

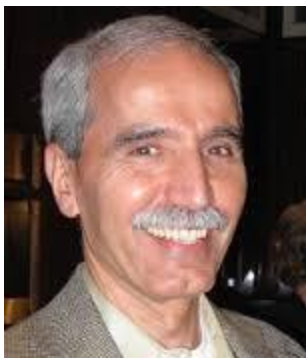
# **Sustainability in the Chemical Industry: Challenges and Opportunities Workshop**

**Saturday November 7<sup>th</sup>, 2015**

**Memphis Cook Convention Center – Room L-13**

- 8:15 - 8:30 **Welcoming address**
- 8:30 – 9:15 **Sustainable Chemistry and the Eight Grand Challenges**  
**Speaker: *Dr. Mahmood Sabahi***
- 9:15 – 10:00 **Sustainability at BASF: Life Cycle, Eco-Efficiency, and the role of Chemists and Engineers**  
**Speaker: *Tom Seagraves***
- 10:00 - 10:30 **Break**
- 10:30 - 11:15 **Materials Chemistry and Technology for a Sustainable Future**  
**Speaker: *Prof. Elsa Reichmanis***
- 11:15 - 12:00 **Sustainability & the Chemical Industry - Eastman's Perspective**  
**Speaker: *Dr. Barclay Satherfield***
- 12:00 - 1:00 **Lunch**
- 1:00 – 1:45 **Case studies in Life Cycle Inventory assessment for the Chemical Industry**  
**Speaker: *Prof. Matthew Realff***
- 1:45 - 2:30 **Sustainability & Life Cycle Assessment**  
**Speaker: *Dr. Abdelhadi Sahnoune, ExxonMobil Chemical Company***
- 2:30 – 3:00 **Energy Intensity of chemic processes, its Economic Impact and Renewables**  
**Speaker: *Dave Yavrek, BASF***
- 3:00 – 3:30 **Panel Discussion and Q&A**

## Biographies and Summaries



**Dr. Mahmood Sabahi**

Mahmood graduated in chemistry from Shiraz University, Iran and received a Ph.D. from Syracuse University in physical organic chemistry. After spending ten years in academia, he joined Albemarle Corporation as R&D Specialist and retired as R&D executive in new product development in Polymer Solutions division. During his years at Albemarle, he held a variety of responsibilities in new product and new process development and is an expert in leading ideas through the development process to commercialization. He was the leader of the Green Chemistry and Engineering program for five years and has actively been promoting sustainable chemistry throughout his career. He received the lifetime achievement award for sustainable chemistry at Albemarle. After retiring from Albemarle in 2013, he has been actively promoting sustainable chemistry. In collaboration with Dr. Michael Benton, he developed and taught the course “Fundamentals and Challenges of a Sustainable Chemical Industry” at the chemical engineering department of LSU. He has 34 US patents and a number of World Patents and 16 publications from his days in academia.

**Summary:** One of the most pressing issues facing the chemical industry today is a need for greater long-term sustainability for both economic and environmental reasons. This opportunity is well recognized by the chemical industry and systematic efforts and programs have been created to address the sustainability of their businesses and products. The creation of the Dow Jones Sustainability Index is a clear indication of the economic, environmental, and social importance of sustainability to corporations. Additionally, the need for increased sustainability has caught the attention of many leaders in the scientific, industrial, regulatory, and engineering communities. For example, the National Research Council (NRC) of the National Academies recently released a report detailing eight grand challenges that must be addressed to secure the long-term sustainability of the chemical industry.

Southeast and Southwest of the United State with its amazing natural resources, the booming petrochemical industry, and diverse chemical manufacturing facilities provide the best opportunity for addressing these grand challenges. In this presentation, I will first provide a historical background of the chemical industry and briefly discuss the grand challenges facing the industry. Then, I will discuss the necessity of providing the best sustainability education for chemistry and chemical engineering students and will provide an overview of the Sustainability course at LSU.



**Prof. Elsa Reichmanis**

Elsa Reichmanis is Brook Byers Professor of Sustainability and Professor, School of Chemical and Biomolecular Engineering at the Georgia Institute of Technology. Prior to joining Georgia Tech, she was Bell Labs Fellow and Director of the Materials Research Department, Bell Labs, Murray Hill, NJ. She received her Ph.D. and BS degrees in chemistry from Syracuse University. Her research, at the interface of chemical engineering, chemistry, materials science, optics, and electronics, spans from fundamental concept to technology development and implementation. Her interests include the chemistry, properties and application of materials technologies for photonic and electronic applications, with particular focus on polymeric and nanostructured materials for advanced technologies. Currently, efforts aim to identify fundamental parameters that will enable sub-nanometer scale dimensional control of organic, polymer and/or hybrid semiconductor materials to meet the vision and expectations for flexible, printed electronic devices, display technologies, and low-cost, portable solutions for energy storage and conversion. She is a member of the National Academy of Engineering and has received several awards for her work, including the SCI Perkin Medal and the ACS Award in Applied Polymer Science. She has also been active in professional societies; she served as 2003 President of the ACS, and has participated in many National Research Council activities.

