GC3 INNOVATORS ROUNDTABLE

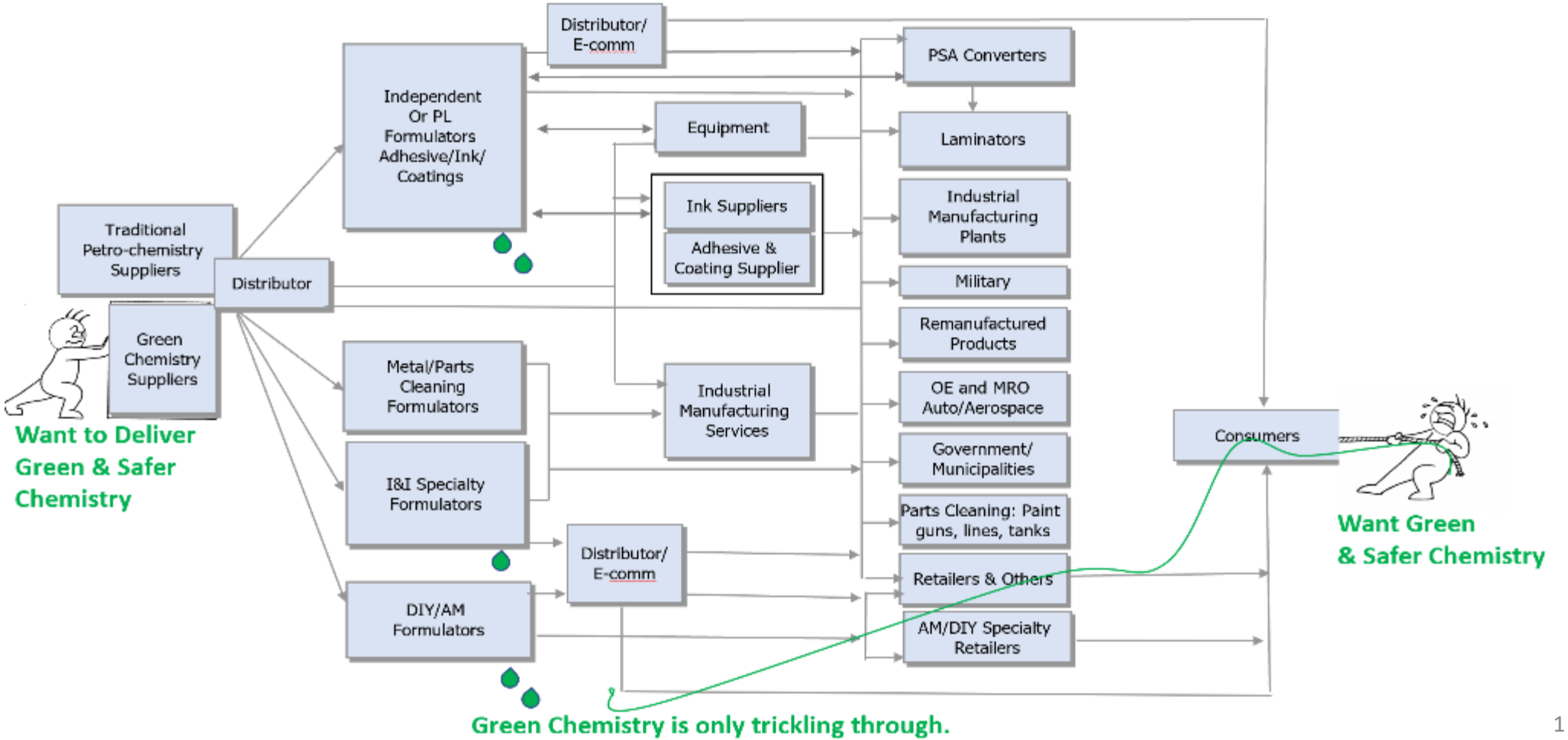
Panel Presentation:
Green Chemistry: The View from the Middle of the Supply Chain
May 9, 2019

