

## 2025 SUMMIT ABSTRACTS

### **Framing Circularity in the Plastics Landscape**

*LaShanda Korley, Director of Center for Plastics Innovation, University of Delaware*

Polymers are ubiquitous in the modern world, and the demand for and production of plastics products continues to climb. Historically, the chemical manufacturing of plastics has focused on key features, such as durability, low-cost, and multifunctionality; however, these aspects also challenge current interventions to combat the plastics waste dilemma. I will overview plastics sustainability from the perspective of transitioning from a linear to a circular economy, addressing macromolecular diversity and plastic waste complexity, reducing dependence on petroleum feedstocks, and maintaining (or improving) material performance.

### **The Big Picture on Plastic: U.S. Challenges and Pathways Forward**

*Danielle Holly, North American Lead, Ellen MacArthur Foundation*

Plastic pollution remains a critical environmental challenge in the United States, with profound implications for ecosystems, human health, and the economy. This talk will explore the evolving landscape of plastic and microplastic management, examining strategies to sustain and expand efforts to mitigate plastic pollution. We will highlight notable successes in addressing this issue, such as upstream plastics reduction strategies, advancements in waste reduction and recycling technologies, and collective industry initiatives that have demonstrated measurable progress. However, significant gaps remain that hinder the transition to a circular economy, including insufficient infrastructure, inconsistent regulatory frameworks, and the need for more robust industry engagement. The presentation will discuss these barriers and propose actionable pathways to overcome them, emphasizing the role of policy innovation, private sector collaboration, and public engagement. By addressing these challenges head-on, we can build a more sustainable future and move closer to achieving a circular economy for plastics in the U.S.

### **State of Plastics Recycling in North Carolina**

*Sandy Skolochenko, Community Development Specialist, NC DEQ*

Gain an understanding of how plastics are recycled in North Carolina and fed into the circular economy. This talk will illustrate statewide recycling trends and provide perspective on the current scope of recycling as a management strategy for end-of-life plastics. It will also touch on global policy changes in recent years that have affected the recycling industry.

### **Breaking Down the Breakdown: What Are Micro and Nano Plastics?**

*Leah Johnson, Senior Director of Biomedical Technologies, RTI International*

The global reliance on plastics has resulted in an unforeseen consequence: the unintentional presence of microplastics (MPs) and nanoplastics (NPs) in the environment and in biological systems. The persistence of these small-scale plastic contaminants has prompted concerns about potential impacts to ecosystems and human health. In this talk, we will explore the origins of MPs and NPs and how the scientific community is approaching critical questions around identification and fate of these materials. We will cover the complex nature of MPs and NPs that can exhibit vast physicochemical properties including chemical compositions, sizes, and shapes. We will examine the distribution of MPs and NPs within the environment, but also within food products, beverages, and drinking water. Lastly, this presentation will highlight some major gaps in our current understanding of MPs and NPs and steps needed to ascertain the potential risks and impacts of these materials.

## **Plastic Pollution and Circularity: The State of the Science, Tools for Communities, and Future Directions**

*Taylor Maddalene, Director of Circularity Assessment Protocol, University of Georgia*

Research on the environmental, economic, societal, and human health impacts of plastic pollution is widespread and growing rapidly. Circular systems and circular economy have been touted worldwide as a potential method to address plastic pollution, though there is still much uncertainty around definitions, metrics, and operationalization, particularly at the local level. This talk will discuss the general state of the science on plastic pollution and circularity, particularly in light of the ongoing negotiations for the international legally binding instrument on plastic pollution, and will discuss existing tools for quantifying circularity and tracking plastic pollution, such as the Circularity Assessment Protocol and the Debris Tracker citizen science app. The talk will conclude with a look to the future for researchers, decision-makers, civil society, and citizen scientists alike in preventing plastic pollution.

## **Tracing the Flow: Microplastic Distribution in the Neuse**

*Jack Kurki-Fox, Research Scholar, NC State University*

Microplastic (MP) concentrations in water and streambed sediment were evaluated at fifteen locations across the Neuse River Basin in North Carolina. Water samples were collected with two different mesh sizes, a trawl net (335  $\mu\text{m}$ ) and a 64  $\mu\text{m}$  sieve used to filter bailing water samples. MPs >335  $\mu\text{m}$  were found in all the water samples with concentrations ranging from 0.02 to 221 particles per cubic meter ( $\text{p m}^{-3}$ ) with a median of 0.44  $\text{p m}^{-3}$ . The highest concentrations were observed in urban streams and there was a significant correlation between streamflow and MP concentration in the most urbanized locations. Spectroscopy analyses indicated that for MPs >335  $\mu\text{m}$  polyethylene, polypropylene, and polystyrene were the most common polymer types. There were substantially more MP particles observed when samples were analyzed using a smaller mesh size (64  $\mu\text{m}$ ), with concentrations ranging from 20 to 130  $\text{p m}^{-3}$ . The ratio of MP concentrations (64  $\mu\text{m}$  to 335  $\mu\text{m}$ ) ranged from 35 to 375, indicating the 335  $\mu\text{m}$  mesh substantially underestimates MPs relative to the 64  $\mu\text{m}$  mesh. We estimate MP (>64  $\mu\text{m}$ ) loading from the Neuse River watershed to be 230 billion particles per year. The findings of this study help to better understand how MPs are spatially distributed across a river basin and how MP concentrations are impacted by land cover, hydrology, and sampling method.