**Summary:** To provide a view on sustainability from the academic sector, this presentation will explore how our educational infrastructure can help promote a global culture of sustainability. Focal points include building a multidisciplinary environment through i) university wide initiatives such as Georgia Tech's Brook Byers Institute for Sustainable Systems, ii) externally funded educational activities such as the NSF funded NESAC IGERT program, iii) opportunities for industrial-academic research partnerships, and iv) individual research in materials chemistries for advanced technologies. Together, these examples demonstrate how academic institutions can enhance their "research, education, and service missions, and campus operations through leadership, communications, development, and decision making inspired and defined by the principles of sustainability".



**Prof. Matthew J Realff**

Dr. Matthew J Realff is a Professor of Chemical and Biomolecular Engineering at Georgia Tech and David Wang Senior Faculty Fellow. He is an Associate Director for the Strategic Energy Institute at Georgia Tech with a focus on separations and catalysis. He has been at Georgia Tech since 1993, after completing his Bachelor's degree at Imperial College London, a Ph.D. in chemical engineering at MIT in 1992. He was a National Science Foundation program director from 2005-2007 in the division of Civil Mechanical and Manufacturing Innovation where he ran programs in environmentally benign design and service enterprise systems. He was co-chair of the ACS Green Chemistry and Engineering conference in 2013.

His research interests are in process and sustainable systems engineering. He has worked on problems of recycling system technology for the carpet industry and how this technology interacts with other supply chain elements to define different industrial systems. He has also worked on electronics recycling logistics and industrial network design. He chairs the Joint Committees of Carpet and Resilient Flooring Sustainability Assessment Standards for NSF (National Sanitation Foundation) and on Environmental Leadership for Computer Servers. These are ANSI approved product sustainability assessment standards. Joint with Dr. Michael Overcash he works on the development of life cycle inventory data for products such as carpet and flame retardants for circuit boards. This life cycle information feeds into the development of methods for product and standards design. His current research interests are in the effective generation of transparent life cycle inventory data and its use in sustainability standards, carbon capture technology development, and biorefinery process design and systems analysis.

**Summary:** "Case studies in life cycle inventory assessment for the chemical industry."

Life cycle studies to support resource footprints have become a staple of industrial system assessment. These studies are complex and technically challenging as they often span across multiple organizations and supply chains. In this talk I will describe several case studies and highlight the challenges in performing these studies and some important lessons that have been learned from doing them. Specifically, I will discuss a single supply chain study for the production of a bio-based ethylene, and a multiple supply chain and company study for the production of bromine and phosphorus based flame retardants. In these studies I will highlight the importance of the chemical engineering fundamentals in ensuring the integrity of the analysis and the issues that arise in the allocation of environmental burdens across products.



## **David Vavrek**

Sr. Site Strategic Development Leader and Master Planner for BASF, Dave has over 25 years of experience in P&L, operations management & leadership experience building high-performance work teams & leading manufacturing, technology & service organizations. Mr. Vavrek has served in various Utilities Plant manager capacities and was responsible for the development of multiple energy concepts. Prior to joining BASF, Dave worked in the Specialty Chemicals Business sector for PPG Industries, and Akzo Nobel, holding a variety of Research and Process Development and Site Management positions. A native of Milwaukee, Dave holds a Bachelor of Science degree from the University of Wisconsin, Madison where he majored in Chemical Engineering.

**Summary:** The United States is the world's largest consumer of energy. The chemical industry accounts for a significant percentage of this usage. A challenge the industry faces is to develop more efficient energy use for current and future sources of energy. Addressing this challenge can be accomplished through the careful shaping of product life cycle analysis. This presentation provides examples of how BASF Corporation is improving its energy intensity of existing processes, exploring emerging technologies (i.e. biotechnology), recycling wastes, investing in renewables and creating chemistry that enables long term sustainable energy savings.



