BizNGO Plastics Scorecard –
Identifying More Sustainable Plastics

David Brower Center,
Berkeley, CA
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Sustainability Consultants

Mikhail Davis
Interface

Co-Chairs
BizNGO Sustainable Materials Workgroup
3:40 – 5:00 pm - Sustainable Plastics

Moving to more sustainable plastics
What are the opportunities? What are the challenges?
What are some examples of sustainable plastics? How can we analyze options?

BizNGO Plastics Scorecard Overview
What is the purpose of the Scorecard? Who are the intended users? What is the overall framework for the Scorecard?

The Safer Chemicals Module of the Plastic Scorecard
How does this module assess the chemistry of plastics? How can the module move us towards safer plastics?

Next Steps for 2013
What should the Sustainable Materials Work Group’s priorities be for 2013 to build out and/or pilot the Plastics Scorecard? Who else should we partner with?
Moving to more sustainable plastics

What are the opportunities? What are the challenges? What are some examples of sustainable plastics? How can we analyze options?
In search of sustainable plastics: Nylon 6,10 vs. Nylon 6,6

CO2eq

- 70%

PA 6,10

PA 6,6

BizNGO
FOR SAFER CHEMICALS AND SUSTAINABLE MATERIALS
Discussion

Q. What are some other examples of sustainable plastics – polymer and additive examples?

q. What makes this polymer/additive sustainable?

q. What could be some concerns/downsides from a sustainability standpoint?
## Sustainable Plastics Examples

<table>
<thead>
<tr>
<th>Polymer/Additive Example</th>
<th>Sustainability Advantages</th>
<th>Potential Sustainability Downsides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nylon 6,10</td>
<td>Can use castor-based (bio-based) sebacic acid rather than petro based adipic acid</td>
<td>Impacts on land and water associated with growing castor seeds</td>
</tr>
</tbody>
</table>
BizNGO Plastics Scorecard Overview

What is the purpose of the Scorecard? Who are the intended users? What is the overall framework for the Scorecard?
Principles for Sustainable Plastics

Principles
1. Sustainable Resources
2. Closed Loop Systems
3. Energy Efficient & Renewable
4. Safer Chemicals
5. Healthy Workplaces & Communities

“...Principles for Sustainable Plastics [will] provide the foundation for a BizNGO framework that evaluates, identifies and selects more sustainable plastics.”
**BizNGO Sustainable Plastics Scorecard**

A decision making tool for material developers, product designers, material and product specifiers, and purchasers to design and select more sustainable plastics.

A tool to track progress toward more sustainable plastics
# Plastics Scorecard Framework

<table>
<thead>
<tr>
<th>Sustainable Plastic Principle</th>
<th>Life Cycle Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Feedstock Production</td>
</tr>
<tr>
<td></td>
<td>Polymer Manufacturing</td>
</tr>
<tr>
<td></td>
<td>Product Use (Product Content)</td>
</tr>
<tr>
<td></td>
<td>End-of-life</td>
</tr>
<tr>
<td>1. Sustainable Resources</td>
<td></td>
</tr>
<tr>
<td>2. Closed Loop Systems</td>
<td></td>
</tr>
<tr>
<td>3. Energy Efficient &amp; Renewable</td>
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</tr>
<tr>
<td>4. Safer Chemicals</td>
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<td>5. Healthy Workplaces &amp; Communities</td>
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## Safer Chemicals Module of the Scorecard

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**Safer Chemicals Module**
## Chemical Scores for Major Polymers

<table>
<thead>
<tr>
<th>Primary Chemicals</th>
<th>Intermediates</th>
<th>Monomer(s)</th>
<th>Catalysts*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benzene 71-43-2</td>
<td>Cumene 98-82-8</td>
<td>Bisphenol A 80-05-7</td>
<td>Pyridine 110-88-7</td>
</tr>
<tr>
<td>Propylene 115-07-1</td>
<td>Sulfuric Acid 7664-93-9</td>
<td>Phosgene 75-44-5 (BM P1)</td>
<td>Pyridine 110-88-7</td>
</tr>
<tr>
<td></td>
<td>Acetone 67-64-1 (BM P1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phenol 108-95-2</td>
<td>P-t-butylphenol 98-54-4 (BM P1)</td>
<td></td>
</tr>
</tbody>
</table>

