

The Path Forward:

Green Chemistry Innovation

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16th Annual Pollution Prevention Conference & Trade Show

Plainfield, Indiana

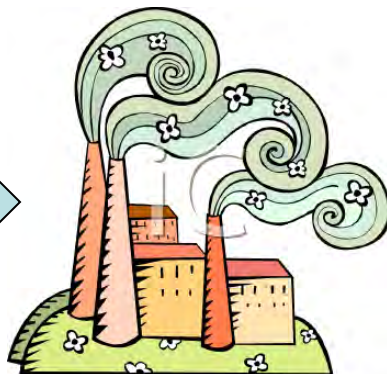
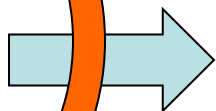
September 26, 2013

Sound Chemical Management Strategies

Green Chemistry



Materials



Production
Processes



Products



Wastes

Chemical Design

What are the consistent challenges facing companies?



Many, including the lack of:

- Toxicity data on many chemicals.
- Systems, in most sectors, to track chemicals and toxicity information on chemicals/products in supply chains.
- Information on safer alternatives: safety, technical performance and cost.

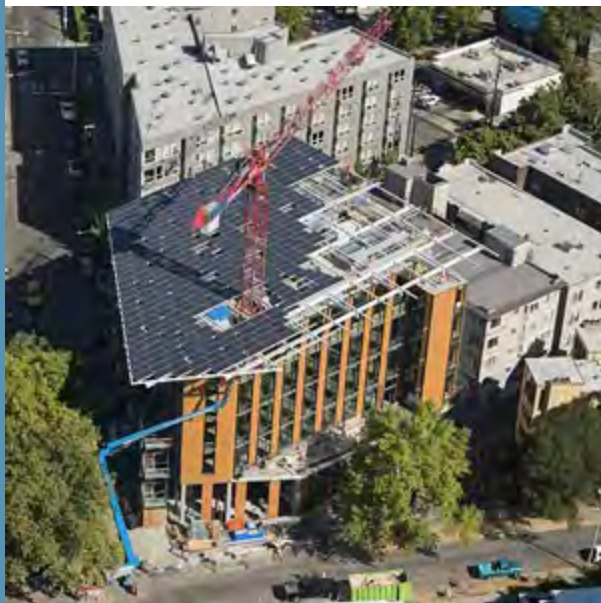
More challenges ...



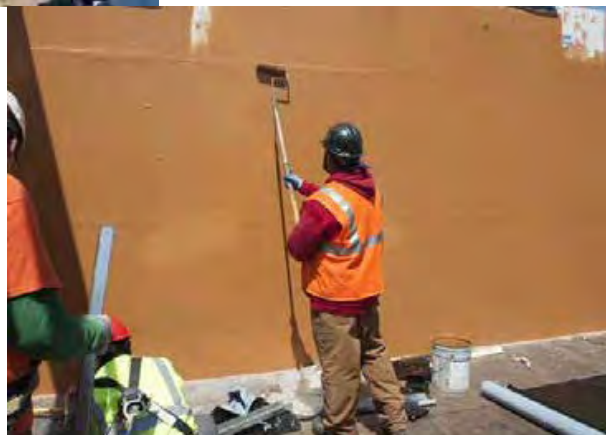
Lack of:

- Clear, widely-accepted criteria for defining and recognizing safer products.
- Incentives to invest in safer chemistries and products.
- Ways to motivate and bridge the gap between what brands and chemical users want and what the chemical industry provides.

Green Chemistry Innovation – Economic Opportunity by going Phthalate-free @ The Bullitt Center in Seattle



Tom Schneider, Building Envelope Innovations



The building is protected from liquid water by the application of the product, but water vapor molecules safely pass through the barrier to allow the building to breath.