## **Contextualizing the Persistence and Pervasiveness of Microplastics from a Human Health Lens**

*Imari Walker-Franklin, Research Natural Scientist, RTI International*

Human exposure to microplastics primarily results from their widespread presence and small size. These particles have now been detected in nearly every part of the human body, including the digestive, respiratory, reproductive, and cardiovascular systems, as well as the brain. Microplastics have the potential to cause physical disruptions in the body and can carry harmful pathogens, such as bacteria and viruses, as well as absorb hazardous heavy metals and other toxic chemicals. Over 16,000 chemicals are associated with plastics, approximately 25% of which are considered potentially dangerous, though many have not been adequately studied for their toxicity. Despite growing concerns, studies have not yet directly linked microplastics to specific health effects due to the complexity of the substance, delays in technological advancements, a lack of interdisciplinary collaboration, and the absence of standardized methods for detecting microplastics and studying their health impacts. Furthermore, existing studies are challenging to integrate for health risk assessments due to gaps in data and limited information on contamination levels. In this discussion, we will examine the current state of knowledge regarding microplastics and human health, as well as the challenges and limitations in the research.

## **Polystyrene Microplastics Induce Genomic Alterations and Impaired Migration in Human Placental Cells: Implications for Maternal and Fetal Health**

*Hadley Hartwell, Laboratory and Research Project Manager, University of North Carolina at Chapel Hill*

Plastics, particularly microplastics (MPs), have become pervasive environmental pollutants, raising significant concerns about their impact on human health. Polystyrene (PS), a common type of microplastic widely used in food packaging, is known to leach into food products, leading to potential ingestion. This raises critical questions about its effects on maternal and fetal health, given the vulnerability of the placental environment and its importance for healthy pregnancy outcomes. In this study, we investigated the genomic and migratory effects of PS exposure on placental cells. HTR-8/SVneo placental trophoblast cells were exposed to 50 nm PS particles at concentrations of 0, 25, 50, and 200 µg/mL for 24 hours. Gene expression profiling was conducted using the Clariom S Assay, and cell migration was assessed using the xCELLigence Real-Time Cell Analysis System. Transcriptomic analysis revealed significant changes in gene expression, with 33, 134, and 70 differentially expressed genes (DEGs) identified at 25, 50, and 200 µg/mL PS, respectively ( $p < 0.05$ ). Pathway analysis indicated that altered genes were associated with reproductive system diseases, endocrine disorders, embryonic development, and cellular migration. Furthermore, PS exposure negatively impacted cell migration, with higher concentrations resulting in significantly reduced migration rates. These findings suggest that PS exposure can induce genomic disruptions and impair migratory behavior in placental cells, potentially impacting placental health and fetal development. This study is the first to combine genomic and migratory analyses to evaluate the effects of PS on placental cells, contributing to the growing body of research on the health implications of environmental plastic exposure.

#### **Fireside Chat: Microplastics Research Needs Within and Beyond North Carolina**

*Barbara Doll, Associate Extension Professor; NC State University; Taylor Maddalene, Director of Circularity Assessment Protocol, University of Georgia; Stacey Wiggins, Senior Advisor for Division of Seafood Safety, US FDA; Moderators: Leah Johnson and Imari Walker-Franklin, RTI International*

The growing prevalence of microplastics in environmental systems has become a critical issue for both local and global ecosystems. This fireside chat will explore the current state of microplastics research within North Carolina, examining key findings, regional challenges, and ongoing initiatives to understand their impact on aquatic and terrestrial environments. The discussion will also address the broader implications of microplastics pollution, highlighting research needs beyond the state level, with a focus on identifying knowledge gaps, emerging trends, and collaborative opportunities for advancing global solutions. Attendees will gain insight into how North Carolina's research efforts align with national and international strategies, and the role of interdisciplinary approaches in tackling the complex issue of microplastic contamination.

#### **Turning the Tide: Industry Solutions to Reducing Plastic Waste**

*Jamie Pero Parker, Sustainability Lead, Innovation Advisors, RTI International*

The fight against plastic waste demands innovative and scalable solutions across sectors and the plastic value chain. In this talk, we will explore successful industry-driven strategies to combat plastic pollution, focused on practical and proven approaches. Key methods include developing alternative materials, designing for recyclability, improving recycling infrastructure, and implementing reuse and refill systems, emphasizing practical approaches that have proven effective. Case studies of leading brands and organizations will showcase how these solutions are reducing plastic waste while paving the way for sustainable industry practices.