Moderator: **Tess Fennelly**, remooble

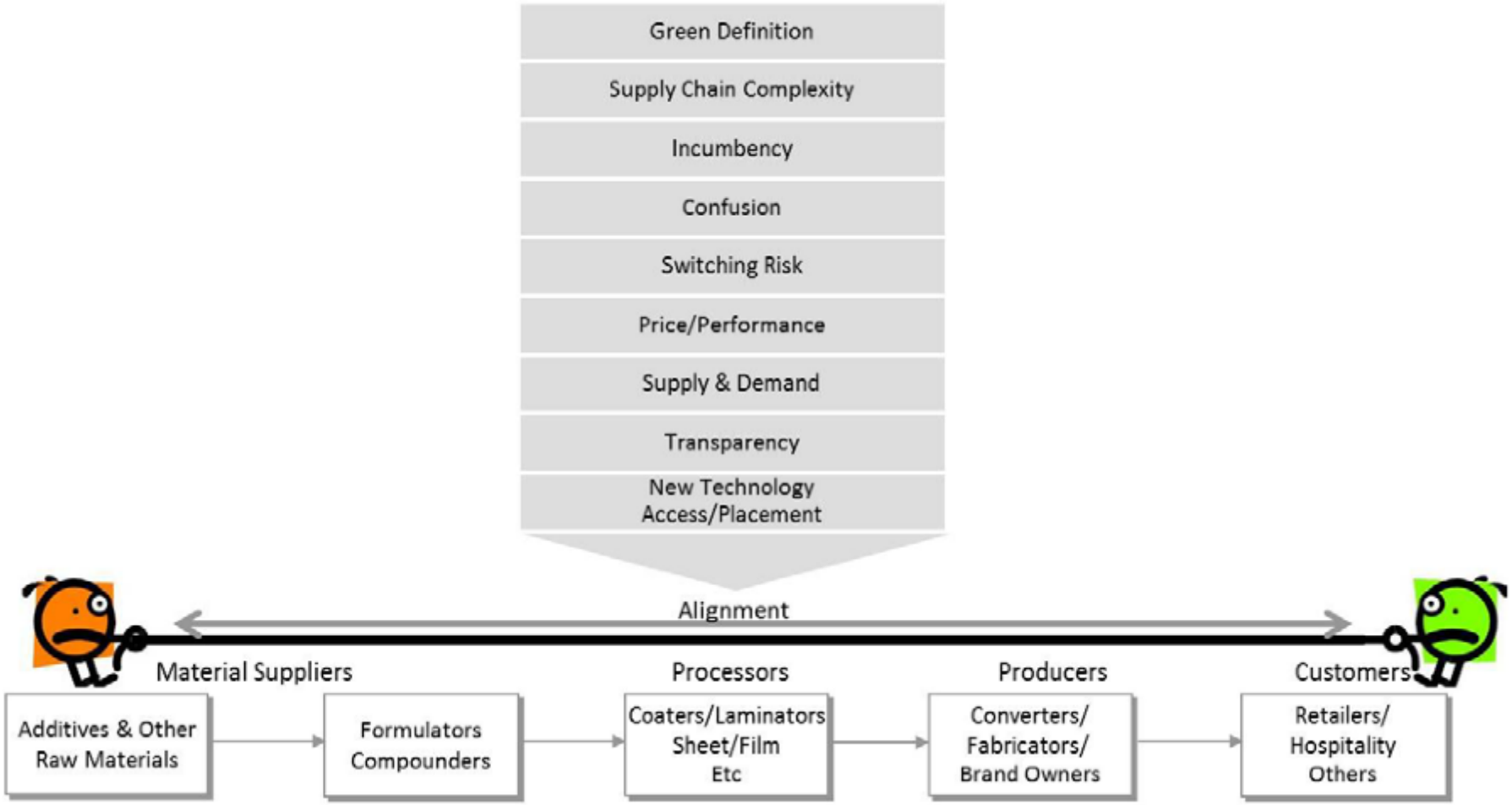
Presenters:
Annie Bevan, Superior Essex Communications
Mike Patel, Teknor Apex Company
Emily Williams, Michelman

The supply chain is often broken or slow which creates complex challenges for new technology adoption.

Supply Chain Example: Adhesive, Ink & Coating Supply



Many possible deterrents to Green Chemistry Supply



Today's Panel

Explore how compounders, extruders, molders, formulators, and fabricators face unique challenges in the adoption of green chemistry

Discuss limitations/impediments to the growth of green chemistry encountered throughout the middle of the supply chain.

Discover ways to overcome these challenges and how to contribute to the faster adoption of safer technologies.

Audience Participation

Talk with members of your table and discuss the following to come up with a question or potential solution to discuss with the panel.

1. From your perspective, what is needed to make the adoption and scale-up of green chemistry in the middle of the chain faster and smoother? -critical steps for advancing these efforts.

2. Can you identify the next steps that members of the GC3 or the GC3 itself can take to promote collaborative models for green chemistry innovation and acceleration?

MICHELMAN®

Emily Williams

Global Growth Platform Leader – Circular Economy

About Michelman

Established in 1949

- Specialty chemicals
- Customer-focused
- Privately held

Today, Michelman is

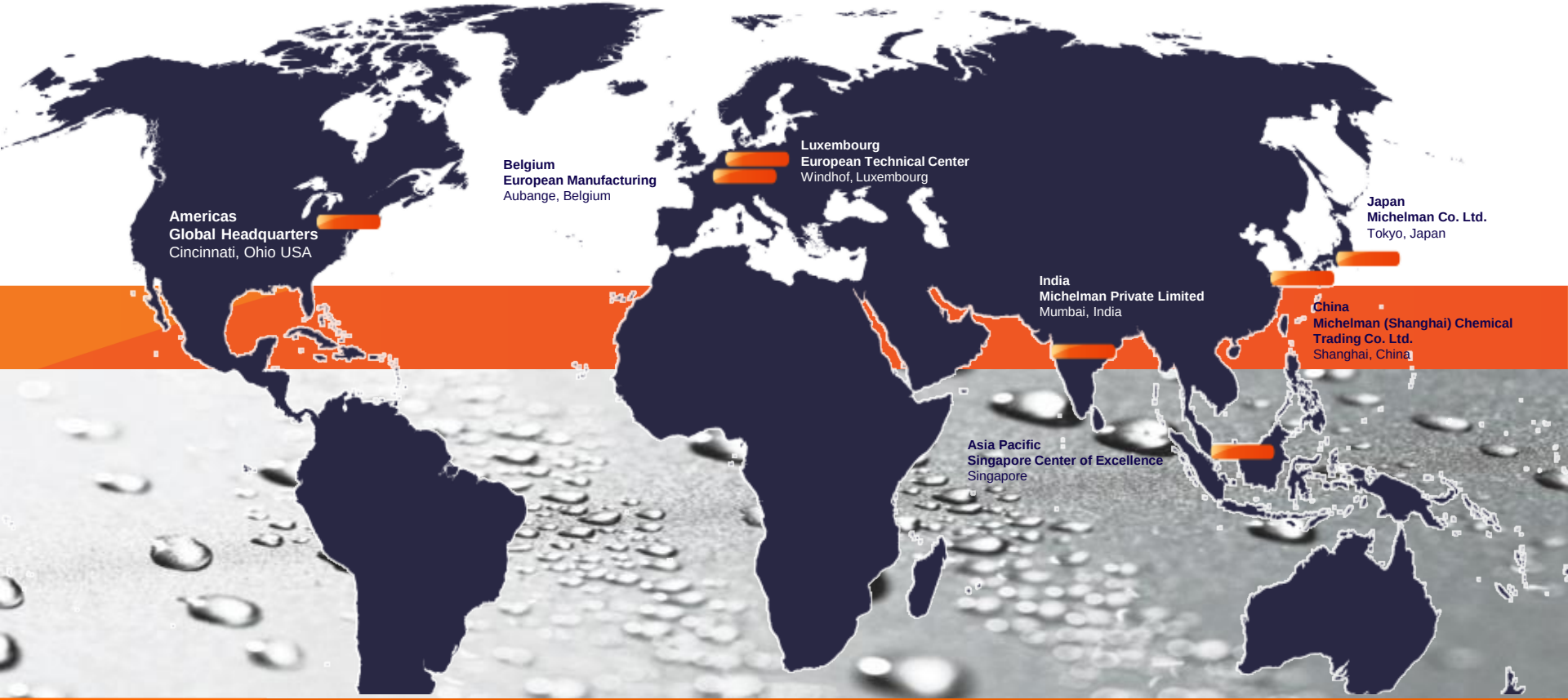
- Global
- Sustainable
- Technology independent

