



Eastman Chemical Company, Kingsport, TN • May 8-10, 2018

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Summary of Session Proceedings

May 8-10, 2018 marked the 13th Annual Innovators Roundtable organized by the Green Chemistry & Commerce Council (GC3). Over 200 people from 132 different organizations convened at the headquarters of Eastman in Kingsport, TN, to talk about emerging technologies, policies, tools, and partnerships to advance green chemistry, and to discuss challenges and successes. Attendees learned from their peers and from other leaders in both structured and unstructured settings, exchanged knowledge, and met potential new collaborators for their work.

The GC3 Roundtable not only promotes supply chain collaboration, but facilitates connections with academic, political and mission-driven organizations, allowing attendees to network and bring emerging information back to their companies. This year's Roundtable attracted an international group of large enterprises and startup companies, representing all parts of the value chain, as well as others, such as NGOs, investors, academics, and government leaders.

What some attendees said about the Roundtable...

“Great transparency and networking. Also, being a first-time participant, I was happy to see retailers at the table openly discuss how green chemistry is important to their consumers and how they can be drivers of green chemistry adoption in the supply chain.”

Attendees heard from 43 motivating speakers about various topics, including collaborative innovation for new preservatives, working across the supply chain to achieve commercial success for green technologies, sustainable apparel, retailers advancing green chemistry, building UN Sustainable Development Goals into business strategy, resources for finding safer chemical alternatives, and more. They also participated in interactive sessions to brainstorm solutions to common green chemistry challenges facing companies and provided input into GC3 programming for the coming year. The following pages of these proceedings contain key takeaways from each session.

The GC3 presented GC3 Champion Awards to US Senator Chris Coons of Delaware, Mango Materials, and Target for their contributions to advancing green chemistry. The conference highlighted three GC3 programs: The Collaborative Innovation Project for Preservatives, the Retail Leadership Council, and the Green and Bio-based Startup Network. The GC3 Startup Network held the 3rd Annual Green and Bio-Based Chemistry Technology Showcase and Networking Event in conjunction with the Roundtable. This event is designed to facilitate direct communication between strategic companies and startups and identify emerging green chemistry innovation. The Showcase brought together 10 start-ups with larger companies in the value chain to identify new partnerships and opportunities.

“What a unique experience! Not only was the content superb, the intimate structure and networking opportunities really allowed us to dig deep into the big issues.”

Throughout the conference GC3 members and others repeatedly emphasized that collaboration is the key to advance green chemistry and produce safer products. To source new, safer chemicals, and accelerate the adoption of green chemistry solutions, it's vital to ensure communication and collaboration up and down the supply chain as well as within/without organizations. Companies need to connect with their industry peers, their suppliers and innovators in startups find information on new alternatives; brands need to know what suppliers are putting into the products, and suppliers need to know what materials have been researched.

Another recurring theme highlighted the tangible shift in the past few years from a focus on chemicals of concern towards a push to proactively find safer alternatives, driven by market demand. Consumer demand for safer, healthier products is universal, transcending geographies. Every year, market pull increases for safer alternatives, both on the consumer and commercial fronts and companies must meet this demand with innovative solutions. Companies have found that being proactive rather than reactive gives industry more time to address challenges of substitution in a meaningful way.

“Such great connections. Networking was excellent.”

There are also global policy drivers of green chemistry, such as the Paris Agreement and the UN Sustainability Development Goals. It's noteworthy that several large corporations are aligning their innovation/R&D departments with the UN Sustainability Development Goals. Attaining goals such as the SDGs requires much more active engagement with the supply chain to educate, agree on metrics, and jointly overcome roadblocks.

The GC3 is pleased to have hosted this conference, because once again it proved to be a very effective way to drive the commercial adoption of green chemistry across an international network of industries, sectors and supply chains. The 2019 GC3 Roundtable will be held in Cincinnati, Ohio, hosted by Procter & Gamble in May 2019.

“The GC3 Innovators Roundtable is truly a one-of-a-kind opportunity for all stakeholders in the Green Chemistry community. It's inspiring to see all the companies large and small striving to make green chemistry the new standard for product development.”

Tuesday, May 8

Welcome and Opening Remarks

Speaker:

Joel Tickner, Director, Green Chemistry & Commerce Council (GC3), UMASS Lowell

Summary:

Tickner opened the conference with a Slido poll, asking audience members what they expect to get out of attending the Roundtable. The vast majority of attendees responded that they hope to network with their peers to find green chemistry solutions, or to find new business partners. Tickner noted that he and others set up the GC3 13 years ago because companies shared common chemistry problems, across sectors and the value chain. He noted that collaboration is essential to solving those problems. He encouraged audience members to spend time with people they don't ordinarily speak with, to discover new possibilities and see issues from another perspective. The GC3 is very good at facilitating networking, and now has a diverse membership of more than 120 companies, which represents an increase of 18% in the past year. Those members represent approximately three billion dollars in economic value across the value chain.

Tickner stated that the GC3 is a multi-stakeholder collaborative that drives the commercial adoption of green chemistry by catalyzing and guiding action across all industries, sectors and supply chains. The GC3 envisions a world where green chemistry is standard practice throughout the value chain. Its mission is to drive the commercial adoption of green chemistry by catalyzing and guiding action across all industries, sectors and supply chains. The GC3 sees its role as a unique bridge across parts of the value chain.

Tickner said these are still interesting and challenging times, politically. Despite the challenges, Tickner is optimistic and sees progress; i.e., green chemistry is gaining ground and growing. The drivers for green chemistry aren't going away; it doesn't matter what is happening in Washington, DC. The market, consumer and industry drivers are there. The foundations are there and it's important to figure out how to use them to make change happen. He noted the following tangible developments:

- Increased focus on chemistry as a solution to sustainability challenges;
- Increased value chain collaboration to solve chemistry challenges;
- Increased focus on commercialization as key to the success of green chemistry;
- Increased integration of green chemistry into circular economy and product policy discussions.

Major retailers and brands are developing sustainability programs that encourage green chemistry, developing green chemistry solutions and working across the value chain to drive those solutions. They have stated that they need organizations like the GC3 to find sustainable chemistry solutions to drive innovation.

One example of progress is that the US Government Accountability Office published a report this spring, entitled *“Technology Assessment: Chemical Innovation: Technologies to Make Processes and Products More Sustainable,”* acknowledging the importance of green chemistry. This study was done in response to a May 2015 request from U.S. Senators Chris Coons (D-Del.), Susan Collins (R-Maine), and Ed Markey (D-Mass.). The press release from those Senators included a quote from the GC3. Another positive sign is that there are new initiatives taking place, such as the ISC3 – International Sustainable Chemistry Collaborative Centre in Germany, which the GC3 will be working with.

Tickner also spoke about the evolving landscape of the green chemistry world, and the nexus between sustainable development goals and sustainable chemistry; companies are increasingly linking chemistry innovation to sustainable development goals.

At the meeting of C-Suite leaders prior to the Roundtable, participants discussed how to overcome the barriers to green chemistry, and the conditions that are necessary to move from the “nice to have” to the “must have.” It’s not just about identifying green solutions, it’s about commercializing green chemistry and ensuring there is an adequate market for those solutions. What are the barriers and how to overcome them? There are some challenges, some of which are definitional; i.e., how is green chemistry defined? At different levels of an organization there may be different definitions or ways of thinking about green chemistry (R&D, purchasing, sustainability). Tickner asked attendees to think about how the GC3 can best serve their needs and have an impact in driving green chemistry solutions.

The GC3 is always seeking better ways to facilitate collaboration and ensure partnerships across the value chain. To grow the GC3 organization it is important to strengthen its infrastructure, so in the past year the organization hired a Director of Operations, a Startup Network Coordinator and a Communications Specialist. Over the past year the team has reflected on where the GC3 is going, and where it wants to be in five years. How to help businesses overcome the barriers to commercialization of green chemistry? How to better facilitate connections between startups and larger companies? How to strengthen the diversity of our membership?

The GC3 is growing and identifying signature projects that can have an important impact on the value chain as well as defining its unique niche in the ecosystem of R&D and innovation. How can the GC3 best serve your needs? The GC3’s value is bridging the whole supply chain, from innovators and startups to end-users and retailers.

The GC3 has organized its activities around three major platforms: supply chain engagement, collaborative technology innovation, and policy advocacy. It has invested more resources in strengthening the GC3 Startup Network, whose main activities are the Technology Showcases, the Strategic Connections Program, and educational webinars. Future plans include expanding the Startup Network into South America and Canada. The GC3 also plans a workshop for startups on targeting applications and readiness.

The Green and Bio-Based Chemistry Technology Showcase is a tremendous opportunity that brings together innovative startups that will present their new technologies to large strategic companies.

