Who is Klean Kanteen®?

Family and employee owned, located in northern CA, since 2004

Reusable, durable, safe food and beverage containers

Outdoor, grocery / natural products, home + housewares
Klean Coat – a Safer Durable Finish

• In 2018 launched new exterior finish called Klean Coat
  – Durable, powder coating finish
  – First product development project with material selection including chemical hazard assessment
  – Used GreenScreen tools to assess hazard level of different coating options and select the safer material
Why GreenScreen

- Going back to 2012-2013
  - Encouraged to get involved with BizNGO Workgroup
    - Guide to Safer Chemicals
  - Member, Outdoor Industry Association Sustainability Working Group
    - Chemicals Management Framework
Why GreenScreen

• 2014-2016 - Integration into Klean Kanteen product development
  – *Developed tools and process to assess product chemistry and avoid hazardous substances*

• GreenScreen was selected as the hazard assessment method to assess + avoid hazardous substances
  – *robust science foundation*
  – *easy enough for non-toxicologist to execute*
  – *modest time and cost requirements*
  – *info for decision-making*
Material Options – Klean Coat Case Study

• Step 1 – confirm requirements of material selection in early product development
  – Late 2016 – product development team kicked off durable coating project
  – Chemical safety requirement for material selection = select safer material among available options based on GreenScreen assessment

• Step 2 - Sourcing presents options based on project specifications
  – Two suppliers, three powders + one supplier, current paint coating

• Step 3 - Collect bill of substances (BOS) for each material
  – All intentionally added chemicals
  – Known impurities >=0.01% by wt;
  – CASRN and % by wt for each chemical
  – Chemical function and supplier for each chemical
  – Material name, supplier, name of person completing the form
Initial Chemical Screen – Klean Coat Case Study

- Step 4 – Review completed Bill of Substances against Klean Restricted Substances List
  - Confirmed no substances from Klean RSL in coating options
- Step 5 - Create blank chemical hazard summary table for each material from Bill of Substances
  - Used GreenScreen Hazard Summary table format
Initial Chemical Screen – Klean Coat Case Study

- Step 6 - Screen each chemical using a GreenScreen List Translator™
  - *Used automated tool by Healthy Building Network called Pharos*
  - *Recorded findings in the hazard summary table*
Initial Chemical Screen – Klean Coat Case Study

- **Step 7 – Assess material**
  - Benchmark scores and indications - BM1 (Avoid), BM2 (Use, seek substitute), BM3 (Use, continuous improvement), BM4 (Prefer), U (Unspecified)
    - followed GreenScreen indications for ‘Use’ or ‘Avoid’
  - List Translator scores and indications: LT-1 (Likely BM1), LT-P1 (Possible BM1), LT-UNK (Unknown)
    - applied Klean rules indicating ‘Use’ or ‘Perform GreenScreen to obtain Benchmark score’