What We Do Best

Known for our industry-first and deep application expertise, Michelman has a rich history of developing innovative water-based coatings for the printing, packaging and corrugate markets.

Global Headquarters - Cincinnati, OH

Michelman Worldwide



Printing & Packaging

Paper Converting

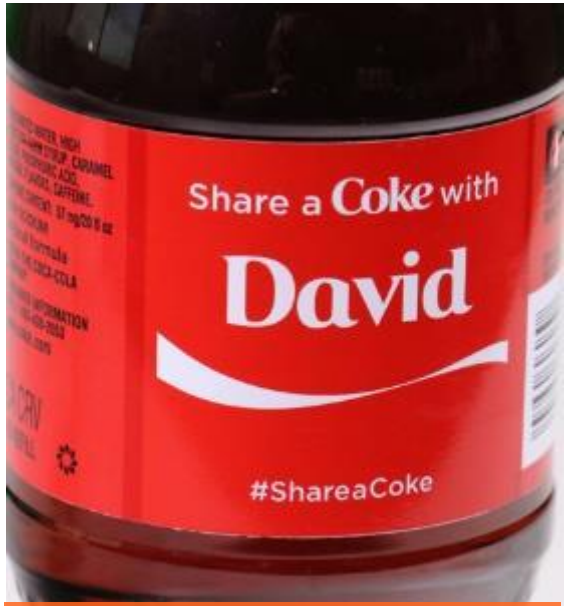
Flexible Packaging

Specialty Printing

Printing & Packaging

Corrugated

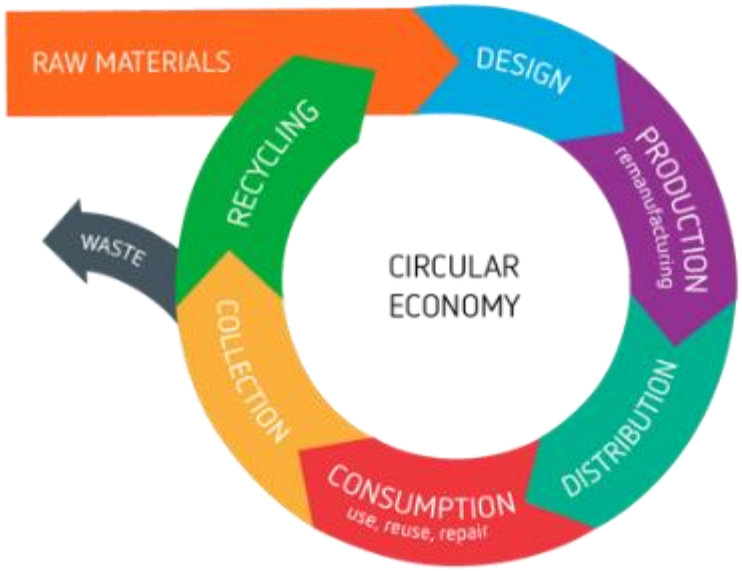
Flexible



Digital

Innovating A Sustainable Future

- We define sustainability using the concept of Circular Economy
- Solutions focused on raw materials, formulating and design that enable different end of life options
- Differing regional needs
  - Compostable, recyclable, repulplable, monomaterials, biobased, renewably sourced



MICHELMAN®

EmilyWilliams@Michelman.com

Who is Teknor Apex ?

9 May 2019

Mike Patel

Director of Marketing and Business Development

Teknor Apex At A Glance

GC3 INNOVATORS ROUNDTABLE

Established in 1924,
headquartered in Pawtucket, RI

Privately held, **family-owned** company

Over **2,000** employees

6 business units

13 Manufacturing facilities worldwide:
USA, Singapore, China, Belgium, Germany

Global Supply. Local Support.