In the past year the GC3 has also brought together 20 companies that identified needs for safer, effective preservatives, and undertook a first of its kind collaborative Preservatives Innovation Challenge Project to invite innovators from across the globe to submit solutions. The day before the roundtable, the project held a final event to bring together the large strategics and the innovators to discuss the finalists that were selected. There has been an abundance of knowledge-sharing, collaboration and insights gained from this Project. Given this success, the GC3 plans to repeat the collaborative challenge in the future, focusing on another class of chemicals.

The Retailer Leadership Council is another signature effort where the GC3 has had a great impact across the retail sector by bringing together experts from the retail field to share best practices and create a learning community to help the retail community to be more sustainable and meet customer needs.

Lastly, our newest effort is the Sustainable Chemistry Alliance, launched this spring and led by nine politically influential GC3 member companies. It's a diverse business-driven advocacy voice for policies to support sustainable chemistry, and it represents GC3 member companies from the entire chemistry value chain and it is expanding rapidly. It has a dual bipartisan policy agenda:

1. Protect existing funding and other government programs from damaging cuts
2. Leverage government focus on US innovation & manufacturing for new policies supporting sustainable chemistry

Our goals for this Roundtable and into the coming year are to do the following:

- Gain insights to enhance the impacts and effectiveness of green chemistry projects;
- Catalyze new partnerships among GC3 members;
- Share the latest innovations in green chemistry design and commercialization;
- Build connections between green chemistry and other important sustainability efforts;
- Empower GC3 members as green chemistry change agents.

Opening Keynote

Speaker:

Richard Northcote, Chief Sustainability Officer, Covestro LLC

Summary:

Northcote described how sustainability is a core value for Covestro and uses it as a roadmap to grow and move forward. He believes sustainability drives innovation and innovation is driven by sustainability. In the balance of people, profit, and planet, Covestro's activities must be positive in two of the "p's" and not negative in the third. Northcote spoke about the use of the chemical and plastic industries to enable sustainable solutions for key sectors. He noted that Covestro has aligned its goals with the UN Sustainable Development goals. He described how Covestro uses carbon dioxide as a raw material feedstock in order to develop sustainable products, reduce its carbon footprint, and have a positive effect on the planet. Covestro believes there is a missing metric that is needed to measure the productivity of fossil-based carbon. He noted that carbon is not the enemy, and decarbonization is a ridiculous term; rather, carbon should be seen as a source of value in producing products that can also result in climate mitigation and carbon emissions reduction.

Key Takeaways:

Opportunities for Safer Chemicals and Products

- Look into sustainable solutions in the chemical and plastic industry in order to influence key sectors:
 - Mobility- lightweight construction (e.g., batteries)
 - Renewables- higher yields (e.g., coatings and adhesives)
 - Construction- thermal insulation- there is a huge opportunity to change traditional thermal insulation material and have a significant impact.
- Focus on carbon as a source of value
 - Science-based metrics only take into account carbon dioxide emissions, but a metric to measure fossil-based productivity is needed.
 - In 2017, CEO Patrick Thomas, CEO of Covestro presented the concept of Carbon Productivity at the UN Global Compact Leaders Summit.
- Align innovation and R&D departments with the UN Sustainable Development Goals.

Key Drivers for Safer Chemicals and Products

- Global drivers are important and include:
 - The Paris Agreement
 - UN Sustainable Development Goals
- Innovation is a key driver of sustainability, and vice-versa.

Challenges for Implementation/Lessons Learned

- Lesson learned: Specify high sustainability goals and if a company hits them before their target deadline, set them higher.

- Covestro initially set 20% reduction of carbon dioxide emissions and hit its target by 2011. The company increased its target to 30% and hit it by 2014. Now its target is set at 50%.
- Challenge: Hitting a carbon dioxide reduction goal is not a financial target so people place less value on it and worry more about the company finances. Yet sustainability goals are just as important and make a company more attractive with a long-term strategy.

Green & Bio-Based Chemistry Technology Showcase & Networking Event

Moderator: Monica Becker, Co-Director & Collaborative Innovation Project Lead, Green Chemistry & Commerce Council (GC3)

Presenters:

- **Patrick Harmon**, Research Chemist, BASF
- **Jeanne Chang**, Assistant Vice President, L'Oréal USA
- **Laura Hoch**, Materials Innovation Engineer, Patagonia Inc.

Summary:

Becker discussed how the overarching goal of the Green & Bio-Based Chemistry Technology Showcase is to foster an innovation ecosystem for green and bio-based chemistry technologies, acknowledging that startups are the engines of innovation. In its third year, the Startup Network seeks to bring startups forward to introduce GC3 member companies to new chemical technologies for partnership/investment opportunities and also to introduce larger companies to smaller companies that are offering new chemical technologies for their products.

Following feedback from previous years' experience, the GC3 endeavored to create a better match between start-ups and member companies by determining the green chemistry technology needs of the member companies (through survey), then compiled technology needs into a document and placed a "call to innovators" and received over 30 submissions, of which 10 innovators were selected to pitch and seven to present posters. The GC3 also matched start-ups with consultant Linda Plano (from Plano & Simple) to help the start-ups refine their pitch to larger companies. To stimulate the engagement, the GC3 asked three of its member companies to provide a "reverse-pitch" to the Startup Network.

Key Takeaways:

Patrick Harmon (BASF):

- BASF is a German-based company with a global annual growth rate ~3.8% that produces chemistry used in almost all industries. As of 2017, they held over 800 patents worldwide.

Opportunities for Safer Chemicals and Products

- Collaborate extensively throughout value chain
- Five business segments: chemicals, performance products, functional materials and solutions, agricultural, oil/gas.
- Sustainable Solutions Steering has two parts:
 - Look at existing portfolio and evaluate if there are 'red flags'
 - Assess products that make a significant contribution to sustainability (termed 'Accelerators')

Key Drivers for Safer Chemicals and Products

- Tagline: "We create chemistry for a sustainable future"
- Accelerators contribute to specific sustainability needs of their customers
 - Goal is to increase the number of 'Accelerators' in portfolio
- Six years ago, established in North America a technology scouting team, which established a technology needs database (includes confidential and non-confidential portions):
 - Technology Needs Database: (30 different buckets): Some key categories where green chemistry can fit needs:
 - Additives: Single-use plasticizers; halogen-free flame retardants; light stabilizers; insect control; weed control; water resistance; stain resistant (water-based) coating for architectural uses

Challenges for Implementation/Lessons Learned

- Constraints within scouting program: experiencing "open-innovation fatigue"

Jeanne Chang (L'Oréal):

- Chang and L'Oréal participate in the GC3 Innovator's Roundtable because they consistently find high level and high interest content at the GC3. Also, they enjoy increasing their network of company contacts who are interested in increasing safer chemistry initiatives.

Opportunities for Safer Chemicals and Products

- L'Oréal's commitment to sustainability dates to late '90s - early 2000s. In 2013, launched program called "Sharing Beauty with All" specifying commitments across all of L'Oréal's value chain, and is divided into four Pillars:
 - Innovate sustainably
 - Produce sustainably
 - Develop sustainably
 - Living sustainably

Key Drivers for Safer Chemicals and Products

- Focus on Innovating Sustainably:
 - 2020 goals include: 1) 100% of products developed have environmental or social benefit. 2) Every new product or re-formulated product will contain one of these four attributes:
 - Reduce environmental footprint (focus on water consumption)

- Renewable raw material (sustainably sourced) or raw materials derived from green chemistry.
 - Packaging improved environmental profile
 - Product has improved environmental and/or social positive impact
- Green chemistry essential ‘safe by design’ products: products with good health and environmental safety profile that also continue to push innovation
- 2006: L’Oréal was the first company to launch on the market eco-designed C-glycoside (anti-aging benefits)
- L’Oréal’s definition of Green Chemistry: three attributes (criteria)
 - Renewable
 - Eco-respectful processes
 - Demonstrating a favorable environmental impact.

Challenges for Implementation/Lessons Learned

- To hit 2020 sustainability targets, L’Oréal needs more offerings in green chemistry.

Laura Hoch (Patagonia):

- Patagonia Mission statement: *“Build the best product, cause no unnecessary harm, and use business to inspire and implement solutions to the environmental crisis.”*

Opportunities for Safer Chemicals and Products

- Patagonia’s legacy of environmental responsibility:
 - Material and social responsibility, including challenging consumer behavior to dissuade unnecessary consumerism to accepting returned garments for repair and resale.
 - Support environmental groups: donate 1% of all profits to environmental groups.
 - Material responsibility initiatives for over 20 years: examples include switching to organic cotton based on LCA analyses in early 1990s that showed that it was a significant driver of company’s impact.
 - Work with partners like BlueSign that help Patagonia manage the chemicals and finishing agents they use in supply chain, resulting in a better understanding of how partners are using the chemistries.