#### **Fireside Chat: Industries Efforts to Address Macro and Microplastics**

*Mark Agerton, Group Scientist, Proctor & Gamble; Glenn Jordan, Director, Global Technology, Sonoco; Amit Lamaye, Director, Sustainable Medical Technology Institute (SMTI) Enterprise R&D Becton Dickinson*

*& Company; Zach Muscato, Sustainability Leader, Plastic Ingenuity; Moderator: Jamie Pero Parker, RTI International*

Plastic pollution poses an urgent challenge that demands innovative solutions from all sectors. This fireside chat brings together representatives from diverse industries to discuss their organizations' efforts in tackling macro and microplastics. The panel will explore a range of topics, including successful strategies for reducing plastic waste, investing in sustainable materials, and addressing microplastics in supply chains and production processes.

Panelists will also share candid insights into the obstacles they have encountered, from technological and logistical barriers to navigating evolving regulatory landscapes and meeting consumer demands for sustainability. Through an engaging and solutions-oriented conversation, the session aims to illuminate pathways for greater cross-industry collaboration and inspire actionable steps to drive impactful change in the fight against plastic pollution.

### **From Global to Local (NC): Policies to Address Plastic and Microplastic Pollution**

*Michelle Nowlin, Professor of Environmental Science and Policy Co-Director, Duke Environmental Law and Policy Clinic, Duke University School of Law*

Plastic and microplastic pollution is a pressing global environmental challenge that requires coordinated policy responses across all levels of government. This session will explore the spectrum of policies designed to address plastic pollution, from global frameworks to local initiatives in North Carolina. Key topics will include the role of international agreements in shaping national and regional regulations, as well as state-level actions and innovative policies implemented in North Carolina to mitigate plastic waste and microplastic contamination. The discussion will highlight the effectiveness of these policies, identify barriers to implementation, and consider opportunities for improving regulatory frameworks. By examining the intersection of global policies and local actions, this session aims to provide a comprehensive overview of strategies to combat plastic and microplastic pollution and promote sustainable practices across scales.

### **Fireside Chat – Government's Role in Addressing Microplastics**

*Scott Cassel, CEO and Founder, Products Stewardship Institute; Madison Haley, Climate and Plastics Advocacy Fellow, Haw River Assembly; Romell Nandi, Trash Free Waters National Program Lead, Office of Wetlands, Oceans, and Watersheds, US EPA; Michelle Nowlin, Professor of Environmental Science and Policy Co-Director, Duke Environmental Law and Policy Clinic, Duke University School of Law; Suzanne VanDrunick, National Program Director for Safe and Sustainable Water Resources, US EPA; Moderator: Keith Weitz, Sustainability and Environmental Program Director, RTI International*

As the science evolves around the effects of microplastics to ecosystem and human health, governments are at the forefront to establish policy, strategy, and legal interventions to address this complex challenge. In this fireside chat, we will explore recent policy developments, key gaps in policy and strategy, and the role of government in reducing plastic and microplastic pollution and its effects. Panelist will address the U.S. government's National Plastic Pollution Reduction Strategy, emerging topics and policy approaches such as the Social Cost of Plastics and Extended Producer Responsibility (EPR), as well as innovative approaches to reduce plastic waste in our state.

### **Concurrent Facilitated Break-out Sessions: Exploring Solutions**

*RTI International Moderators: Verone Bernard, Urban Resilience Manager; Edgard Ngaboyamahima, Operational Excellence Lead; Jamie Pero Parker, Sustainability Lead, Innovation Advisors; Cary Strickland, Director Strategy and Innovation*

In this interactive first step of the breakout sessions, participants will collaboratively generate and prioritize innovative interventions to address microplastic pollution. Using a creative matrix approach, attendees will brainstorm a diverse range of ideas across three thematic areas — research, policy, and procurement/manufacturing — encouraging interdisciplinary exploration and bold, forward-thinking solutions. Guided by facilitators, participants will leverage their unique perspectives from academia, industry, and government to identify opportunities for action. The session will conclude with a group voting exercise to prioritize the most promising interventions, laying the groundwork for deeper evaluation and strategic planning in subsequent discussions.

**Concurrent Facilitated Break-out Sessions: Turning Ideas into Actionable Strategies**

*RTI International Moderators: Verone Bernard, Urban Resilience Manager; Edgard Ngaboyamahima, Operational Excellence Lead; Jamie Pero Parker, Sustainability Lead, Innovation Advisors; Cary Strickland, Director Strategy and Innovation*

Building on the creative brainstorming in step one, this session will focus on evaluating and refining prioritized interventions using an impact-difficulty matrix. Participants will collaboratively assess each intervention’s feasibility and potential for impact, identifying “quick wins” that can be implemented swiftly, alongside long-term opportunities requiring deeper investment. By analyzing interventions through the lenses of practicality and transformative potential, attendees will align around a set of actionable strategies designed to mitigate microplastic pollution. This structured and participatory process will contribute directly to a post-summit report, empowering stakeholders to drive meaningful change for North Carolina’s environmental and human health.