The Red List: Living Building Challenge requirements:

The project cannot contain any of these Red List materials:

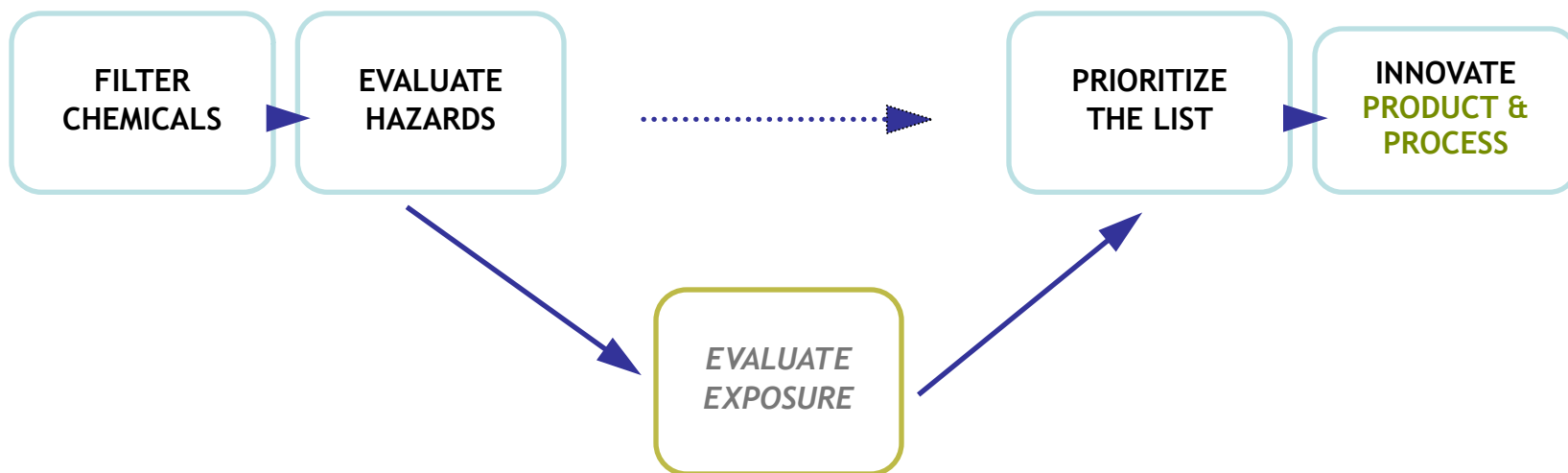
- Asbestos
- Cadmium
- Chlorinated Polyethylene and Chlorosulfonated Polyethylene⁴³
- Chlorofluorocarbons (CFCs)
- Chloroprene (Neoprene)
- Formaldehyde (added)
- Halogenated Flame Retardants⁴⁴
- Hydrochlorofluorocarbons (HCFCs)
- Lead (added)
- Mercury
- Petrochemical Fertilizers and Pesticides⁴⁵
- **Phthalates**
- Polyvinyl Chloride (PVC)
- Wood treatments with Creosote, Arsenic or Pentachlorophenol



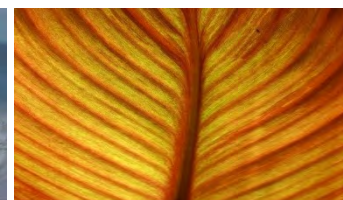
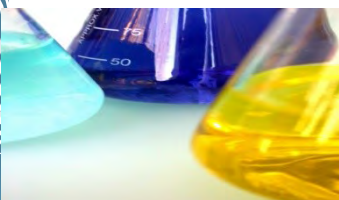


considered chemistry

NIKE GREEN CHEMISTRY



Source: Nike, Inc., Used by Permission





considered chemistry

TOXICS REDUCTION - EPR

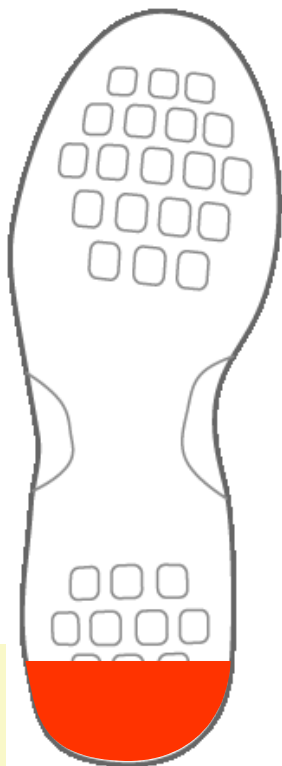
TRADITIONAL RUBBER

Number
of "Red"
Chemicals:

5

"Red"
Chemicals
by weight

12%



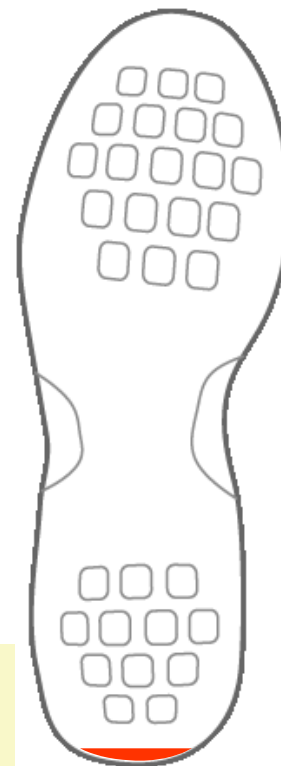
ENVIRONMENTALLY PREFERRED RUBBER

Number
of "Red"
Chemicals:

1

"Red"
Chemicals
by weight

1%



REDUCED TOXICS
96% BY WEIGHT

Source: Nike, Inc., Used by Permission





Question:

**How can the industry help
advance green chemistry?**



GC3 | **Green Chemistry &
Commerce Council**
Moving Business Toward Safer Alternatives

- Share best practices and push the frontier of business practices that promote green chemistry.
- Work collaboratively on projects to develop new business strategies, technologies, tools and information.

Join GC3 - A cross sectoral, B-2-B network of more than 75 companies and other organizations formed in 2005 with a mission to promote green chemistry and design for environment (DfE), nationally and internationally.





What might the future hold?

- More state, federal, international regulations likely to affect supply chains and products
 - Information requirements
 - Restrictions on chemicals of concern
 - Guidance or requirements for alternatives assessment & substitution
- Greater public scrutiny and knowledge; advocacy pressure particularly on business leaders
- Greater demands for information on “green” products, accountability, safer alternatives
- Greater focus on products – but also impacts along supply chain



Case Study: Collaborative Plasticizer Evaluation Project

Project Objective:

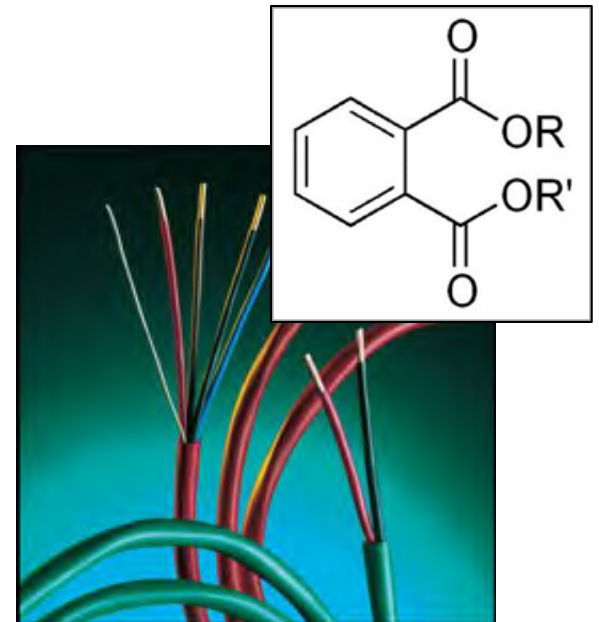
To conduct a collaborative project to support informed decision-making on selecting alternatives to di (2-ethylhexyl) phthalate (DEHP) plasticizers for electronic wire & cable applications

Project Audience:

- Electronics original equipment manufacturers (OEMs)
- Plastic compounders
- Retailers
- Plasticizer manufacturers
- Others: purchasing organizations, governments, advocates, green certification programs

Why focus on wire & cable for electronics?

- Of interest to many GC3 companies
- Leverages Univ. of Mass. Lowell's expertise in plastics engineering