NORTH AMERICA

PAWTUCKET, RI
HEADQUARTERS
TPE COMPOUNDING,
VINYL COMPOUNDING

INDUSTRY, CA
VINYL COMPOUNDING

HENDERSON, KY
COLORANTS
TPE COMPOUNDING

LEOMINSTER, MA
TPE COMPOUNDING

JAMESTOWN, NC
CPVC COMPOUNDS
PVC ALLOYS
VINYL COMPOUNDING

FOUNTAIN INN, SC
GARDEN HOSE,
VINYL COMPOUNDING

BROWNSVILLE, TN
GARDEN HOSE
VINYL COMPOUNDING
CHEMICALS
TPE COMPOUNDING
ETP COMPOUNDING

JACKSONVILLE, TX
COLORANTS

SAINT ALBANS, VT
TPE COMPOUNDING

EUROPE

BELGIUM: GENK
TPV COMPOUNDING

GERMANY: ADELSHOFEN / TAUBAERZELL
SALES OFFICE

GERMANY: STEINSFLED
TPE COMPOUNDING
ETP COMPOUNDING

NETHERLANDS
SALES OFFICE

ASIA

SUZHOU, CHINA
VINYL COMPOUNDING

SHANGHAI, CHINA
SALES OFFICE

SHENZEN, CHINA
SALES OFFICE

SINGAPORE
COLORANTS,
ETP COMPOUNDING
TPE COMPOUNDING
VINYL COMPOUNDING

TAIWAN
SALES OFFICE

Sales in 90 countries

TEKNOR APEX

teknorapex.com

Global Facilities Overview

California

Tennessee

South Carolina

North Carolina

Singapore

China

Global Facilities Overview

Vermont

Massachusetts

Texas

Kentucky (2 plants)

Belgium

Germany

Our Mission

Teknor Apex is dedicated to providing our customers superior products and services throughout our operations worldwide.

We conduct ourselves with integrity which is the cornerstone of our business reputation and foundation to build long-term, trusting partnerships with employees, customers, and suppliers.

Our work environment stimulates innovation while creating accountability and respect in our teams. We are committed to continuous learning and development so that our employees can grow to their fullest potential.

We promote the health and safety of our employees and contribute to the well-being of the communities in which we do business. Working together towards our shared vision assures a financially successful company that is a source of sustainable growth and pride for all.

Core Values


INTEGRITY
PARTNERSHIP
SUSTAINABILITY
INNOVATION
WE VALUE
ACCOUNTABILITY
SAFETY
RESPECT

Our Vision

To be the sought after provider of thermoplastic compound solutions

Our Business

6 Business Units

CHEMICAL DIVISION

VINYL DIVISION

TPE DIVISION

ETP DIVISION

COLOR DIVISION

HOSE DIVISION

Industries We Serve

GCB INNOVATORS ROUNDTABLE

 Packaging	 Consumer	 Industrial	 Electrical & Electronics
 Building & Construction	 Transportation	 Medical & Regulated	

Vinyl Division

Industries:

- Consumer
- Industrial
- Building & Construction
- Electrical & Electronics
- Medical & Regulated
- Transportation

Products:

- Apex® Flexible PVC
- Apex® Rigid PVC
- Apex® PVC Blends
- Apex® Calendered PVC Film
- FireGUARD® LS FR PVC
- Flexalloy® PVC Elastomer
- Halguard® LS HFFR
- AquaGuard® cPVC

TPE Division

Industries:

- Consumer
- Industrial
- Building & Construction
- Electrical & Electronics
- Medical & Regulated
- Transportation
- Packaging

Products:

- Monprene®
- Sarlink®
- Medalist®
- Elexar®

ETP Division

Industries:

- Consumer
- Electrical & Electronics
- Transportation

Products:

- Chemlon® (PA6, PA66, PA612)
- Creamid® polyamides
- Duramid® polyamides
- Other Specialty ETP compounds

Teknor Color Division

Industries:

- Consumer
- Industrial
- Building & Construction
- Electrical & Electronics
- Medical & Regulated
- Transportation
- Packaging

Products:

- Custom & Standard Colors
- Additives and Special Effects
- Dry Colors

Apex Hose Division

Industries:

Commercial

Residential

RV/Marine

Products:

- Zero G®
- Apex®
- NeverKink®
- Flexalloy®

Chemicals Division

Industries:

Industrial

Consumer

Transportation

Products:

- Plasticizers
- TruVis® Esters (Adipate, trimellitate and polyol esters)

Single Source - Custom Compounds

- Globalized numerous product lines - technology transfer
- Compliance with global codes and standards in diverse markets

RoHS REACH UL NAFTA FDA IEC

ISO CSA NEMA SAE NSF

EU CPR EU MDR

Technology & Customer Support

We offer state-of-the-art technology and hands-on customer support

- Technical Service
- Formulation Customization
- Product Development
- Fully Equipped Analytical Lab
- A2LA Accreditation
- Specialized Services/Support
- Application Development
- Design & Launch Support
- Algor FEA / MARC Analysis
- AutoCAD & Mold Flow
- Prototyping Equipment
- Weight/Cost Reduction
- Research & Development
- Future Innovation & Solutions
- CTC Customer Collaboration

Application Development Centers

LEOMINSTER, MA, USA | SUZHOU, CHINA | ROTHENBURG O.D.T., GERMANY - 2020

- Provides the tools for Engineers and customers to explore ideas, solve production issues, and minimize speed to market when testing new materials or concepts
- Production scale equipment provides real time part and process screening
- AD support enables concept designs from CAD and FEA to transform to real parts
- Mobile engineering team for on-site assistance

Application Development Lab

This is where we keep our problem-solving promise

- CAD/CAM Tool Development
- FEA Simulation
- Extrusion Prototyping
- Sheet Extrusion
- Profiles – co-extrusion up to 4 materials
- Wire & Cable Line
- Injection Molding Prototyping
- Blown Film
- Thermoforming
- 3D Printing: Prototype Parts and Tooling
- Specialized Lab Equipment Built to Replicate End-Use Conditions