Key Drivers for Safer Chemicals and Products

- Material innovation: increase performance and decrease environmental impact (goal is to have both be equal but understood if trade-off needs to occur).
 - Innovation team: Work closely with materials department, product design, commercialization, and environmental responsibility. Focuses on initiatives that are further than two years away from launch date.
- Tin Shed Ventures team (Corporate venture arm): Established in 2013, seeks to invest in new technologies across four categories: waste, water, energy and food (as well as anything that impacts Patagonia’s supply chain in any way).

- Example of company that Patagonia has partnered with through Tin Shed Ventures:
 - Beyond Surface Technologies (Swiss company)—develops textile treatments (wicking technology used in many fabrics). Partnered with Patagonia in 2015; great development partner due to high technical expertise and transparency

Challenges for Implementation/Lessons Learned

- Patagonia: Green Chemistry challenges:
 - Better performing, non-fluorinated durable water repellents (high performance water repellency as well as oil and soil release; contamination resistance)
 - Non-petroleum-based feedstocks (recycled, regenerated or bio-based): for any polymers to make fibers or any chemistries/finishes that apply to their products

Wednesday, May 9

Working Across the Supply Chain to Achieve Commercial Success for Green Technologies

Moderator: Joel Tickner, Director, Green Chemistry & Commerce Council (GC3), UMass Lowell

Panelists:

- **René Molina**, Global Business Product and Planning Manager, Dupont Industrial Biosciences
- **Bart Campbell**, Carpet Fiber Application and Development, Ascend Performance Materials
- **Logan Pensinger**, LCA Programs Manager and Innovation Project Leader, Universal Fibers
- **Stephen Croskrey**, Chief Executive Officer and Member, Board of Directors, Danimer Scientific
- **Brad Rogers**, R&D Director, Discovery and Sustainability PepsiCo Global Foods Packaging

Summary

The GC3 should focus on generating more case studies about challenges and successes regarding commercialization of green chemistry solutions through the supply chain. The panel provided lessons learned from concrete examples of companies working across their supply chains to achieve commercial success.

Molina spoke about the three key elements that Dupont Industrial Biosciences focuses on during development of biomaterials made from renewable resources: Innovate for high performance, ensure scalable supply (accessible and affordable), and prioritize

renewable sourcing (responsible materials) that includes responsible end-of-life for products. Dupont has experienced commercialization success with their specialty polyester, Sorona®, by moving beyond drop-in replacements for petroleum-based materials and creating solutions that have differentiation in the marketplace.

Campbell spoke to how Ascend Performance Materials is not focused on developing new green chemistry solutions, but rather on identifying more sustainable feedstocks for pre-consumer materials that customers can use in their products through the formation of a sustainability-focused group within the company.

Pensinger discussed Universal Fibers' recent sustainability initiatives including the development of light-weight, solution-dyed fiber products that are also recyclable, as well as the 2017 publication of the company's first Corporate Sustainability Report in its 50-year history. Universal Fibers partners with Ascend Performance Materials to identify waste streams/feedstocks that they can use for their customers to meet compliance requirements (i.e. LEED certification).

Croskrey described how Danimer Scientific's success in the development of functionalized PLA for extrusion coating for paperboard led to their acquisition of P&G's intellectual property on PHA, a polymer used to make fully biodegradable bioplastic, even for marine applications. Danimer Scientific partnered with Rogers at PepsiCo Global Foods Packaging to develop 100% certified biodegradable and compostable replacements for many types of petroleum-based plastics that are both renewable and recyclable. PepsiCo Global Foods Packaging is committed to reducing the company's global carbon impact by 20% in 2025 (from their 2015 baseline), and eventually designing 100% of their packaging to be recyclable, compostable or biodegradable. The material development process for Danimer/ PepsiCo Global Foods Packaging has already taken 10 years and will likely require about five more years to complete development on these initiatives. This partnership highlights the need to anticipate and prepare for a long development process to ensure long-term success of new material adoption and implementation.

Key Takeaways:

- Opportunities for Safer Chemicals and Products
 - Beyond 'drop-in' replacements products- create products that have differentiation in the marketplace based on key performance characteristics
 - Identify more sustainable feedstocks, including waste streams, for pre-consumer materials
 - Develop strategic partnerships with companies in the supply chain to bring new products to market
 - Innovative science, scalable supply, and functional materials are key to success
 - Converters play a key and often under-appreciated role in driving green chemistry solutions.

- Key Drivers for Safer Chemicals and Products
 - Performance value of product and marketplace acceptance
 - Responsible material sourcing and end-of-life disposal
 - Meeting customer needs regarding sustainability-driven compliance requirements

- Challenges for Implementation/Lessons Learned
 - Product has to have value for customer but also has to make financial sense for the company to develop a more sustainable option. Can be difficult to sell premium—a lot of customers ask for it and then flinch at cost
 - Ensure that material supply and cost-to-scale are feasible. Don't lower costs for a quick sale that jeopardizes sustainable business
 - Balancing desire to engage potential customers via access to free samples with reality of high financial output during development process
 - Underestimation of actual research and production costs has led to asking customers to invest in research
 - Anticipate and be prepared for the 'long dance' to scalable production. This requires building a trusting relationship
 - To meet customer demands, need to have strong relationships with the right suppliers that will work with company to address challenges moving forward.
 - Be realistic about startup costs
 - Understanding IP and regulatory requirements/timelines with any new material that is ready to go to market

- Helpful Actions to Advance Green Chemistry (Policies, Education, Partnerships)
 - Be flexible but don't "chase" the business.
 - Engage the entire value chain, particularly converters in securing success in commercialization.
 - Find key partners in feedstock supply and downstream key brands that will drive demand as well. Have both feedstock and brand partners.
 - Identify partners that are triggered by core values and want to do long term business. Have to be willing to say 'no' sometimes when finding a good partner.
 - Find partners that share innovation principles (and costs) that lead to marketplace solutions. Ensure customers/partners are committed through the entire commercialization process.
 - Always try to find multiple applications within the marketplace
 - Be as transparent as possible to build trust with partners for long term relationships.

The GC3 Collaborative Innovation Project on Preservatives: Outcomes, Learnings, and What's Next

Moderator: Monica Becker, Co-Director, Collaborative Innovation Lead, Green Chemistry & Commerce Council (GC3)

Panelists:

- **Phil Hindley**, Lonza, Inc.
- **Irena Jevtov**, Irena Jevtov Research & Innovation
- **Vanita Srinivasan**, RB
- **Homer Swei**, Johnson & Johnson

Summary:

The GC3 Collaborative Innovations Project on Preservatives originated from a member request for a facilitated initiative to identify new, safer preservatives for personal care products, that quickly expanded to encompass water-based products in household products, paints, coatings etc. The goal was to bring together companies with similar needs to solve chemistry challenges and advance innovation in preservatives technologies. The project had a dual focus: to find and encourage new novel, safer preservative technologies as well as facilitate commercialization of those technologies to expand the palette of those safer preservatives available for industry use. Consumer packaged goods companies and formulators developed technical, safety, marketing criteria for new technology.

The challenge of this effort was how to create a way to work together to use these foundational criteria to establish a collaborative crowd source competition to identify promising technologies and accelerate to market scale. The sponsorship structure was developed to raise funds and engage companies – retailers, brands, and other stakeholders involved – to design the challenge and as judges to evaluate submissions based on their needs. A number of preservative suppliers were interested in the opportunity to access new, innovative preservative chemistries and joined the effort as sponsors. The project ultimately engaged a range of solvers, from individual innovators working alone to a company already in commercial production.

There were 48 preservatives technology submissions and seven semi-finalists presented to sponsors at the Roundtable. The effort represents the first collaborative green chemistry innovative challenge and demonstrated the value of the approach in engaging supply chain dialogue to develop green chemistry solutions.