Plasticizer Evaluation Project Partners

Government & NGOs

Washington State

Clean Production Action

Pacific Northwest Pollution Prevention Resource Center

University Partners

Lowell Center for Sustainable Production

Faculty of Univ. of Mass Lowell

OEMs/Retail

Dell

EMC

HP

Staples

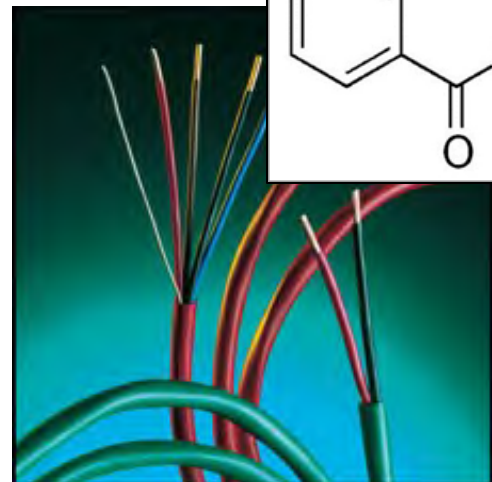
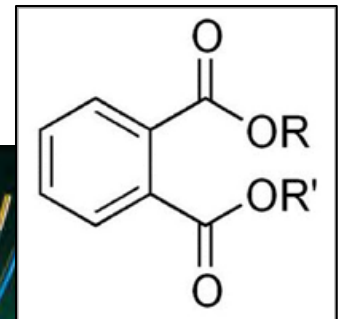
Suppliers

