Chemical Screening 101

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Towards Safer Design Strategies: Using Toxicology Tools & Concepts

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GHS Screening Pilot Project

Goals

• Demystify the hazard screening process & provide upgrade to list-based approaches
• Demonstrate value of GHS classification for evaluating hazard
• Complement ACC efforts to evaluate multiple criteria, including hazard, in making chemical-selection decisions

Output

• Searchable database of GHS/P/B classifications and hazard forecasts for all REACH registered chemicals
Overview of ACC/SMO Technical Projects

Product Evaluation Framework

Marketplace focus

Safety Information
Hazard Analysis
Exposure Assessment
Life Cycle Information
Alternative Assessment

GHS screening
Tiered exposure
Multicriteria decision analysis

Chemical Management Modules

TOWARD MORE COMPLETE EVALUATIONS

Overview of ACC/SMO Technical Projects
Criticisms of GHS as a Screening Tool

- **Hazard information is self-reported**
  - not reliable

- **Not comprehensive**
  - persistence & bioaccumulation
  - endocrine activity

- **Does not provide a “benchmark” score**
  - subject to interpretation
  - difficult to compare substances

- **Does not include expert assessment**

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- ECHA data base of all classifications submitted by REACH registrants

- Use P&B data from Canadian DSL

- Map GHS category & class data to hazard level/forecast

- GHS approach limits potential for bias & promotes transparency
**GreenScreen® Overview**

**GreenScreen® Full Assessment**
Individual chemical assessment, limited number of licensed profilers, proprietary, $  

Benchmark Scoring:  
1: Chemical of high concern  
2: Use but search for substitutes  
3: Use but still opportunity for improvement  
4: Safer chemical

**GreenScreen List Translator™**
List of lists (40+), free, automated  

Scoring:  
LT-1 = Most likely Benchmark 1  
LT-P1 = Possible Benchmark 1  
LT-UNK = Insufficient information
# HPD for Low-VOC Paint

**Interior Latex Flat Finish**

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>%Weight</th>
<th>GreenScreen</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>60-65</td>
<td>4</td>
</tr>
<tr>
<td>Titanium dioxide</td>
<td>20-25</td>
<td>LT-1</td>
</tr>
<tr>
<td>Methyl methacrylate</td>
<td>20-25</td>
<td>LT-U</td>
</tr>
<tr>
<td>Nepheline syenite</td>
<td>15-20</td>
<td>LT-U</td>
</tr>
<tr>
<td>Kaolin, calcined</td>
<td>5-10</td>
<td>LT-P1</td>
</tr>
<tr>
<td>2,2-ethyleneoxydiethyl bis(2-ethylhexanoate)</td>
<td>1-5</td>
<td>LT-U</td>
</tr>
<tr>
<td>Alcohols C9-11, ethoxylated</td>
<td>1-5</td>
<td>LT-P1</td>
</tr>
<tr>
<td>Silica, amorphous</td>
<td>1-5</td>
<td>LT-1</td>
</tr>
<tr>
<td>Alumina trihydrate</td>
<td>1-5</td>
<td>2</td>
</tr>
<tr>
<td>Ferric oxide yellow</td>
<td>Res</td>
<td>LT-U</td>
</tr>
<tr>
<td>Potassium carbonate, anhydrous</td>
<td>Res</td>
<td>LT-U</td>
</tr>
<tr>
<td>Pentapotassium triphosphate</td>
<td>Res</td>
<td>LT-U</td>
</tr>
</tbody>
</table>

CLASSIFICATION: 09 00 00.00 Finishes

PRODUCT DESCRIPTION: Zero VOC interior paint flat finish
Flooring Coating Example - List Translator™

<table>
<thead>
<tr>
<th>Material</th>
<th>% Wt. Part</th>
<th>% Wt. Whole</th>
<th>Hazard</th>
<th>Green Screen</th>
</tr>
</thead>
<tbody>
<tr>
<td>[140-31-8] Aminopropylamine</td>
<td>5.00 - 11.00</td>
<td>5.00 - 11.00</td>
<td>![Hazard Icon]</td>
<td>![Green Screen Icon] LT-P1</td>
</tr>
</tbody>
</table>

**LT-P1 = Possible Benchmark 1**

**Benchmark 1 (including LT-P1) chemicals are deselected**
Flooring Coating Example Using GHS-based Hazard Screen
Floor Coating Example - GHS Forecast

- Method uses GHS data - rather than lists - to screen for hazard
- Provides robust and transparent forecast

Looking at the GHS data, aminoethylpiperazine forecast is GHS H2, rather than LT-P1
Floor Coating Example – REACH Data

• Link to ECHA data base
## Comparison to Hazard Screening Tools

<table>
<thead>
<tr>
<th>Chemical</th>
<th>GreenScreen List Translator</th>
<th>GreenScreen Full Assessment</th>
<th>GreenSuite Adjusted</th>
<th>USEPA DfE</th>
<th>SciVera Lens</th>
<th>GHS Forecast</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caffeine</td>
<td>LT-1</td>
<td>2</td>
<td>Very high</td>
<td>High</td>
<td>High</td>
<td>3</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>LT-U</td>
<td>2</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>2</td>
</tr>
<tr>
<td>Ethylene Glycol</td>
<td>LT-P1</td>
<td>1</td>
<td>Very high</td>
<td>High</td>
<td>Moderate</td>
<td>3</td>
</tr>
<tr>
<td>Glycolic Acid</td>
<td>LT-U</td>
<td>1</td>
<td>High</td>
<td>High</td>
<td>Very high</td>
<td>2</td>
</tr>
<tr>
<td>DBP</td>
<td>LT-1</td>
<td>1</td>
<td>Very high</td>
<td>Very high</td>
<td>High</td>
<td>1</td>
</tr>
<tr>
<td>BIT</td>
<td>LT-U</td>
<td>U</td>
<td>Very high</td>
<td>High</td>
<td>Very high</td>
<td>2</td>
</tr>
<tr>
<td>HBCD</td>
<td>LT-1</td>
<td>1</td>
<td>Moderate</td>
<td>Very high</td>
<td>Very high</td>
<td>1</td>
</tr>
</tbody>
</table>

Panko JM et al. 2016.
Ethylene Glycol - Evaluation Details

GreenScreen® full assessment (available from http://theic2.org)

- “Ethylene glycol was assigned a score of High for developmental toxicity based on it being designated as a Category A developmental toxicant by NTP . . . clear evidence of adverse developmental toxicant effects”

NTP CERHR (2004)

- Clear evidence of adverse effects (high oral doses)
- “the NTP judges the scientific evidence sufficient to conclude that EG may adversely affect human development if oral exposures are sufficiently high.”

Since 2004, additional mechanistic work supports the conclusion that exposure to EG “is unlikely to achieve levels of human blood glycolic acid concentrations that could lead to developmental toxicity” (Health Canada 2014)
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