## **Dr. Barclay Satterfield**

Senior Chemical Engineer with Eastman Chemical Company. She supports a 6-year, \$10M innovation partnership with NC State University as a relationship and project manager, performs environmental life cycle assessments (LCA) of Eastman's products, and has managed Eastman's contribution to the World Business Council for Sustainable Development's Social LCA Metrics development for chemical sector products. Prior to joining Eastman, Barclay performed life cycle assessment studies as a consultant to trade associations and consumer products companies and was a Science Policy Fellow in the ACS Office of Public Affairs. At ACS she supported efforts including congressional science policy briefings and the Society's discussion of sustainability in the chemical enterprise. She was lead author on a 2009 ACS policy viewpoint '[Overcoming Nontechnical Barriers to the Implementation of Sustainable Solutions in Industry](#)'. She has served on the ACS Committee on Environmental Improvement since 2011, and recently led writing teams to recraft the Society's statement on [Sustainability and the Chemical Enterprise](#). Barclay earned her Ph.D. in Chemical Engineering from Princeton University in 2007 and her B.S. in Chemical Engineering from Yale University in 2002. As a graduate student, she researched polymer membrane fuel cells, helped run the student organization Greening Princeton, and also completed a certificate in Science, Technology and Environmental Policy through the Princeton Environmental Institute and Woodrow Wilson School.

**Summary:** As a growth- and innovation-oriented specialty chemical company, Eastman sees sustainability as central to our corporate strategy and to our day-to-day operations. Our annual sustainability report outlines sustainability goals and progress in areas ranging from workplace safety to renewable feedstock to reduction of emissions and greenhouse gas intensity at our sites. In 2012 Eastman became the first chemical company to be recognized with the US EPA's ENERGY STAR<sup>®</sup> Partner of the Year award, an award which it earned again in 2013. In 2014 and 2015 received the ENERGY STAR<sup>®</sup> program's highest honor – the Sustained Excellence Award. We are also active participants in the World Business Council for Sustainable Development (WBCSD), which leverages a large fraction of the chemical sector to identify opportunities, address needs, and generally bring business to the table in crafting a sustainable future. Among other efforts with the WBCSD, we participate in pre-competitive efforts to align our assessment methodologies and work with other industries to develop solutions. Finally, our new product development efforts include sustainability, with a goal of 2/3rds of new product revenue coming from sustainably advantaged products. This presentation will also discuss the American Chemical Society's (ACS) 'Sustainability and The Chemical Enterprise' public policy statement, which the speaker helped to write as a member of the ACS Committee on Environmental Improvement, policy subcommittee.



**Dr. Abdelhadi Sahnoune**

He received his Masters and PhD in Physics from McGill University, and performed postdoctoral work at Queen's University. Prior to joining ExxonMobil, he spent four years at the National Research Council Canada where he worked on the development and application of non-destructive techniques for the characterization of polymers.

At ExxonMobil, Abdelhadi has worked in several areas of polymer research, product development and applications. He has authored over 60 technical publications and patents, and has given numerous national and international lectures. Currently, Abdelhadi is the Sustainability Team Leader at ExxonMobil Chemical and has been active in several workgroups from academia and industry, working on sustainability and life cycle assessment.

**Summary:** Over the past few decades sustainability and sustainable development have become major areas of attention for the public, policy makers, and companies alike. More specifically, the environmental impacts of products and processes have been and continue to be the subject of intense research activity. Life Cycle Assessment (LCA) has emerged as the primary and key tool utilized for these studies. LCA allows a holistic view and a quantification of the environmental impacts associated with a product or activity, and avoids burden shifting from one life cycle phase to another. For a number of years, ExxonMobil Chemical has been incorporating sustainability considerations in its operations. To further build on these activities, it has set up a research team which serves as a focal point for LCA and supports the various business units' needs. The presentation will briefly describe the overall interaction of the team with the different groups in developing the LCAs. In addition, it will highlight the team's overall approach to LCAs and ways to address issues related to methodologies, and the availability/quality of life cycle inventory data. Finally, I will also touch on the need to streamline the sustainability metrics and common indicators that are globally accepted and supported by credible LCA methods and data sources.



## **Tom Seagraves**

Tom is currently the Director of Site Development for BASF's largest North American manufacturing site located in Geismar, Louisiana. His duties include site strategy, site material optimization, organizational design and continuous improvement. Tom has worked 27 years in the chemical industry with BASF. He has held various positions in chemical manufacturing including: Operations engineering and plant management in Freeport Texas, Site Director- Long Island, NY, Global Director of Operations and North American Business Director for BASF Beauty Care Solutions. Tom has experience in batch and continuous processes spanning commodity, specialty and cosmetics applications as well as power generation and waste treatment. A native of Oklahoma, Tom holds Bachelor's and Master's of Science degrees in chemical engineering from Oklahoma State University.

**Summary:** The concept of Sustainability is not an easy concept to measure. Most sustainable solutions require considerable compromises in the products, processes and chemistries utilized to solve today's problems. Chemists and Engineers play critical roles in steering industry's efforts to minimize the environmental and social impacts on the planet. This presentation will outline BASF's approach to sustainability, examining the life cycle analysis and eco-efficiency measurements used within BASF. Examples of the dilemmas inherent with any sustainability measurement will be discussed.