, a carcinogen (Simple Green Concentrate, Pine-Sol Original, Comet Disinfectant Powder Cleanser, Super Cleaner Concentrate)
- **Dibutyl phthalate**, a reproductive toxin (Shineline Seal Floor Sealer/Finish)

Environmental Working Group, 2009
Green Cleaning Products Released
15% Less Air Pollutants

EWG, 2009
AFTER THE FACT TOXICITY STUDIES: TRICLOSAN

- Found in anti-bacterial soaps, detergents & toothpaste
- Endocrine disruptor
- In tap water, lakes & streams, it forms chemicals linked to cancer
- Found in human blood & breast milk, and in the environment
- Not regulated as pesticide by EPA, minimally covered by FDA

Source: Environmental Working Group, 2012
PERIPHERAL NEUROPATHY IN AUTO MECHANICS

HEXANE BRAKE CLEANERS

n-Hexane Use in Vehicle Repair

Long-term overexposure to n-hexane can damage the nerves in the feet, legs, hands, and arms. The damage can last a long time and may become permanent. The symptoms include numbness, tingling, weakness (sometimes even paralysis), and reduced ability to feel touch, pain, vibration, and temperature. Short-term overexposure can cause headache, dizziness, loss of appetite, dizziness, and confusion. Health effects have only been reported when exposure levels were above California’s workplace permissible exposure limit—but people working with n-hexane can easily be exposed to levels that high. This Health Hazard Alert was prompted by cases of nerve damage identified among auto mechanics using spray brake cleaners that contain n-hexane.

How to know if you are working with n-Hexane

Hexane is a solvent. It’s used mainly in vegetable oil extractors and in cleaners, degreasers, solvents, and spray paints. n-Hexane is one kind of hexane. Commercial hexane usually contains 10% to 60% n-hexane, so you should treat all hexane as if it’s n-hexane. Pure n-hexane is a colorless, very fast-evaporating liquid with a faint disagreeable odor.

In addition to the recent cases among auto mechanics, nerve damage from hexane exposure has been reported among workers making jet engine parts, furniture, shoes, medical, and vegetable oil, and doing printmaking. Other workers likely to be exposed to hexane include laboratory workers, construction workers, and artists. Pure n-hexane is used in laboratories.

If you may be exposed to hexane at work, ask to see the Material Safety Data Sheet (MSDS) for each brake and parts cleaning product in your work area. Your employer must have an MSDS for any workplace product that contains a hazardous substance, and must make the MSDS available to you on request. If a product contains n-hexane, the MSDS should identify it in section 2 by the CAS number 110-84-3.

Do you use any of these products?

- Amrep Brake Parts Cleaner
- Berryman 20-12 Chemical Carb and Choke Cleaner
- Berryman Chemical Air Filter Cleaner
- Berryman Non-Chromated Brake Cleaner
- Cerama Labs Brake, PJ 5 Aerosol
- Continental Research Break Master
- Dremel and American Corp. Strife
- Lectra Disc Brake Quiet
- Lectra Rim Brake Clean
- Lectra OPC-free Cleaner and Degreaser
- Lectra Pro Strength’s Degreaser
- Maico Brake and Parts Wash
- Maico Carb, Choke and Injection Cleaner
- Master Clear 5K Aerosol
- Penray Non-Chromated Brake Garg
- Seymour’s Non-Chromated Brake Cleaner
- Sherwin Williams Automotive Cleaners
- Sherwin Williams Brake Parts Wash
- Sherwin Williams Cleaner/Degreaser
- Sherwin Williams Non-Chromated Brake Cleaner
- Sherwin Williams Parts Wash
- Taylor Made Non-Chromated Brake Cleaner
- Technical Chemical Non-Chromated Brake Cleaner
- Williams Brake Cleaner, Non-Chromated
- Zep Brake and Parts Cleaner
- Zep Brake Wash, Liquid
- Zep Parts Cleaner (aerosol)

(These are some products reported to contain hexane in a recent survey. Always read the label for changes in ingredients or substitute products. Be sure to check the MSDS for whatever products you’re using.)
**Why Hexane?**

Unintended consequence of California phase-out of chlorinated solvents

Serial Phase-outs & Substitutions

1970: Stoddard solvent  
1978: CFCs  
1980: Methylene chloride  
1985: 1,1,1-Trichloroethane  
1990: Perchloroethylene  
2002: Hexane/acetone blends  
Next: 1-Bromopropane

Fire hazard  
Ozone depletion  
Carcinogen  
Ozone depletion  
Dioxin emissions  
Neurotoxicant  
Reproductive toxicant
Chemical Usage
Industry

- Regulators
- Watchdog groups
- Media
Module 7: Taking Action
**Be an informed consumer:**

- Read labels
- Do your homework! Stay informed
- Exercise your power as a consumer
- Tell your friends
BE AN EMPOWERED WORKER: COMMUNICATING WITH DECISION MAKERS

Did you know?
Cleaning products can create indoor air pollution that can affect your health.
We spend 90% of our time indoors. This is why indoor air quality is one of the top 5 health priorities of the EPA.
Sampling conducted by the CDC indicates that chemicals associated with cleaning products in over 90% of the population.
Mixing these products and adding water causes chemical reactions that can create toxic gases, some of which cause cancer.

Not all cleaning products are created equal
The terms ‘green’, ‘natural’ and ‘non-toxic’ are not regulated. Studies have shown that products making safety claims are not always accurate. That is why it is important to be an informed shopper. Using a third party evaluator to help select your products is the best way to be an informed consumer.
Worker Lobby Initiatives on Chemical Safety

Telling your story about chemical exposure:

- How and where you use it
- Why you can’t use something safer
- How it has made you feel
- How has it affected your life (and your family’s)

Hazardous Chemicals in Health Care
A Snapshot of Chemicals in Doctors and Nurses
CA State GC Initiatives
Public Review and Comment

- AB 1879 – Safe Consumer Products (& alternatives assessment)
- SB 509 – Toxics information clearing house
- SB 289 – Chemical information call-in
KNOWLEDGE IS POWER: PLUM activity