Toxics Use Reduction Institute

MA TURI Five Chemical Alternatives Assessment Study

Potential for HPV to Serve as a Supplemental Data Source

Liz Harriman
Toxics Use Reduction Institute

TURI
Toxics Use Reduction Institute
University of Massachusetts Lowell
One University Avenue
Lowell, Massachusetts 01854-2866
978.934.3275 fax: 978.934.3050
www.turi.org

Overview

- 5 Chemicals Alternatives Assessment Study – Overview
- Principal EH&S Data Sources
- Data Issues
- HPV Case Example: DEHP

What is the “5 Chemicals Study?”

- The Commonwealth of Mass. requested that TURI assess the feasibility of adopting alternatives to 5 chemicals:
  - Lead
  - Formaldehyde
  - Perchloroethylene
  - Hexavalent chromium
  - di-(2 ethylhexyl)phthalate (DEHP)

- Project began Aug 2006; Final report submitted to legislature June 30, 2006

Legislative Request

- For each substance:
  - Describe the significant uses in MA
    - Manufacturing
    - Products
  - Identify potential human health and environmental impacts
  - Identify possible alternatives, proven and emergent, for selected uses

Legislative Request

- For each alternative chemical or technology*:
  - Assess their potential to serve as substitutes for specific applications
    - Technical feasibility
    - Economic feasibility
    - Environmental and occupational health & safety evaluation

** chemical, materials and technological alternatives will all be considered*

TURI goals

- Conduct an objective and scientific alternatives assessment
- Be transparent and open
- Get input from major stakeholders in Massachusetts
- Produce results that will help companies and consumers make better decisions

TURI goals

- Results **did not**
  - Advocate or state preference for any particular alternatives
  - Recommend bans or phase-outs of any chemicals or any uses of chemicals

Study Process

- Resources:
  - Institute staff, University staff
  - Consultants and outside experts
- Very tight schedule (10 months)
- Common methodology developed and used for each assessment
- Massachusetts stakeholder input

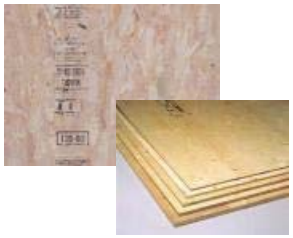
Setting Priorities

- Schedule and Budget require assessing a subset of chemical uses and alternatives
- Focus on uses and alternatives where assessment results will be of most value
- Stakeholder input used to select high priority uses and alternatives

Selected Chemical Uses

Perchloroethylene

Formaldehyde



DEHP

Lead

Hexavalent Chromium

Results

- In every application studied, at least one alternative was identified that was
  - commercially available,
  - was likely to meet the technical requirements of some users, and
  - was likely to have reduced environmental and occupational health and safety impacts.
- Study available at www.turi.org

Key EH&S Parameters – Preferred Sources

- Published, publicly available, references from authoritative bodies
  - HSDB, NIOSH, IRIS, IARC, USEPA fact sheets, NFPA
  - Models – PBT Profiler
- State/International sources
  - CA Prop 65, EU ESIS, WMA, IPCC
- Industry Sources
  - MSDS
- Published studies

Key EH&S Parameters - Environmental

- PBT {PBT Profiler}
  - Persistence/Biological Degradability
  - Bioaccumulation
  - Aquatic Toxicity
- Environmental Mobility {HSDB, PBT Profiler}
  - Water solubility, Kd, log Kow, Koc
- Degradation products {HSDB, studies}
- Ozone depletion potential {WMA}
- Global Warming Potential {IPCC}

Key EH&S Parameters – Human Health

- Human health – Chronic/CMR
  - Carcinogenicity {EPA, IARC}
  - Mutagenicity {EU ESIS}
  - Reproductive/developmental toxicity {EU ESIS, CA Prop 65}
- Endocrine Disruption – *no accepted standard*

Key EH&S Parameters – Human Health

- Human health – acute/occupational
  - Oral LD50, Inhalation LC50, Dermal Ld50 {HSDB}
  - IDLH, PEL, REL {NIOSH}
  - Irritation {HSDB, NIOSH, MSDS}
  - Skin Sensitization {ACGIH, AIHA}
  - Reference Dose {HSDB, IRIS}
  - Metabolites of concern {HSDB}

Key EH&S Parameters - Safety

- Safety
  - Corrosivity {HSDB, MSDS}
  - Reactivity {NIOSH, MSDS}
  - Flash Point {HSDB, MSDS}
  - Flammability {NIOSH, MSDS}
  - Vapor Pressure {HSDB, MSDS}

EH&S Data Issues

- “Authoritative bodies” don’t always have most up-to-date information
- Data discrepancies
- Data gaps
- Not enough measured data (e.g., PBT), so used modelling results
- No US consensus on indicator (e.g., endocrine disruption)
- Inability to include complexity, different interpretations of study results, etc.

EH&S Assessment Issues

- Mixtures
- Material alternatives vs. chemical alternatives
  - e.g., different flooring materials rather than different plasticizers
- Process alternatives – achieve function, but no comparable substance to compare against
  - Video dissection vs. formaldehyde preserved specimens

HPV

- HPVIS searched for DEHP and plasticizer alternatives
- Looked for selected parameters:
  - PB and T
  - Water solubility, log Kow, vapor pressure
  - Acute toxicity: LC50, LD50

Plasticizers in HPVIS – Alternatives Screening Phase

- Persistence and Bioaccumulation
  - 25 out of 41 Plasticizer alternatives
    - *Located by CAS #, not retrievable by name*
  - Many data gaps, a few chemicals well studied, most no data
  - Most persistence data estimated by calculation using EPA tools
  - Great variation among studies
    - E.g., DIDP 5 studies measured bioaccumulation factor: .6, <3.6, <14.4, 116, 4500

Plasticizers in HPVIS – Alternatives Screening Phase

- Persistence and Bioaccumulation (cont)
  - Persistence in water consistently higher in HPVIS than via PBT Profiler
    - wouldn't have changed screening results, those chemicals were already considered persistent due to sediment values
    - HPVIS values typically derived from HYDROWIN in EPISuite

Plasticizers in HPVIS – Alternatives Assessment phase

- Water Solubility
  - 4 of the 8 alternatives to DEHP were located in HPVIS
  - DEHP: *no data in HPVIS*

DGD: 3.4 mg/L (PBT Profiler) vs. 8.69 (HPVIS)

DINP: 0.0003 (study) vs. 0.00061 (HPVIS)

TOTM: 4.5×10^{-8} (PBT Profiler) or 3.85×10^{-4} EPA OPPT

vs. 3.9 x 10-4 to .13 (HPVIS)

DEHA: 0.78 vs. 0.0032 (HPVIS)

Plasticizers in HPVIS – Alternatives Assessment phase

- LC50, LD50
  - Additional studies provide additional information – values typically similar to those in HSDB
  - Different study conditions make comparisons across values difficult

Would the HPVIS have improved our assessment?

+ More data to choose from
  - could have used as supplement to other information or to highlight inconsistencies and parameters needing further investigation, great summaries for studies
+ Would be assured that up-to-date industry data included
- Time consuming to access
- Different study conditions complicate comparison
- Many estimated/calculated values
- Many data gaps in HPVIS
- Didn't fill our data gaps - newer, less studied chemicals were unlikely to be in HPVIS