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### Chemical Scores for Major Polymers

Plastics provide benefits to people across the globe. Lightweight, durable, flexible and easy to form, their use continues to grow rapidly.....
**Safer Chemicals Module of the Scorecard**

**Goals:**

1. To promote plastics that use inherently safer chemicals in all steps of polymer production and have safer degradation and transformation byproducts; and

2. To promote the use of plastic additives that are inherently safer to consumers and the environment.

Guided by the **12 Principles of Green Chemistry**, in particular:

*Design safer chemicals and products:* Design chemical products to be fully effective, yet have little or no toxicity.

*Design less hazardous chemical syntheses:* Design syntheses to use and generate substances with little or no toxicity to humans and the environment.
Safer Chemicals Module of the Scorecard

Chemical categories assessed

Primary chemical production → Chemical Feedstocks → Feedstock Production

Primary Chemicals → Intermediate chemical production → Intermediate Chemicals → Monomer production

Polymer Manufacturing

Catalysts

Monomers

Polymerization

Catalysts

Plastic Compounding

Additives → Compounding → Compounded plastic
Safer Chemicals Module of the Scorecard

• Uses the GreenScreen™ to assess chemicals

• Two Tiers:

**Tier 1: Polymer Manufacturing**
- Chemicals associated with polymer production
- Allows comparison of one base polymer to another

**Tier 2: Plastic Compounding**
- Polymer + additives
- Allows analysis and comparison of polymer and additive options
**Safer Chemicals Module of the Scorecard**

**Tier 1: Polymer Manufacturing**

<table>
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<tr>
<th>Polymer</th>
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<th>Intermediates</th>
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<th>Catalysts*</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC</td>
<td>Benzene 71-43-2</td>
<td>Cumene 106-82-8</td>
<td>Bisphenol A 89-05-7</td>
<td>Pyridine (M) 110-86-1</td>
</tr>
<tr>
<td></td>
<td>Propylene 115-07-1</td>
<td>Sulfuric Acid 7664-93-9</td>
<td>Phosgene 75-44-5 (BM P1)</td>
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| PLA     | Sugar (dextrose aka l-glucose) 921-60-8 | Lactic Acid 50-21-5 | Lactide (L-lactide - 4511-42-6; DL-lactide - 615-95-2) | Tin Octanoate 301-18-8 |

- Results based only on GreenScreen List Translator - identifies BM 1 & Possible BM1 chemicals
- **Red cell** = GreenScreen List Translator Benchmark 1
- **Red text** = GreenScreen List Translator Possible Benchmark 1

**In 2013 will conduct full GS assessments for PET, PP & PLA**
** Safer Chemicals Module of the Scorecard **

** Tier 2: Plastic Compounding **

<table>
<thead>
<tr>
<th>Polymer</th>
<th>Primary Chemical Score</th>
<th>Intermediate Chemical Score</th>
<th>Monomer Score</th>
<th>Catalyst Score</th>
<th>Additives</th>
<th>Score</th>
<th>End-of-Life Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>PC</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>Titanium dioxide 13463-67-7</td>
<td>1</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ultramarine Violet 12769-96-9</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Antimony\Chromium\Titanium Buff Rutile 68186-90-3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Carbon Black 1333-86-4</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>ABS carrier 9003-56-9</td>
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</tr>
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</table>

** Current version does not roll-up polymer (Tier 1) or compounded plastic (Tier 2) chemical scores into a single score for polymer/plastic **
Next Steps for 2013

What should the Sustainable Materials Work Group’s priorities be for 2013 to build out and/or pilot the Plastics Scorecard? Who else should we partner with?
Small Group Discussion

Reflecting on the discussion and presentation, discuss:

1. What dimensions of sustainable plastics are top priority for your organization?
   
   E.g.,
   
   - toxic chemicals/restricted substances
   - recyclability
   - recycled content
   - biobased content
   - biodegradable
   - carbon footprint

2. What is needed to move to sustainable plastics?

3. What should the priorities should be for building out the Plastics Scorecard in 2013? Other activities focused on sustainable plastics?