The Advantages of Teknor Apex

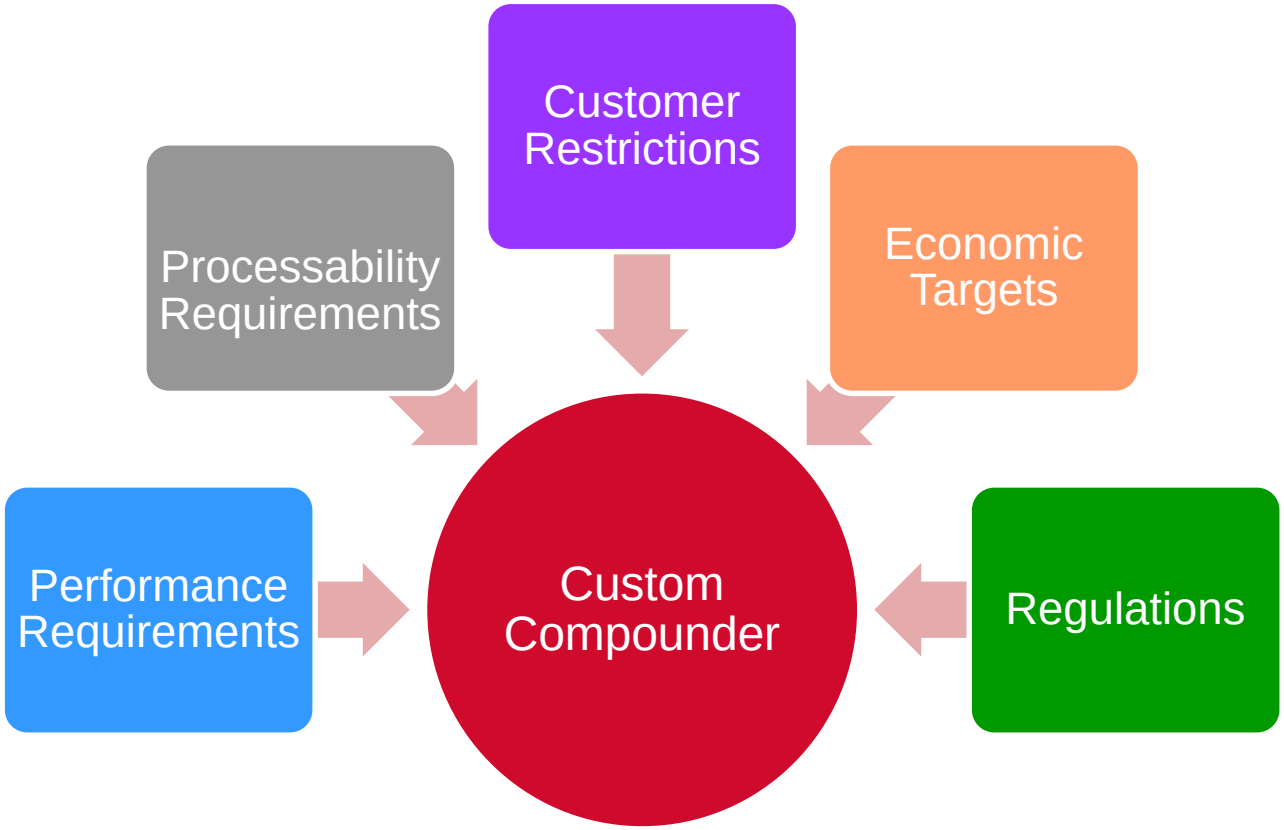
How we've become the industry's trusted polymer partner:

- Breadth of Polymer and Compounding Knowledge
- Expertise in a Wide Range of Industries
- Internal Efficiencies that Impact Speed to Market
- Customized Formulations & Product Development
- Application Development Support
- Intimate Customer Relationship with Superior Support

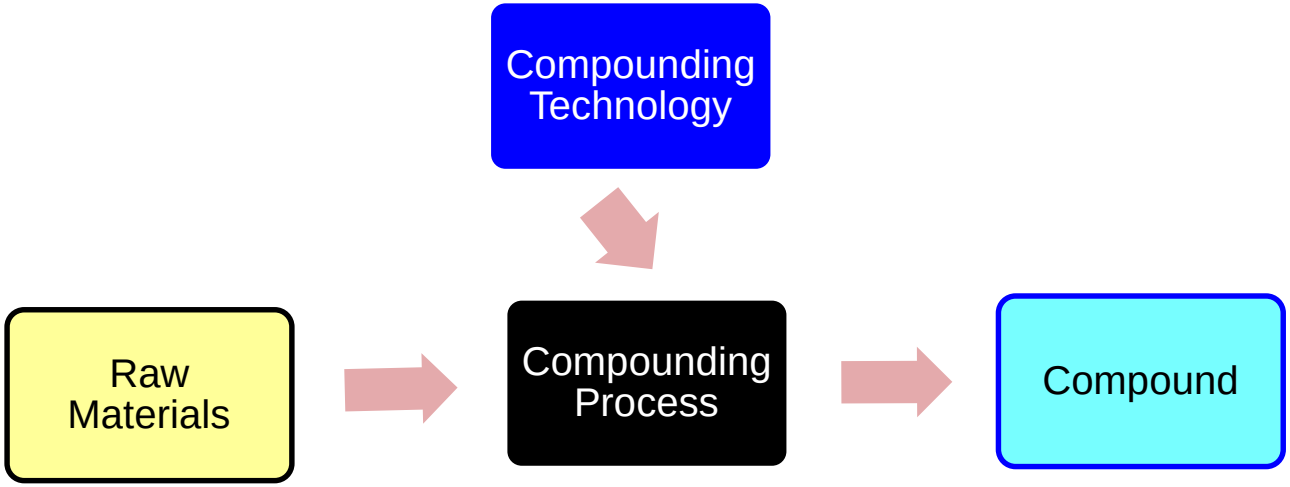
We are dedicated to providing quality products with superior support and value!

