Design for the Environment
Approaches to Safer Chemicals

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Design for the Environment Program

Office of Pollution Prevention and Toxics
DfE’s Mission

• Promote Design of Safer Products
  ▪ Safer chemical ingredients
  ▪ Life cycle impacts

• Develop Tools to Identify Safer Chemicals
  ▪ OPPT technical tools and expertise
  ▪ Multi-stakeholder participation

• Results
  ▪ Industry partners reduced more than 750 million pounds of chemicals of concern last year by substituting safer chemicals
Design for the Environment (DfE) Programs

• **Safer Product Labeling:** High exposure, release products; Label innovative formulations made with low hazard ingredients with the DfE logo as incentive

• **Lifecycle Assessment:** Concerns exist throughout lifecycle; use LCA to identify better alternatives and otherwise improve risk management

• **Chemical Alternatives Assessment:** Environmental and human health impacts of chemicals of concern & alternatives; Promote informed substitution.

• **Best Practices:** Safer alternatives are not available, reduce worker and community exposure
DfE Decision Logic

End Use, Function

Substitution Need

Potential Alternatives?

Yes/Uncertain

Chemical Hazard Assessment: Select Preferable Alternatives

Technical & Economic Considerations

Additional Concerns?

Drivers

Best Practices

Continue Search

Select & Implement Safer Alternatives

Life Cycle

Yes

LCA – Partial or Full

Exposure

Yes

Risk Assessment

Office of Pollution Prevention and Toxics
What is Safer?

- Hazard can be ranked on a continuum
  - OPPT
    - New Chemicals Program
      - Sustainable Futures Program
    - Existing Chemicals Program
  - OPP
  - GHS
  - EU REACH Annex IV
The function of a chemical in a formula is related to p-chem properties and toxicity.

Criteria can be tailored to functional class to distinguish safer chemicals.

Functional use classes:
- Surfactants
- Solvents
- Chelating and sequestering agents
- Fragrances
- Colorants
- Preservatives
DfE Criteria

- Carcinogenicity
- Mutagenicity/Genotoxicity
- Acute mammalian toxicity
- Respiratory & Skin Sensitization
- Eye & Skin Irritation/Corrosivity
- Reproductive and Developmental Toxicity
- Repeated Dose Toxicity
- Neurotoxicity
- Aquatic toxicity
- Persistence
- Bioaccumulation
- Endocrine activity
Safer Product Labeling Program

- Promote use of safer chemicals in products
- Review every ingredient by functional use class
  - Pass/Fail based on criteria
- Review formulation as a whole
  - Synergistic effects
  - pH
  - Performance testing
- Partnership Agreement
  - Use DfE Logo
  - Annual audits
  - Over 2000 products from several hundred manufacturers
### SPLP Chemical Evaluation

#### Carcinogenicity

<table>
<thead>
<tr>
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<th>Pass</th>
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</thead>
<tbody>
<tr>
<td>No known, presumed, or suspected human carcinogens (based on GHS criteria and authoritative lists)</td>
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#### Developmental Toxicity

<table>
<thead>
<tr>
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<tbody>
<tr>
<td><strong>Oral (mg/kg/day)</strong></td>
<td>&gt; 250</td>
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<tr>
<td><strong>Dermal (mg/kg/day)</strong></td>
<td>&gt; 500</td>
</tr>
<tr>
<td><strong>Inhalation (vapor, gas, mg/L/day)</strong></td>
<td>&gt; 2.5</td>
</tr>
<tr>
<td><strong>Inhalation (dust/mist/fume, mg/L/day)</strong></td>
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#### Repeated Dose Toxicity (90-day study)

<table>
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<tr>
<td><strong>Dermal (mg/kg-bw/day)</strong></td>
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<td><strong>Inhalation (vapor/gas) (mg/L/6h/day)</strong></td>
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<tr>
<td><strong>Inhalation (dust/mist/fume) (mg/L/6h/day)</strong></td>
<td>&gt; 0.2</td>
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Chemical alternatives assessments:

- Identify and evaluate potentially safer alternatives
- Involve stakeholders from across the spectrum of interested parties

The outcome of an alternatives assessment:

- Provides the best information on hazard from literature and models (Based on New Chemicals Program approaches)
- Helps stakeholders choose safer alternatives
  - Provides information that manufacturers can use to create more sustainable products
  - Helps minimize the potential for unintended consequences by reducing the likelihood of moving to alternatives that could pose a concern
### AA Chemical Evaluation Approach

#### Table 4-1

<table>
<thead>
<tr>
<th>Company</th>
<th>Chemical</th>
<th>% in Formulation³</th>
<th>Human Health Effects</th>
<th>Ecotoxicity</th>
<th>Environmental</th>
<th>Potential Routes of Exposure</th>
<th>Reactive or Additive?</th>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Cancer Hazard</td>
<td>Skin Sensitizer</td>
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<td>Developmental</td>
<td>Neurological</td>
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<td>Albemarle</td>
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<td>L</td>
<td>L²</td>
<td>L</td>
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<tr>
<td></td>
<td>Proprietary E Tetra bromophthalate diol diester</td>
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<td>L</td>
<td>L²</td>
<td>L</td>
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<tr>
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<td>L</td>
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Chemical hazard exists on a continuum

DfE considers chemical hazard within the context of chemical function

DfE criteria, which is used to define “safer”, closely mirrors GHS criteria

DfE approaches facilitate the identification of safer alternatives and informed substitution to minimize unintended consequences
For more information:

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