Green Chemistry Solutions for Preventing Hazardous Materials Exposure in Children’s Environments

Perspective from Lead Poisoning Prevention

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Why Discuss Lead?

Considerable experience working to prevent lead exposure

- Example of an ubiquitous hazardous exposure, which affects all ages but particularly the young

Efforts have largely been successful

- Exposure and blood levels have decreased
- Lessons learned may be useful in formulating green chemistry policies
Components in Reducing Exposure

Recognition that lead harms (toxic example)
• Varies with level and stage of development

Use of Public health programs
• Identify and eliminate exposures

Outreach, education, and publicity
• Reach public and industry to reduce use

Public and government will
• Laws and regulations on use and disposal
Recognition Lead Does Harm

Lead enters the body in multiple ways, e.g.:

- Gastrointestinal - foods, hand to mouth
- Respiratory - inhaled
- Transplacental - mother to fetus

Remains in the body, half life 30-70 days in soft tissues and in bone decades; released from bone during pregnancy
# Adverse Effects of Lead in Children

<table>
<thead>
<tr>
<th>Blood levels, micrograms per deciliter (mcg/dL)</th>
<th>Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>100-150</td>
<td>Death</td>
</tr>
<tr>
<td>50-100</td>
<td>Encephalopathy, Seizures, Kidney disease, Anemia</td>
</tr>
<tr>
<td>10-50</td>
<td>Developmental effects - hearing, learning, Vitamin D, growth <em>(subclinical, must test)</em></td>
</tr>
<tr>
<td>&lt;10</td>
<td>Increasing awareness of problems, e.g. IQ, school performance, hyperactivity, puberty delay</td>
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Levels considered elevated fell as lead use declined.

- Current CDC* “level of concern” 10 mcg/dL
- Recent studies show steepest rate of decline in IQ at levels < 10
- No safe lower level known

* Centers for Disease Control and Prevention
Recognition Lead Does Harm

Lessons:

• Despite extensive use, range of effects not initially apparent
• Once taken up persists in body
• Goal should be prevention of exposure
Use of Public Health Programs

California Childhood Lead Poisoning Prevention Program (CLPPP) 1980s; Expanded 1990s. At State and local levels:

- Work to prevent lead exposure
- Promote blood testing, since lead already in the environment
- Those with highest levels receive investigations of behaviors and homes
- Identification and removal of exposures
Blood Lead Testing

Over 700,000 California children were blood lead tested in 2009

• Results are reported to CLPPP
• Testing identifies populations and areas at increased risk and individuals who are exposed (surveillance/monitoring)
• Targeted toward those at risk
CLPPP Identified Exposures

Analysis from 2000-2002 poisonings:

• Source of lead was identified in and around housing in 69-90% (varying levels used to define lead contamination in paint and soil)

• Non-housing potential exposures found in 36%, include take home, remedies, hobbies, pottery, candy, etc.
Public Health Programs

Lessons:

• For lead, there are multiple potential sources of exposure in daily life of individual children
• Since exposure is cumulative, need to minimize all potential sources
• (Relevant to other chemicals and chemical interactions)
Outreach, Education, Publicity

Through multiple venues including CLPPP, educate, empower, reduce use, and make children’s environments safer. Reaching:

• Communities- multiple languages
• Childcare- behaviors and facilities
• Schools- students with teaching activities
• Media- generating further dissemination
• Industry- safer alternatives
Achieved Through Collaboration

Many programs address lead issues, e.g:

- Health, Developmental, and Environmental Programs
- Public- Community and advocacy groups
- Government – federal, state, and local
Outreach, Education, Publicity

Lessons:

• Wide range of groups have knowledge and interest in issues relating to toxic exposures
• All should be partners in disseminating information and working towards prevention
• Lead week collaboration is example
Public and Government Will

Concerns resulted in federal and California laws and regulations limiting lead use, e.g.:

- Paint
- Gasoline
- Water
- Tableware
- Children’s products
- Jewelry
- Plumbing
- Packaging
- Candy
Lead Laws and Regulations

Additional limits:
- Wheel weights
- Ammunition
- Daily exposure limits
- Worker training

Lessons:
- Will exists to minimize and prevent exposures
- Multiple agency roles are sometimes confusing
- Coordination between agencies challenging but key
Success With Lead

Fewer young children with lead ≥ 10 mcg/dL
- 6 to 14% of those tested in 1988-92 (studies in Sacramento and Santa Cruz)
- Statewide, less than 0.4% in 2009

Fewer with blood lead ≥ 5 mcg/dL
- 26% in 1988-94 (U.S. data)
- Statewide, 3.9% in 2009
Even With Reduced Levels

In California in 2009, in children under age 6 years, we identified:

- 2,400 with blood lead $\geq 10$ mcg/dL
- 25,000 with lead $\geq 5$ mcg/dL
Final Lessons From Lead

Toxic exposures may persist in the environment and in children’s bodies

- Hard to eradicate
- New sources must be addressed

Continuing public and government will is essential to fully achieve prevention and health goals