Key Takeaways:

- Opportunities for Safer Chemicals and Products
 - Regulation, market demand and NGO pressure have all contributed to shrinking the preservative options available for formulators to use
 - The preservatives challenge directly connected solvers (technology innovators) to strategics (preservatives suppliers, consumer packaged goods companies, product formulators) for partnership to further develop technologies, to invest, license, acquire – essentially commercialize and bring to scale

- Power of collective thinking – possibilities are enhanced when smart thinkers with diverse backgrounds and experience come together to develop shared understanding
- Opportunity to make significant contribution to creating safer ingredients for everyday products – project allowed solvers tremendous shortcuts with testing, help developing value proposition and crafting responsive proposals with strategics
- When solvers came together, it created a community of innovators that could cross-pollinate and support each other, learning from each other's experiences
- Key Drivers for Safer Chemicals and Products
 - Foundational criteria document succinctly captured emerging market signals, regulatory requirements and NGO demands for next generation preservatives that all stakeholders were facing
- Challenges for Implementation/Lessons Learned
 - There was continual learning as the process unfolded and challenges were identified and then collectively solved. This pragmatic mindset overcame many barriers, such as issues with performance testing.
 - Precompetitive model was vital – in order to make progress, there is a need for a safe, trusting space for candid conversation on challenges.
 - Process needed to be flexible and adaptive to different sponsors. Being the first collaborative innovation challenge, there was a need to address issues of contracts, IP, and anti-trust that took time as well as specific contractual arrangements for some companies - all kinds of flexible arrangements to bridge competitive issues/work with various sponsors corporate cultures.
 - Carefully managing around intellectual property issues is critical – need to create structure, rules for robust conversations without worry about one sponsor taking a technology and leaving others out.
 - It is important to continue this work, optimize and deploy solutions as well as facilitate ongoing discussions to continue development of safer preservatives.
- Helpful Actions to Advance Green Chemistry (e.g., Policies, Education, Partnerships)
 - The many conversations among sponsors during design and judging process provides a model for supply chain dialogue that can accelerate design and commercialization of green chemistry solutions.
 - It was reassuring to see competitors come together this way, for the benefit of industry, given that all are facing similar pressures.
 - For innovators, there was a unique opportunity to preview how solutions would be used, to not work in isolation but in a process where they get feedback from larger companies. This was a tremendous benefit to them.

- The process gave strategics access to some of the most talented minds in the world – facilitated connection to individual contributors across globe.
- The GC3 plans to repeat the process with at least one other chemistry in the coming year, attempting variations on the collaborative innovation model.

Notes from the Field: Retailers Advancing Green Chemistry

Moderator: Sally Edwards, Retail Project Lead, GC3

Panelists:

- **Chris Cassell**, Director, Corporate Sustainability, Lowe's Inc.
- **Paul Ellis**, Head of Sustainable Chemicals Management, Kingfisher International Products LTD
- **Oliver Price**, Global Product Sustainability Manager, Reckitt Benckiser

Summary:

The goal of this session was to highlight the unique challenges retailers face in sourcing and selling safer products, provide examples of how challenges are addressed through supply chain collaboration, and engage participants to consider how they could work more effectively with retailers to advance safer chemistry.

Edwards began the session by briefly describing the [Joint Statement on using Green Chemistry and Safer Alternatives to Advance Sustainable Products](#). This Statement, signed by five major chemical companies and six retailers in 2016, includes the following elements: goal setting and continuous improvement, communication, transparency, information on new chemicals and safer alternatives, and green chemistry education.

The panelists then answered a series of questions related to challenges in product sustainability and safer sourcing. They listed complex and non-consistent regulations, lack of transparency, non-updated IT systems, and organizational resources as limiting factors in achieving their sustainability visions. Challenges for sourcing safer products include not knowing what safer alternatives are available. Suppliers tend to select unregulated and cheaper alternatives; yet this is not an effective long-term solution if these alternatives are not safer. Other challenges include how to define the word "safer" beyond compliance and explain it to customers, how to become more proactive instead of reactive, the importance of consistent information, transparency and ingredient disclosure, open communication throughout the entire organization (including all decision makers) and supply chain, and finally, the importance of collaboration in order to advance green chemistry and produce safer products.

Key Takeaways:

Opportunities for Safer Chemicals and Products

- Help consumers drive more sustainable behavior and educate buyers to ask the right questions of suppliers

Key Drivers for Safer Chemicals and Products

- Products reach millions of customers per week; therefore, safety of the customers and employees is critical

Challenges for Implementation/Lessons Learned

- Regulations are complex and not consistent among state, national, and international levels. Regulations must be harmonized and simple in order to be effective, provide guidelines, and focus on problem solving.
- Transparent ingredient reporting is a big challenge. Suppliers often react to chemical restrictions by replacing an ingredient with an unregulated and cheaper chemistry. There is a need to understand product ingredients and for alternatives to be assessed in order to ensure that substitutes are indeed safer.
- Restricted substance lists provide guidance on what substances are restricted but do not include information on safer substitutes.
- IT systems vary within organizations and need to be updated to track changes in the supply chain and changes in regulations. This is difficult, takes much time, and is expensive.
- A tool that will help designers identify low-risk materials is needed.
- Lessons learned: Being proactive gives companies more time to solve a problem in a meaningful way.
- Lessons learned: It is important to communicate with everyone in the organization who is involved in decision making.
- Lessons learned: External partnerships are important in order to bring new knowledge into the organization.

Solve My Problem Session – Building the UN Sustainable Development Goals into your Business Strategy

Moderator: Sally Edwards, Green Chemistry & Commerce Council (GC3), UMASS Lowell

Summary:

In 2015, the UN released its 2030 Agenda for Sustainable Development with 17 Sustainable Development Goals (SDGs). Three of these Goals include indicators that are specifically related to safer chemistry. In this session, participants discussed how they are working to meet the goals, the challenges they are facing, and ways to overcome them.

Commentators:

- **Alexis Bazzanella**, Co-Director, International Sustainable Chemistry Collaborative Centre (ISC3) Innovation Hub
- **Michelle Andriot**, Regulatory Affairs Manager, Dow Chemical Company

- **Shawn Hunter**, Sr. Global EH&S Product Sustainability Leader, Dow Chemical Company

The ISC3's vision statement discusses how sustainable chemistry can help to achieve the SDGs, specifically Goals 3,6, and 12. Bazzanella noted that the SDGs can serve as guiding principles for sustainable chemistry and align with GC3's efforts. In addition, collaboration and innovation are key to achieving these goals. A holistic view and transparency on issues and data gaps are critical to addressing potential trade-offs between SDGs.

Dow has linked its [2025 goals](#) with the UN SDGs; these goals built on Dow's 1995 EHS goals for world class operations. The development of the 2025 goals involved extensive stakeholder engagement, including with academia, NGOs and a Sustainability External Advisory Committee (SEAC) who were key in strengthening and refining the goals. The 2025 goals are part of everyone's job at Dow and focus employees on where Dow can have an impact and really do things differently.

Questions for all participants:

Is your company working to meet the UN SDGs that encompass chemicals management? If so, how are you building these efforts into your business strategy?

One participant noted that their company had worked with the UN on the SDGs, and subsequently aligned their corporate targets with these goals. This company has now turned the SDGs into a management tool with "impact categories" that they use to assess their innovation pipeline. Other participants commented that they have sustainability goals that could readily fit into the framework of the SDGs, but they have not yet focused on aligning these efforts. Other participants noted that they appreciated this session for making them aware of the SDGs as a useful, broad framework for corporate sustainability goals.

What kinds of challenges are you facing and how are you overcoming them?

Participants agreed that the contract manufacturing model of many current supply chains is a barrier to achieving progress on sustainability goals, as problems often occur in places in the supply chain that are distant from a brand. Attaining goals such as those outlined in the SDGs requires much more active engagement with your supply chain to educate, agree on metrics, and jointly overcome roadblocks.

What additional resources do you need? Is there a role for the GC3 in supporting your efforts? If yes, what role do you envision GC3 playing?

Participants suggested that they could use help in translating current sustainability goals into the SDG framework. GC3 could potentially provide guidance to members on doing this responsibly with some sample best practices. Participants suggested that GC3 could assemble case studies to showcase best practices and highlight the differences

between high level goals and sub-goals and their relevance to implementing green chemistry.

Other participants highlighted resources that are already available in this area, including:

- The World Business Council for Sustainable Development (WBCSD) with the Global Reporting Initiative (GRI) and the UN Global Compact have developed guidelines for incorporating SDGs into management systems. This tool is called the [SDG Compass](#).
- The American Chemical Society's Green Chemistry Institute is working on highlighting where green chemistry research and education can impact the SDGs, with the goal of inspiring the next generation of chemists to work on these problems.
- The international NGO coalition IPEN (International POPS Elimination Network) in June 2017 commented on a United Nations Environment Assembly (UNEA2) resolution by providing examples of best practices and detailing the possible impacts of green chemistry on the SDGs. This paper is available on their website at www.ipen.org.

Solve My Problem Session – Balancing Brand Loyalty with Innovation

Moderator: Joel Tickner, Director, Green Chemistry & Commerce Council (GC3), UMass Lowell

Summary:

In this breakout discussion session, attendees discussed challenges and lessons learned in either re-launching cleaner, greener versions of their products, or launching new companies as sustainable, “alternative” brands. There was some discussion about how companies co-brand, and what brands must do to align with each other.