<table>
<thead>
<tr>
<th>Substance Name</th>
<th>CAS#</th>
<th>BM/LT Score</th>
<th>% by wt</th>
<th>Carcinogenicity</th>
<th>Mutagenicity/Genotoxicity</th>
<th>Reproductive Toxicity</th>
<th>Developmental Toxicity</th>
<th>Endocrine Activity</th>
<th>Acute Toxicity</th>
<th>Systemic Toxicity</th>
<th>Neurotoxicity</th>
<th>Skin Sensitization*</th>
<th>Respiratory Sensitization*</th>
<th>Skin Irritation</th>
<th>Acute Aquatic Toxicity</th>
<th>Chronic Aquatic Toxicity</th>
<th>Persistence</th>
<th>Bioaccumulation</th>
<th>Reactivity</th>
<th>Flammability</th>
<th>Multiple</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance A</td>
<td>xxxxxx-xx-x</td>
<td>LT-UNK</td>
<td>60</td>
<td>C</td>
<td>M</td>
<td>R</td>
<td>D</td>
<td>E</td>
<td>A</td>
<td>T</td>
<td>M</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>M</td>
<td>L</td>
<td>H</td>
<td>U</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Substance B</td>
<td>xxx-xx-x</td>
<td>BM-2</td>
<td>20</td>
<td>L</td>
<td>L</td>
<td>DG</td>
<td>M</td>
<td>DG</td>
<td>L</td>
<td>DG</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>U</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Substance C</td>
<td>xxx-xx-x</td>
<td>LT-UNK</td>
<td>8</td>
<td>L</td>
<td>L</td>
<td>DG</td>
<td>M</td>
<td>DG</td>
<td>L</td>
<td>DG</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>U</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Substance D</td>
<td>xxxxx-xx-x</td>
<td>LT-P1</td>
<td>8</td>
<td>L</td>
<td>L</td>
<td>DG</td>
<td>M</td>
<td>DG</td>
<td>L</td>
<td>DG</td>
<td>L</td>
<td>M</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>U</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
<tr>
<td>Substance E</td>
<td>xxxxx-xx-x</td>
<td>BM-3</td>
<td>4</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>DG</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>L</td>
<td>H</td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>H</td>
<td>U</td>
<td>L</td>
<td>L</td>
<td></td>
</tr>
</tbody>
</table>
Assess with GreenScreen – Klean Coat Case Study

• Step 8 - Assess chemicals with GreenScreen
  - Hired ToxServices, a Licensed GreenScreen Profiler, to complete GreenScreen assessments for the Klean Coat project
  - 3 powder materials and 1 paint = 18 unique chemical substances
  - Assessed 12 of 18 chemical substances with GreenScreen
  - Licensed Profiler assessment took 4-6 weeks to complete*
  - Dropped paint from process, lack of information from supplier
  - Evaluation of GreenScreen results indicated all initial substances acceptable for use
  - Additives proposed later in project, substitution implemented successfully
Comparing Material Options

- Step 9 – Compare hazard summary tables following GreenScreen assessment and select safer option

<table>
<thead>
<tr>
<th></th>
<th>Group I Human</th>
<th>Group II and II* Human</th>
<th>Ecotox</th>
<th>Fate</th>
<th>Physical</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Carcinogenicity</td>
<td>Mutagenicity/Genotoxicity</td>
<td>Reproductive Toxicity</td>
<td>Developmental Toxicity</td>
<td>Endocrine Activity</td>
</tr>
<tr>
<td></td>
<td>S</td>
<td>R*</td>
<td>S</td>
<td>R*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>M</td>
<td>R</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>M</td>
<td>M</td>
</tr>
<tr>
<td></td>
<td>M</td>
<td>L</td>
<td>L</td>
<td>L</td>
<td>L</td>
</tr>
</tbody>
</table>

**Group I Human**

- Carcinogenicity
- Mutagenicity/Genotoxicity
- Reproductive Toxicity
- Developmental Toxicity
- Endocrine Activity
- Acute Toxicity
- Systemic Toxicity
- Neurotoxicity
- Skin Sensitization*
- Respiratory Sensitization*
- Skin Irritation
- Eye Irritation
- Acute Aquatic Toxicity
- Chronic Aquatic Toxicity
- Persistence
- Bioaccumulation
- Reactivity
- Flammability

**Group II and II* Human**

- Carcinogenicity
- Mutagenicity/Genotoxicity
- Reproductive Toxicity
- Developmental Toxicity
- Endocrine Activity
- Acute Toxicity
- Systemic Toxicity
- Neurotoxicity
- Skin Sensitization*
- Respiratory Sensitization*
- Skin Irritation
- Eye Irritation
- Acute Aquatic Toxicity
- Chronic Aquatic Toxicity
- Persistence
- Bioaccumulation
- Reactivity
- Flammability
Summary – Klean Coat Case Study

• Developed a material selection process based on principles recommended by BizNGO and Outdoor Industry Association Sustainability Working Group >> know & assess product chemistry to avoid hazards

• Adopted GreenScreen and GreenScreen List Translator to do the heavy lifting >> hazard assessment

• Resulted in a safer powder finish >> Klean Coat