Compounder's Perspective

Compounding Inputs



Compounding Process



Restrictions and Regulations

Customer Restrictions	Regulations
Non-DEHP	CA Prop 65.
Non-Phthalate	CPSIA
Low VOC	RoHS
BPA Free	EU REACH – no SVHC
Latex Free	EU BPR
Non-Animal Derived	EU MDR

“Green” Product Line

Biovinyl®

- First to market in 2012 with “green” product line of flexible PVC compounds based on bio-sourced plasticizers
- Required significant R&D to identify optimum formulations and viable application space – numerous challenges
- Limited success

“Green” Product Line

Terraloy®

Bioplastics for bio-content and compostability

- Starch based bioplastics
  - Limited commercial success due to cost situation with natural gas on PE and PP and Braskem bio-based PE
- PLA based bioplastics
  - Higher heat PLA product
  - PLA product for 3D Printing

Conclusion

Is the market ready for “green” ?

Thank You.

Tel: 401-725-8000

Email: vinyl@teknorapex.com

We believe that technology that interconnects the world should also respect it

SUPERIOR ESSEX

One of the largest cable manufacturers in North America

Copper and Optical Fiber Premises wire and cable products

Everywhere You Live and Work

Fiber & Copper Outside Plant (OSP) wire and cable products

Smart Building Technology

http://sustainability.superioressexcommunications.c

How is Superior Essex implementing Green Chemistry practices into our Organizatin?

1. The Market is Demanding It!

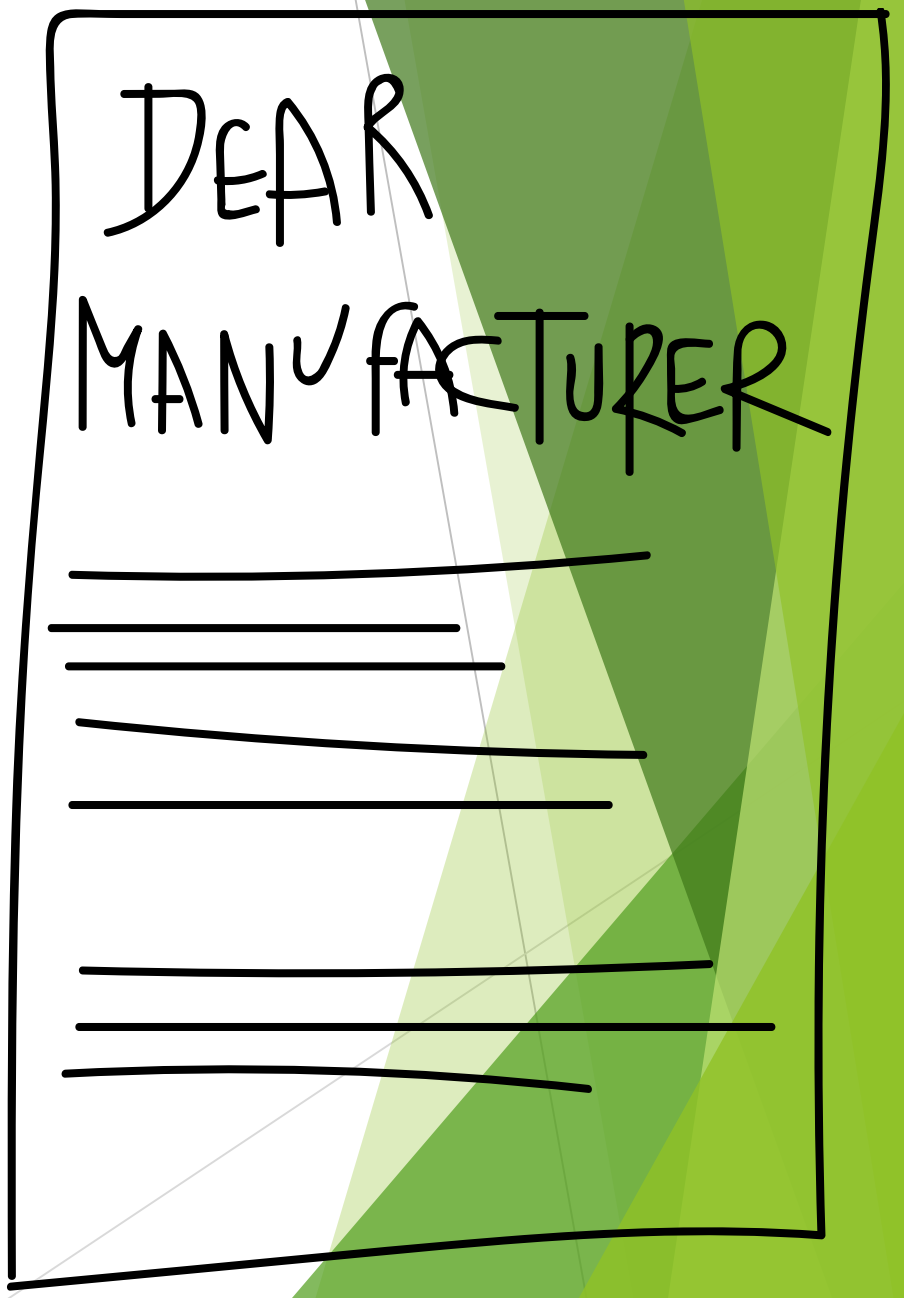
2012 A+D LETTERS:

A united request for greater transparency using available tools.