Key takeaways:

- Brands are often challenged by “pressure due to name” with regards to consumer chemical concerns yet have an important “trust mark” they have to protect. Nonetheless, brands have an important role in driving more sustainable products.
- Established, older companies that begin to offer greener products must re-brand themselves or their products, whereas new companies that started out as greener alternatives must maintain their brand image and their market share as the safer alternative to traditional products.
- Consumer demand for safer, healthier products appears to be universal, transcending geographies.
- There is a wave of consumers who want to make more natural and sustainable choices, and at least one survey has shown that a small percentage of consumers are much “greener” than others.

- Companies that launch as a safer, sustainable brand have different challenges than older, established companies that must re-define their brands or product lines as “green” including concerns about lower performance.
- When introducing a “green” product, companies must beware of “overselling” the green aspects of a product, to avoid being perceived as “greenwashing.” Companies should avoid using terms that overstate the benefit of their product.
- It takes time for new products to gain market share; even within a company, some employees may be reluctant to promote the new, greener product from within.
- Brands must apply learnings and technologies about safer alternatives to the production of their more traditional products. This will impact the traditional product line, so that ultimately all the company’s products are greener.
- Communication across the supply chain is important.

Challenges:

- As consumers and NGOs push for safer, healthier products, brand companies face the dual challenges of 1) satisfying current customers who are loyal to an existing product for its performance, and/or 2) gaining new customers for their new safer products. If the consumers don’t like the taste, smell or performance of a new product, they’re not going to buy it.
- Negative perceptions impact retailer and consumer behavior. NGOs and consumers can have perceptions of products in the marketplace that conflict with actual scientific evidence. Often consumer opinions are based on perceptions, not science.
- Some brands have had a particular product pulled from some marketplaces (international or national) because of market or consumer perceptions about the product’s safety.
- Suppliers must also make efforts to understand the brand’s needs to meet consumer preferences.
- Surveys show that consumer choice is driven more by the desire to protect personal or family health, rather than the desire to protect the environment in general. It is important to understand how consumer choice differs depending on segment of the population.
- The growth of a company’s “natural” product suite can outpace its traditional products, setting up internal competition. The goal of a brand may not be to convert a competitor’s customers who are using a natural product, but rather to transition a customer from a traditional product to a safer, greener product.
- There is often consumer tension; i.e., consumers say they want safer products, but actually they buy the traditional product. At the same time, brands must offer products that appeal to customers who want natural products, or those customers will choose a competitor’s products. Companies must appeal to current and future customers.
- Modifying existing products can be a challenge in terms of maintaining performance (critical to the brand) and the feel, smell, etc. to which consumers are accustomed.

- Anticipating consumer demands or criticism often feels like a moving target. Consumers seem to be looking for certain key words or phrases: “biodegradable,” “natural” and “sustainable” are popular, trending terms. Companies need to anticipate the next category of concern. For example, fragrance formulators will have issues in the near future.
- When there is pressure to remove a chemical of concern, what should companies do when there is no safe known substitute?
- It seems that big brands are highly scrutinized in terms of the health and safety of their products, whereas small, green brands “sort of get a pass.”
- Cost vs performance for bio-based materials can be a factor; what can be done from a policy stand point to reward green chemistry to make it more affordable?
- What incentives are there for a formulator to incorporate more expensive raw materials in to a product?
- It typically takes six-10 years to develop chemicals and get them through government and certification processes which is slower than market pressures.
- For those companies that are trying to innovate, sometimes government regulations make it more difficult for companies to adopt new technologies.

Opportunities:

- To improve brand reputation, it’s helpful to cultivate consumer trust through transparency. One GC3 member stated that their company has had a five-step safety process in place for many years, but had not been public about it, until the company decided to share that in an effort to be more transparent with its customers.
- Be proactive and upfront. One member said that years ago their company created an “emerging issues” process group that tracks comments about their products, which helps the company anticipate either negative feedback, or consumer trends about product opinions.
- One GC3 member said, “When you’re explaining, you’re losing.” It’s important to avoid, but be prepared for, consumer criticism of your products and be ready to educate about what the company is doing to address concerns.
- Another GC3 member company said that it created an internal incentive program as a way to champion innovative green chemistry solutions.
- It’s important to educate consumers/customers. One GC3 member said “I feel that we have a corporate responsibility to guide consumer behavior by educating the consumers.”
- Storytelling, whether internally or externally, is important. The bigger brand tells the story about innovation, and the startup talks about the bigger brand with whom they’re partnering. It doesn’t have to be consumer storytelling. Employees are also listeners and storytellers.
- B2B green marketing is bigger than B2C; there are more opportunities to implement change and powerful market incentives.
- It’s smart for smaller suppliers to align with a large brand that makes a large commitment to green chemistry; smaller companies increasingly realize that big brands need help in meeting their green chemistry goals.

- One company said that supply chain issues are going to increase, so it is important to try to predict the next commodity challenge, such as the availability of agricultural and mineral raw materials.
- It's helpful to get ahead of criticism of NGOs; have more conversations/open dialogue to understand where they're coming from, find common ground, make sure that they are presenting a scientific or technical case, and approach the conversation with a level of humility and openness. Go into the conversation with a belief about your scientific approach, but with a curiosity about what they have to say. More dialogue with NGOs helps them understand industry's challenges, earnest efforts and progress that industry is making.

Role for the GC3 in Addressing Brand Issues:

- The GC3 could play the role of “honest broker with facts” to serve as an educational advocate for green chemistry when state or federal governments attempt to impose bans or regulations of products. As a case in point, the recent decision by the state of Hawaii to ban all sunscreens to protect coral reefs may have been avoided if a non-industry group such as the GC3 had facilitated a meeting with Hawaiian legislators and industry members to discuss the science of sunscreen and pros and cons of solutions. The GC3 could also facilitate discussions on the challenges brands face in reformulating products in response to retailer or consumer concerns.
- Events such as the GC3 Annual Roundtable offer a valuable opportunity for businesses to share dialogue with NGOs. What the GC3 has done with its Preservatives Project is an excellent model; attendees suggested doing more of those challenges, beyond the area of preservatives.
- The GC3 should continue to identify best practices and case examples to help overcome the challenges.
- The GC3 can connect brands with retailers and innovative start-ups to address green chemistry innovation challenges.
- The GC3 can help support policies that better enable product innovation and scale.

Solve My Problem Session – Working Across Supply Chains

Summary:

This session convened interested attendees to discuss the challenges of working in their supply chains, to brainstorm on efforts to overcome those barriers and provide examples of success. To initiate the discussion, potential problems were posed to the group: companies a) lacking economies of scale due to products used in multiple and varied end-markets, and b) prioritizing a supply chain to pursue. Participants responded to those and other supply chain challenges. Some of the main problems identified were communication challenges and differing levels of expertise in the supply chain. A number of ideas to overcome the challenges were proposed as well as several ideas

that the GC3 could pursue. The discussants included materials companies (majority), manufacturers, brands, and a retailer.

Key Takeaways:

What Are the Major Supply-Chain Problems?

- Communication
 - Lack of standardized definitions and understanding can lead to confusion and miscommunication.
 - There is a one-way direction of information flow, from the supplier to customer.
 - Information requests are not adequate due to a challenging format or incomplete information.
- Protecting IP
 - Most of the new ideas come from customers but companies don't work with the customer on the science. Change would likely go much faster if there is collaboration with the customer at the research level, but protecting IP inhibits this.
- Lack of expertise/different levels of expertise in the supply chain
 - No in-house chemical/engineering experts to understand which chemicals to avoid
 - Need expertise of others to help vet where materials are best used
 - Upstream = more technical, downstream = less technical and focusing on lists
- Limited bandwidth
 - Companies, especially start-ups, are limited on resources and have to decide which markets to prioritize
 - Alignment of product could help scale-up
- Global supply issues
 - Getting the attention of distributors is hard
- Lack of data:
 - Prevents new chemistries/technologies moving forward
 - Degree of uncertainty of what might be greener
- Difficulty confirming "safer":
 - Certifying body can dilute this; no set definition
 - No full data set and lack of full disclosure to protect IP
 - Expense of certification

How Can Barriers Be Overcome?

- Communication
 - Standardize the definitions. What is Green Chemistry, what is Sustainability?
 - Learn the vocabulary. Define not as ideals but with specific criteria and define the problems. That way one can meet the criteria and have deliverables that meet this.