BASF

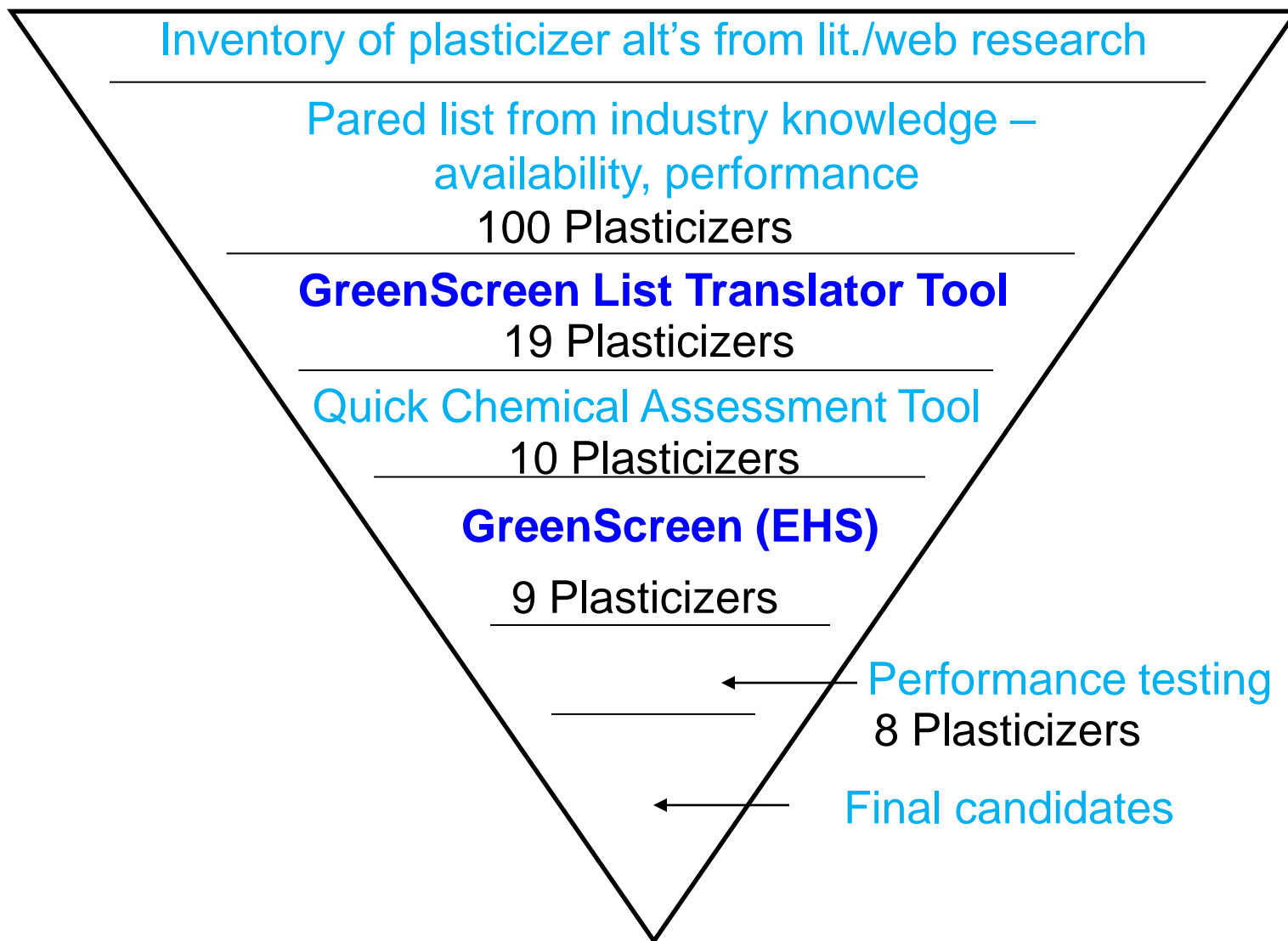
Dow Chemical

Hallstar

Teknor Apex



Plasticizer Candidate Screening Process



GreenScreen Assessment Process

- Draft reports were posted on a webpage, workgroup members were invited to comment, and comments were posted.



The screenshot shows the GC3 website header with the logo "GC3 Green Chemistry & Commerce Council" and the tagline "Moving Business Toward Safer Alternatives". The navigation menu includes "Home", "About GC3", "Projects", "Events", "Publications", "Retailer Portal", and "Memberships". A sidebar on the left has a "MEMBERSHIP" link. The main content area displays the following information:

- 7. TEHTM**
- TEHTM ver. 1 - 12/20/11**
- TEHTM ver. 2 - 1/6/12**
- TEHTM ver.3 -2/13/12**
- Comments:
- BASF comments on GreenScreen™ for TEHTM**
- Safety Data Sheet: PALATINOL® TOTM**

- Profiler reviewed assessments and comments, and revised assessments where scientifically valid and consistent with GreenScreen guidelines.
- The work group is currently finishing validation of results.

Validated Results (as of Jan 2012)

Plasticizer	GreenScreen TM Benchmark	Notes:
Hexamoll® DINCH® (BASF)	BM 2	Moderate endocrine activity
DOZ	U	Data gaps for cancer and endocrine activity
DPHP	U	Data gaps for cancer and endocrine activity
TEHTM	U	Data gaps for cancer and endocrine activity
DEHT (Eastman 168)	BM 3 _{DG}	Data gaps for neurotoxicity and respiratory sensitization
DINP	BM 1	High endocrine activity, developmental and reproductive toxicity
Dow Ecolibrium TM (Redacted)	Not validated	
HallStar Dioplex TM and Paraplex TM (Redacted)	Not validated	



Lessons Learned

1. Lessons on making informed decisions

- Plasticizer manufacturers found value in an independent assessment for internal communication and marketing
- Compounders found value in an independent assessment, to avoid “regrettable substitutions”
- Original equipment manufacturers (OEMs) also found value in an independent assessment to avoid “regrettable substitutions” and getting a single score to support decision-making
- GreenScreen offered a robust system/program for comparative hazard assessment for all parties



Lessons Learned (cont'd)

2. Value of collaborative process

- Pooling knowledge, funds and data to evaluate alternatives is valuable
 - lowers the cost to individual companies
 - creates more robust results



Lessons Learned (cont'd)

3. Challenges

- Obtaining complete data sets
 - Chemical product manufacturers need up-front guidance on data requirements in order to facilitate timely collection of all available data
 - Be prepared to tackle data gaps, particularly when evaluating newer chemical products and products from smaller manufacturers.



2012 -2017 Washington State Green Chemistry Roadmap

- Green Chemistry Awareness and Outreach
- Advancing Green Chemistry Education
- Driving Safer Product Innovation through Tools and Information
- Incentivizing Green Chemistry Through Supply Chains
- Accelerating Economic development & New Collaborations
- Harmonizing Policy and Regulatory Frameworks
- Emerging Technology: Green Nanotechnology

Washington State Green Chemistry Roundtable



Creating Awareness and Building Capacity

2012 -2017

A Roadmap for Advancing Green Chemistry in Washington State



Washington should become a national leader in green chemistry, making these innovations a trademark of the State just like apples, wheat, software and airplanes.



WA State Green Chemistry Innovation

- Green Chemistry Project Ideas:
 - Better Brakes (completed/ongoing)
 - Roofing Assessment
 - Antifouling Marine Coatings
 - PCBs in Inks/Dyes Pigments
 - Non-halogenated Flame Retardants
 - Phthalate Replacements
- Educational Network Project