DISCLOSURE LETTERS ISSUED

As of Oct. 1, 2013, the following firms, listed alphabetically) had issued letters as part of the disclosure campaign:

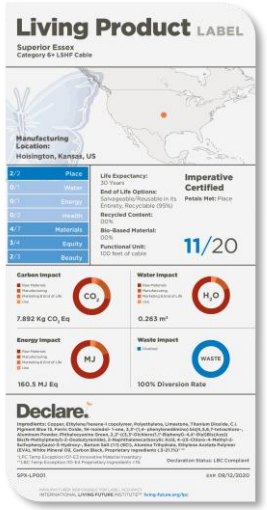
Beck Architecture
Boora Architects
Cannon Design
EHDD
FXFOWLE
GGLO
Harley Ellis Devereaux
HDR
HKS
KMD Architects
Lake| Flato Architects
Lord, Aeck & Sargent
Mahlum
Miller Hull
Perkins+Will
RTKL
SHW Group
Siegel & Strain Architects
SmithGroupJJR
Solomon Cordwell Buenz Architecture
Tsoi Kobus & Associates
Wight & Company
WRNS Studio
Yost Grube Hall Architecture



Materials Transparency-Communication Cables

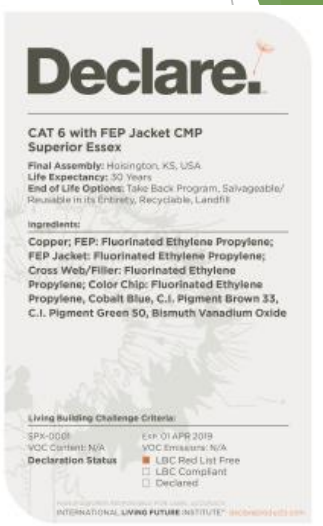
LIVING PRODUCT CHALLENGE

1 Living Product (2 Pending)



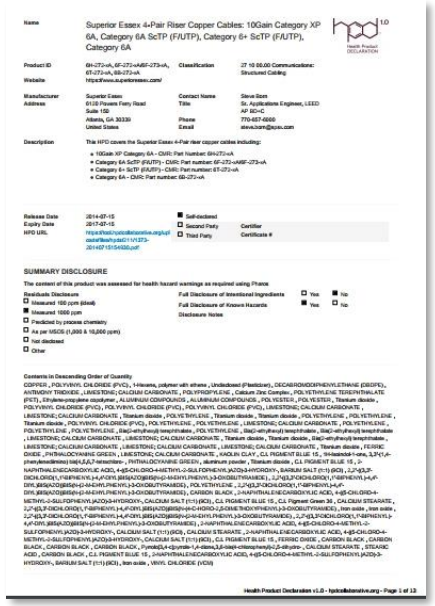
Declare.