- Change the messaging from “safe” to “Continuous Improvement.” Promote products as safer not safe as there are degrees of hazard and continuous movement towards safer.
- Align the chain with values but then provide each link with the criteria/information needed in a format that is accessible, since different parts of the supply chain have different needs and levels of expertise,
- Use certifications to help with communication of flow of ingredients (these provide more accurate and thorough disclosure).
- Build relationships with customers and suppliers (versus transactions).
- Provide clarity, purpose, and feedback: why you are asking for information, what are you going to do with the information?
- Clearly define requirements for each step of the supply chain and message the materials appropriately depending on the level of expertise of the audience.
- Regular reporting to buyers can lead to progress– example: footwear had clear metrics where they had standards and reviewed them on a quarterly basis.
- Data
 - Develop an in-house testing program to help ensure that the products do not have certain chemicals.
- Collaboration
 - Find the performance need and work with someone (both technical and marketing) who knows where it could be successful.
 - Get the attention of key distributors- consider a stipend, share costs.
 - Bring in NGOs to develop shared vision.
- Pilot
 - Select certain pockets of the supply chains where there is a critical need to develop an economy of scale.

What Role Can the GC3 Play in Overcoming Barriers?

- Focus a project on articles vs formulated products.
- Identify the disconnects/failures in a supply chain and engage the community for a solution.
- Develop case studies on a supply chain challenge.
- Bring together the supply and NGOs to talk about a model for supply chain communication.
- Connect groups.
- Recruit missing parts of the supply chain, including the distributors.

Keynote Address

Speaker: David Golden, Vice President, Chief Legal & Sustainability Officer and Corporate Secretary, Eastman

Golden said that the current media and political climate has led to the devaluing of science by the public, as well as the loss of public trust in corporations, especially those

that do science. Those that have no scientific background are increasingly trusted, and perception is becoming reality. Companies will not be going backwards on protecting the environment, despite the change in public policy and perception; they know that they live on this planet and that activists won't let them. They have to be proactive in protecting the environment. There has never been a better time for green chemistry, there is a strong tailwind. But it is still a heavy lift. Corporations that don't innovate will die.

This means that green chemistry has never been more relevant. It is important to create far more value than the resources used or the future is not sustainable. Golden gave several examples to show that when a company has the right partner and is putting in the right time and thought to define the problem, new innovations will come. The person who controls the conversation is the one with the microphone — will it be us or the blogger on the internet? Get the mic and generate a compelling argument to get people to think differently and solve problems. If we don't start acting differently, we are doomed.

Key Drivers for Safer Chemicals and Products:

- There are four main drivers for green chemistry:
 - macro trends;
 - ESG;
 - sustainability, and
 - corporate responsibility.
- Macro-trends include a growing population, emerging middle class, more focus on health and wellness, and resource limitations.
- Investors are looking at the SDGs, they increasingly recognize that solving world problems creates long term value. Blackrock's Larry Fink's 2018 annual letter to CEOs illustrates that the market wants a long-term strategy that will create shareholder value. Increasingly, environmental, social, and governance (ESG) issues are on proxy statements. If you are not creating value that doesn't destroy resources, your company is not a good investment. When Sustainability Accounting Standards Board (SASB) standards get adopted, it will provide more metrics that will support this.

Opportunities for Safer Chemicals and Products

- Everything is interrelated. Must learn how to make materials in a way that helps feed and clothe the planet, that uses natural resources efficiently, and that helps people feel better and live longer.
- Corporate strategy has to be linked to the planet we live on. The UN Sustainable Development Goals (SDGs) are a great place to start, there is no need to reinvent the wheel.

Challenges for Implementation

- Stepping out of a quarter to quarter mentality will be a challenge, but is necessary

Role for the GC3 in Advancing This Mission

- Help bring new solutions to market
- Help find the best and brightest
- Get the message out more effectively to shareholders, to communications people, and communities

Thursday, May 10

Finding Safer Chemical Alternatives: Resources for Selecting Green Chemistry Technologies

Moderator: Roger McFadden, Vice President of Innovation and Sustainability, Canberra Corporation

Panelists:

- **Scott Boito**, Product Stewardship & Advocacy Rep, Eastman
- **James Ewell**, Director, Sustainable Materials, GreenBlue Institute
- **Anna Lennquist**, Toxicologist, ChemSec
- **Teresa McGrath**, Environmental Regulatory Toxicologist, The Sherwin-Williams Company
- **Mario Stewart**, Chemist, Earth Friendly Products

Summary:

Many members of the chemicals supply chain are interested in learning more about resources available for identifying safer alternatives to chemicals of concern. This session provided information on some of the resources that can be used to find safer chemicals, for both formulated products and articles/hard goods. It featured the users of these tools, including who are supplying information on safer ingredients and technologies and those who are searching for safer alternatives.

Ewell reviewed two approaches manufacturers use to screen chemicals (Regional Screening Levels and hazard evaluation), the different types of RSLs (regulatory, authoritative, and voluntary), how RSLs are implemented (certifications and product registries) and finally, resources used for a more robust hazard evaluation approach (assessment methodologies, tools, and product registries).

The rest of the panel discussion focused on three resources: the EPA Safer Choice Program, CleanGredients, and the MarketPlace developed by the European NGO ChemSec. The panelists included developers and user of these resources who shared their insights and recommendations.

Key Takeaways:

Opportunities for Safer Chemicals and Products

- The EPA Safer Chemical Ingredient List (SCIL) contains functional chemical classes for cleaning products and other relevant sectors, and it lists the preferred or best in class chemicals.
- Formulators can also use CleanGredients which contains a database of ingredients from suppliers that have been reviewed by third party toxicologists and meet the EPA's Safer Choice Standard.
- MarketPlace developed by ChemSec helps connect manufacturers who want to find safer alternatives for their products with suppliers who have developed alternatives and comply with the requirements ChemSec has established.
 - This database aims to catalyze the market place by making information easily accessible.
 - The suppliers who provide the safer alternatives on MarketPlace are liable for what they advertise about their product.

Challenges for Implementation/Lessons Learned

- There is an assumption in the market place that manufacturers know the chemicals in their products, understand the hazards of these chemicals and thus will be able to find safer alternatives. However, most manufacturers' visibility into the chemistry of their products depends on where they are in the supply chain.
 - Supply chain chemical visibility listed from the most transparency to the least: Mixtures → Materials → Components → Assemblies → Finished products
- It is important to market these resources and educate consumers and suppliers about the value of resources such as the CleanGredients in order to collect more data from suppliers that will in turn be useful for formulators.
- Lessons learned: A goal is to move from red lists (chemicals of concern) to positive lists (preferred chemicals)
- Lessons learned: keep communication open between the legal department and the business department in an organization. If the legal department understands what risks are being taken, they can help support green chemistry.
- Lessons learned: When tackling a chemistry challenge in the marketplace, learn from experts outside the company such as toxicologists, academics and NGOs.
- Challenge: Expanding these resources to suppliers and manufacturers in Asia.

Project Breakout Session – Growing the Green Chemistry Movement Internationally

Summary:

This session explored ways to expand the GC3's reach nationally and internationally. Participants discussed questions such as: what sectors the GC3 should more actively engage to drive green chemistry commercialization; how the GC3 can more effectively engage global supply chains in green chemistry collaborations; and which regions would be most ripe for expanding GC3 activities. Those attending expressed interest in finding new raw materials, the circular economy, better engaging/partnering with

international suppliers, and growing green chemistry in Europe, South America, and Asia.

Key Takeaways:

Challenges for Implementation

- Cultural differences
- Language barriers- general understanding and jokes, skilled translation needed
- How to find commonality and synergy given regional differences around policy and standards
- So many suppliers!
- How to go beyond a one-time event, and instead focus on growing local adoption and ownership
- Not stretching the GC3 too thin or diluting its success in the US

Helpful Actions to Grow GC3 Membership Internationally

- Build on existing GC3 relationships
 - Ask member companies to tap into their international teams to be part of a roundtable in other countries.
 - Ask GC3 members with an international presence to be ambassadors for the GC3 and engage local communities, including universities.
 - Engage parts of the GC3 members' supply chain that are international:
 - Hold a pre- or post- Roundtable event with suppliers.
 - Prioritize a sector to work with and go where the supply chain takes us.
- Don't pick up the GC3 and put it down in another country; tap into existing international champions, communities and networks to build credibility
 - Identify key opinion leaders in target countries (Asia, China, India South/Latin America) as GC3 "ambassadors" to help understand and grow the level awareness, motivation, and culture.
 - Include tier 1 or tier 2 suppliers as well as testing labs
 - "Co-brand" events with local organizations
 - Focus on building relationships vs transactions
 - Support creation of an alliance of local organizations
 - Identify international NGOs and UN focal points
 - Create a two-way street of information.
 - The Peace Corps might be a model. Could they do some green chemistry projects?
 - Identify pain points; what are the countries doing that most need green chemistry innovations.
 - Learn from others' experience expanding internationally,
 - e.g., GreenBuild China. What worked and what didn't
 - Hold more international challenges, such as the Preservatives Challenge, as a way to find and empower international innovators.

Think About the Message

- The *how* might be different in each country, but the *what* should *fundamentally* be the same.
- The background goal is making it a competitive advantage to use green chemistry, but for that to happen, need to define GC, have measures etc.
- Identify a “war cry” for green chemistry.
- Develop case studies--stories from companies that explain: “this is what green chemistry can do for you.”
- Provide tools.
- Take action before it becomes a compliance issue for one’s company.

Project Breakout Session – The GC3 Sustainable Chemistry Alliance

Moderators: Michele Jalbert and Michael Parr, Co-Directors, GC3 Sustainable Chemistry Alliance

Summary:

This session summarized challenges and barriers in adopting green chemistry and the role of policy in addressing them. Presenters provided an overview of the role of industry advocacy in shaping policy and detailed the current membership, structure and work underway by the recently-established GC3 Sustainable Chemistry Alliance. It is a diverse business-driven advocacy voice for policies to support the development and application of sustainable (green) chemistry. Comprised of GC3 member companies from the entire chemistry value chain, the Alliance leverages the political clout of member companies to drive a sustainable chemistry agenda.

Key Takeaways:

Opportunities for Safer Chemicals and Products

- Policy can incentivize and support research and development (academic research; tax credits, loan guarantees, grants); help support and de-risk early stage research and development into sustainable alternatives; support process demonstration & scale-up (tax credits, grants, loan guarantees)
- Government purchasing can drive demand growth.

Challenges for Implementation of green or sustainable chemistry

- Intensive research and development required to achieve desired sustainability, performance and cost attributes while research and development budgets are decreasing
- Disconnect between downstream customer demand for sustainable chemicals and time required for invention and development
- Difficult to rapidly achieve adequate scale in sustainable chemicals production to meet customer needs
- Barriers to transitioning major “platform” chemistries, given existing industry assets and investment

Helpful Actions to Advance Green Chemistry

- Work to protect existing programs from damaging cuts, such as Department of Energy & Department of Agriculture funding (grants, loans, etc.); BioPreferred labeling; Environmental Protection Agency, National Science Foundation, Health & Human Services; Department of Defense and other federal preferred purchasing for sustainable chemistry products
- Leverage government focus on US innovation and manufacturing for supportive policy, such as preferred purchasing opportunities in new infrastructure package, Department of Defense spending; tax credits, grants and loan guarantees for: sustainable chemistry research and development, investment and scale-up sustainable chemistry production

Project Breakout Session – The GC3 Green and Bio-Based Startup Network

Moderator: Joel Tickner, Director, Green Chemistry & Commerce Council (GC3), UMass Lowell

Attended by phone: Julie Manley, Startup Network Coordinator, Green Chemistry & Commerce Council (GC3)

Summary:

Tickner gave an overview of the GC3 Startup Network activities in the past year, which included the Strategic Connections Program, the Green and Bio-Based Technology Showcase, networking sessions including an event at Greenbuild, and webinars on a variety of relevant topics for startups. The purpose of this breakout session was to identify needs of the Startup Network members and to begin to map out activities for the 2018/2019 program year. Tickner said that the Startup Network would be expanding into South America and further expanding its connection with Canada, and the GC3 will be planning a workshop for the Startup Network, on targeting applications and readiness.

Key Takeaways:

- Part of the purpose of the GC3 Startup Network is to drive innovation to connect innovative technologies with the needs of the larger companies. The GC3 should continue to enhance its role as a connector between solvers and large companies.
- The GC3 is recognized as an agent of trust so that when startups are introduced by GC3 to larger firms, there is already an open reception. The GC3 should maintain this position by possibly creating clearer guidelines for membership in the Startup Network.
- Startups need help in finding investors and building their business case when presenting to large companies.
- Incubators can help nurture startups by helping them build their business case, so maybe the GC3 should help startups connect with incubators.

- Attendees generally agreed that it was a good idea to have the Technology Showcase integrated into the main Roundtable program, and it was good to have a semi-finalists poster session during the Eastman evening reception.
- The GC3 could do a better job communicating information about startups in its network to GC3 members through the website and newsletter.

Challenges:

- The GC3 would like to find sustainable revenue streams so that it can have funding to support the Startup Network initiatives.
- One startup member said they need help in “de-risking” the process of commercialization - to prove to larger companies that the startup’s technology and business plan are viable. There was substantial discussion about what startups need to “de-risk” their business and technology. It is important to identify how to help companies transition from an R&D project to a business. Bioindustrial Innovation Canada does this type of work.
- Some startups stated they need help with achieving regulatory approvals and certifications.
- One large strategic company member said that a startup’s team must be complete to have a better chance of getting “buy-in” from that large company. If you ask a large company to provide their process technology, then the startup does not have a full team.
- Startups should have their business “mapped out”; i.e., to show its business case to investors and companies.
- Startups expressed a need for partners who share their values.
 - In the past, the GC3 tried creating and using an innovation portal, along the concept of a “Match.com for green chemistry,” but it did not succeed, and the GC3 does not think that approach will work. However, there may be connections to new initiatives like the ChemSec Marketplace.
- Some attendees said that all startups look for investment funding, but that it is hard to find venture capital investors who want to invest in chemistry, since most want to invest in digital technology.
- One attendee from a large cosmetic company said that large companies need transparency from startups to understand the technology that the startup offers. That transparency creates trust.
- Another challenge for many startups is how to create a team to come to the table for quality conversations with larger companies.

Opportunities:

- Strategic Connections – the program has been very successful and useful to startups
 - Extend the strategic connections component of the Startup Network to help startups find commercialization partners, which is important for Small Business Innovation Research (SBIR) grants and other funding opportunities
 - Match up solvers with problems – would help startups understand what large companies need

- Have an incubator or small business resource center connect a startup with a corporation
- Introductions to accelerators/incubators within corporations
- Consider doing one to many strategic connections
- Connect startups with partners that have plants and the financial resources to ensure the supply and demonstrate the security of partnership
- Connect Canadian and European nodes to US nodes, without duplicating what is being done in Canada or Europe
- Many GC3 members have connections in Latin America and Mexico; Brazil and Argentina have a lot going on in terms of bio-based materials. The GC3 has new funding from Germany that will make it easier to reach out to Latin America and Mexico.
- Technology Needs
 - Expand the communication of large company needs regarding technology and contracts.
- Resources & Templates
 - Consider sharing templates, systems, contracts, etc.
- De-risking
 - Outline how to go from an R&D project to commercialization.
- One company suggested a reservation fee, so that when larger companies are very interested in a startup technology, that reservation fee would go towards the first year's orders, like a down payment.

How the GC3 could help:

- Workshops/Webinars
 - Consider a series on startup case studies and learnings from past mistakes. How to encourage more open sharing of problems and solutions.
 - The intellectual property webinar series by Finnegan law firm was very helpful. A member of the Finnegan team suggested the idea of lawyers leading some support workshops.
 - An audience member said webinars are easier because the attendees don't have to spend time away from the desk.
 - Another attendee said that allowing more Q&A time on webinars would be helpful.
- Revenue Stream
 - Explore how to create a "trust platform" that utilizes the trust that GC3 has created among members.
- De-risking
 - Explore if there is a role for the GC3 in finding organizations that help startups by checking off those boxes to reduce risk.
- Mentoring & Connections

- Consider forming a mentor board, whereby each startup would be matched with members in the supply chain.
 - Can the GC3 do a better job in its “Tech Scouting” value to larger members, helping Startup Network companies provide better information/pitches on value and differentiation in green chemistry.
 - Connect startups to investors. The Chemical Angel Network webinar was helpful and greater connections to the group would be useful.
 - Consider developing a list of contract manufacturing facilities.
 - Canada has tried to set up collaboration and advisory services located in a research park incubator – partnerships available on brownfield sites for building larger installations; depending on individual needs of companies, could help make connections.
 - Consider a certification of partnerships
- Publicity & Outreach
 - On the GC3 website, provide an enhanced guide to all the startups in the network allowing potential business partners to get more information about the startup.
 - To grow membership in the startup network, the GC3 should provide a standard email/ letter for current members to send to prospective members explaining the value proposition. Consider including membership forms/materials (vetting of potential new startup members).
 - Email exciting startup member developments/news to GC3 membership.

Presidential Green Chemistry Awards: Learning from the Champions

Moderator: Tess Fennelly, CEO and CCO, remooble

Panelists:

Myron Shaffer, Product and Technical Service, Covestro LLC

Brian Glasbrenner, Global Commercial Manager, NatureWorks LLC

Audra Wendt, Bioindustrial Senior Marketing Manager, Cargill, Inc.

James Bohling, Associate Scientist, Dow Chemical Company

Summary:

Fennelly introduced four companies that have all been past recipients of the prestigious EPA Presidential Green Chemistry Challenge Awards, which recognize innovative chemical technologies that incorporate the principles of green chemistry into chemical design, manufacture and use. For a company to qualify for this award, they must demonstrate green chemistry technology that includes source reduction and undergo all things associated with ‘unique discovery’ (i.e. patents, proof of scalability, regulatory reviews). Since the awards started in 1996, over 1600 nominations have been submitted resulting in 120 award winners.