3 Red List Free Declare Labels



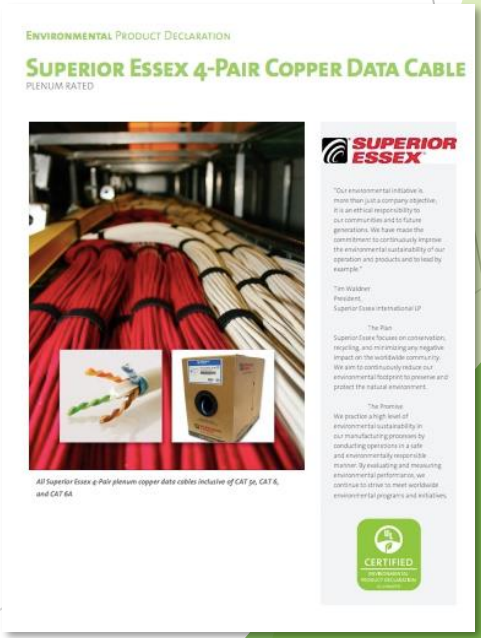
hpdc

55+ HPDs

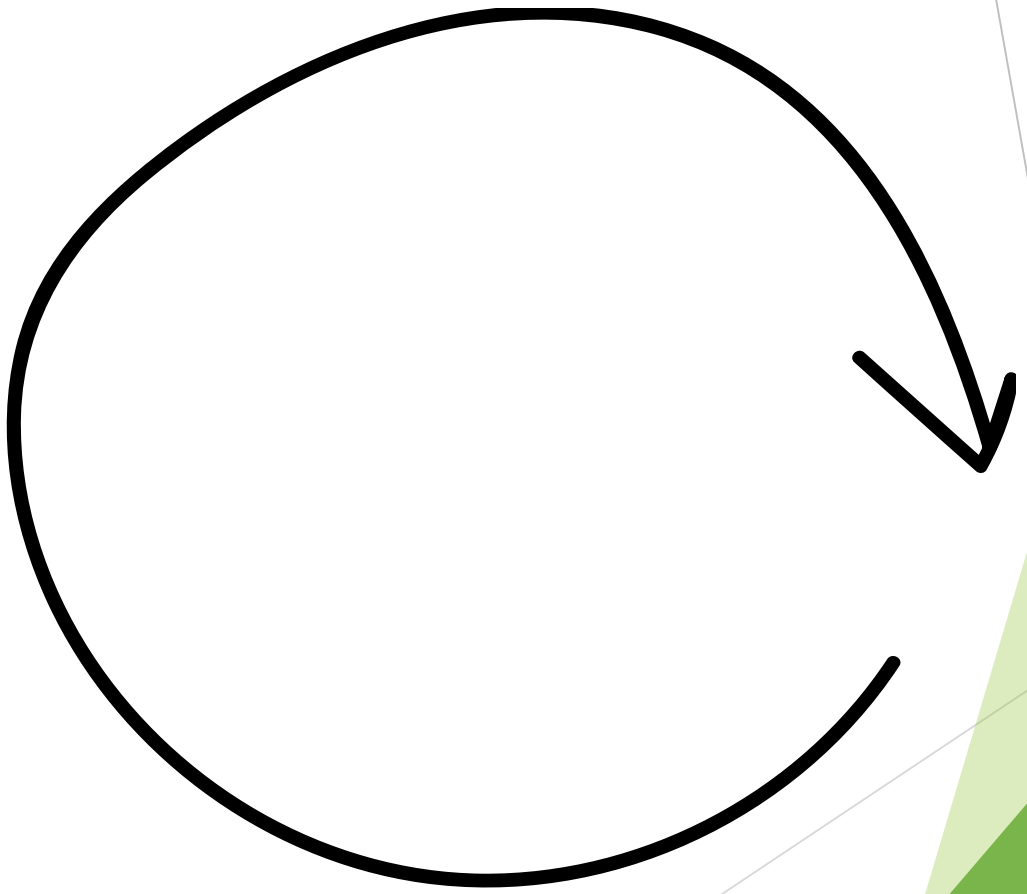


CERTIFIED ENVIRONMENTAL PRODUCT DECLARATION UL.COM/EPD

55+ EPDs



CLOSING THE LOOP ON TRANSPARENCY




THE LP50
SUPERIOR ESSEX
Mohawk Group
OWENS CORNING
ASPECTA BY METROFLOR
teknion
Industrial Louvers, Inc.
3form
CS
Construction Specialties
LightArt HANDMADE IN SEATTLE
nora
ALLEGION
EF Contract
Milliken
PROSOCO
J+J FLOORING GROUP
A Division of Engineered FLOORS
SAINT-GOBAIN
OregonDoor
we build the doors that build your reputation
Humanscale
CertainTeed SAINT-GOBAIN
Sustainable Northwest WOOD
Steelcase
Kingspan
SHANNON SPECIALTY FLOORS
WHOLETREES ARCHITECTURE & STRUCTURES www.wholetrees.com
GAF
Tarkett
KNAUF INSULATION
shaw contract
Armstrong FLOORING
MechoSystems Design with light.
Mannington COMMERCIAL
patcraft
Armstrong CEILING & WALL SOLUTIONS
ROCKWOOL
KAWNEER AN ARCONIC COMPANY
KOHLER
HermanMiller

2. Life Cycle & Chemistry Considerations into our Product Development Process

PRD Process

DRAFT PRD Sustainability Process:

Step 1: Add Sustainability Check box on CQP Checklist/ MK003T

- EPD (informational only)
- HPD
- Red List Free
- Declare
- Living Product Challenge

Example:
Sustainability Initiative:

- ☐ EPD
- ☐ HPD
- ☐ Red List Free
- ☐ Declare
- ☐ Living Product Challenge

If HPD:

- Need confirmation from suppliers to provide .1% information
- Do not need total disclosure for HPD
- Could settle for up to .1% in product if supplier won't confirm .1% in their material

If Red List Free, Declare, LPC:

- Need supplier to confirm commitment disclosure and the raw material is red list free to ILFI Red List 3.1.
- Must obtain disclosure to .01% in product
- Could settle for up to .01% in product supplier won't confirm .01% in their material

3. Further Engagement with our Supply Chain

Supply Chain Engagement

Information Collected & Data Managed in toxnot

- Compositional Chemistry of Raw Materials Supplied
- Corporate Social Responsibility
- Hazardous Chemistry Assessment
- Development of Material Ingredient Reports
- Confirmation of REACH/ RoHS Compliance
- Prop 65 Compliance
- Etc…..

FEP Concerns….

- **ToxServices recommends the following:**
- If FEP copolymers were to be exempt from the Red List, it is imperative that ILFI mandate manufacture-specific disclosure and analytical testing to ensure the following:
  - Residual monomer levels must not exceed a specific level in the copolymer and the final material/product
  - Process chemicals used during the FEP copolymerization process should be fully disclosed and, if present, should be below a specified level in the FEP copolymer and the final material/product
    - Alternatively, the use of certain process chemicals (i.e., PFCs) should disqualify FEP from the exception, but a residual in final product could also be considered
    - If no PFCs or Red List surfactants/process chemicals are used in the production of the FEP, the FEP should need to undergo a material health review to obtain full disclosure of these surfactants, understand physical form and manufacturing processes, and hazard screening of constituents.

Superior Essex's FEP Supply Chain Optimization

- Both suppliers for FEP have confirmed:
  - No Residual Monomers or below 100ppb
  - No processing agents on the red list utilized to manufacturer the product
  - Waiting on confirmation from suppliers to confirm there are no surfactants used within the FEP co-polymerization process and a better description of if they are used how they are distilled during the process
  - Will disclose their trade name, product IDs as well as manufacturing facilities
- Further Details and thoughts to consider:
  - If the end product w/ FEP had any impurities it would de-grade the di-electric properties of FEP—would not be valuable or useful, that's how we know they don't exist in the final product
  - As compared to flexible PVC alternative—there is significant migration of chemistries from PVC—much more than FEP

Sustainable PVC

- Currently working in collaboration with other market leading manufacturers in the Carpet/flooring, Window, Siding and panel industries to establish to define manufacturing leadership in sustainable PVC products

GC3
GREEN CHEMISTRY & COMMERCE COUNCIL

THANK YOU!

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