The market-based sustainability gains achieved since 1996 include the elimination of 826 million pounds of hazardous chemicals and solvents, conservation of 21 billion gallons of water, and reduction of 7.8 billion pounds of CO₂ equivalents that would have been released to the air each year.

- Myron Shaffer, Product and Technical Service, Covestro LLC
Covestro (previously Bayer Corporation) is a 14 billion-euro company in global net sales, offering product solutions for polyurethanes, polycarbonate, and adhesives/coatings and specialties. Covestro has won two Presidential Green Chemistry awards and Shaffer highlighted how the 2000 award acknowledged the company's goal to reduce VOCs through the development of a series of high performance waterborne coatings that eliminated the use of hazardous solvents from many applications.
- Glasbrenner, Global Commercial Manager, NatureWorks LLC, noted that Natureworks received the award in 2002 for demonstrating how to engineer polylactide (PLA) polymer in an economical, safe, and sustainable manner. The Award also acknowledges efforts to ensure that significant improvements in environmental impact are sustained over time. Polylactide polymer is not derived from lactic acid but rather from *lactide* (the dimer ring from lactic acid). Natureworks has primarily focused on lactide polymerization chemistry, leveraging compostability of products within the food service packaging industry. Currently, they are looking for ways to incorporate this technology in materials outside of thermoplastics (i.e. adhesive and coatings space).
- Wendt, Bioindustrial Senior Marketing Manager, Cargill, Inc., noted that Cargill has been in business for 150 years and services four major sectors: food, agriculture, energy and industrial space. A major business driver for Cargill is determining how to change the industry 'game' and provide high societal impact for good. Cargill has won two Presidential Green Chemistry Challenge awards, one for the development of bio-polyols developed to help polyurethane manufactures increase their recyclable content, move away from petroleum-based polyols and reduce their overall environmental footprint. The major focus was on environmental benefits of implementing new material: 36% less global warming emissions, 61% reduction in non-renewable energy, and 23% reduction in total demand of non-renewable energy. For every million pounds of bio-polyols products generated, 200 barrels of crude oil are saved.

The second award was given for the development of a bio-based transformer fluid, Envirotemo FR3, to replace mineral oil. Major benefit of this unique chemistry is that it allows that inside of transformer lasts 5-8 times longer than with mineral oil. Also, the properties of the vegetable oil base allow the same size transformer to run more efficiently, reducing costs per KBa. This also allows one to have a smaller transformer box with the same capacity, which reduces the imprint/space. There is also a significantly improved fire-safety profile with this natural ester transformer fluid.

- Bohling, Associate Scientist, Dow Chemical Company, noted that Dow Paper Coatings division has received two Presidential Green Chemistry Challenge awards, one for developing original thermal paper technology to eliminate need for harmful chemical developers, and the second for modifying the latex structure capabilities in paint to achieve better performance and increase sustainability profile of the paint material.

Original thermal paper technology requires the use of BPA as the developer. BPA is used as a 'free' (unbound) chemical coating for the paper, so the potential risks are amplified from the BPA polymer resins. EPA and other groups put out a call to replace BPA, but no good alternative chemicals were available on the market. Dow's innovation was to create paper material that uses thermal technology to generate a text imprint without the use of dyes or developer chemicals. Dow's ingenuity also lies in creating thermal paper that is compatible with the same imprinting machines that are currently on the market, eliminating the need for capital investment to replace existing hardware. The added benefits of this technology are that the process generates a permanent image on the paper that does not fade and it is also the first thermal paper to be approved for food contact.

The second award-winning innovation reduced the use of titanium dioxide, used to create opacity, in latex-based paint. Titanium dioxide requires a lot of energy to produce. Dow designed a latex that results in a more ordered film, which confers higher performance through better color retention, stain and wear resistance. This superior latex technology allows paint manufacturers to use 20% less titanium dioxide in their products and formulate at a lower cost.

Key Takeaways:

Challenges to Implementation/Lessons Learned

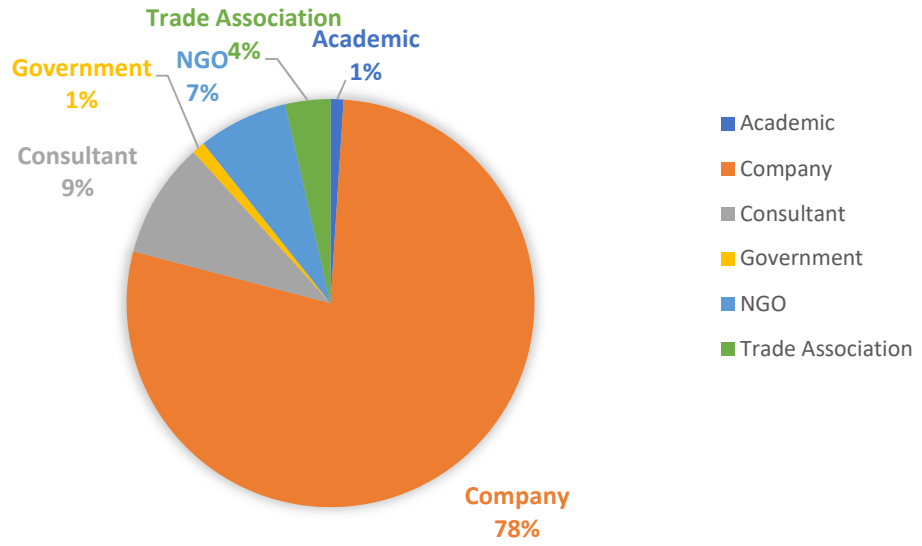
- Market need and acceptance
 - How do you find the right market for the right technology? Need to identify the market need, develop ancillary strategies in place to develop a market niche!
 - Customers need clarity on value proposition for customer beyond environmental impact.
 - Convincing their own sales reps about finding opportunity for sale (competing with similar products).
- Time
 - Need patience to withstand a long commercial path
 - Market acceptance of innovations can be slow (took seven years to go to market with this innovation in two component waterborne solvent technology)
 - Testing requirements lengthen timeframe; performance has to be equivalent or better at the same price point
- Improved performance

- Performance has to be equal to or better than what is being replaced because cycle time to replace a material is quite expensive, so not economically viable to replace it with something that is just “as good as”
- Scale-up constraints with suppliers
- Value Chain
 - Middle of the value chain (i.e., retailers) often poses the biggest hurdle to adoption.
- Customer-driven material developments (such as texture and color) did not occur until material performance proved better than solvent borne materials.

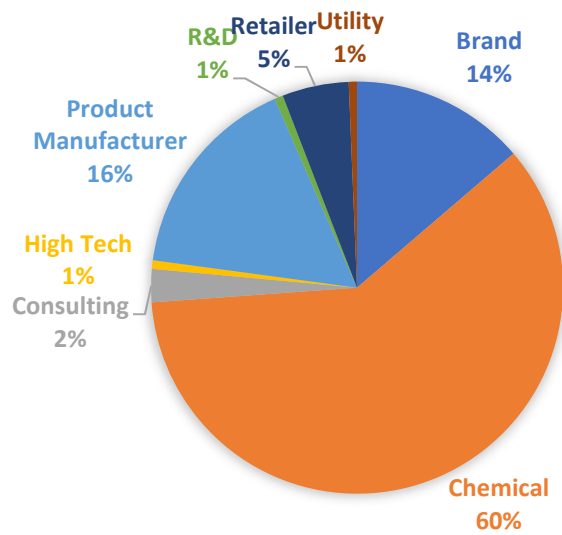
Key Drivers for Success

- Performance
 - Sustainability equals improving system performance so that material does not have to be replaced as often by customer
- Flexibility
 - Recognize that the initial target market may not be where you find final success
- Understand your customers
 - What is critical to your consumer? Understand market pull versus technology push; stopped leading with the ‘green’ and switched to performance and defining the needs/wants of the market and customer
 - Structure business to key value proposition
 - Important to determine what problem you are trying to solve for the customer and back it up with chemistry.
 - Pitch to customers’ needs to target “why” we need to introduce a new technology, not just present the new technology.
 - The story to your brand is critical, but companies need to define it and make it something that is critical for their potential customer(s).
- Collaboration
 - Surround yourself with companies that can support your process (you don’t have to do it all).
 - Define the decision makers in the value chain and identify resources that will help you meet your goals.
 - Need to increase retailer adoption of new technology and look for ‘pull through’ opportunities between company and government, university, and/or healthcare system purchasing programs.

2018 Roundtable Sectors Represented



2018 Roundtable Industries Represented



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