

UNIVERSITY OF RHODE ISLAND

# 2023 Global Plastics Forum

FUTURE ROADMAP OF TEXTILES

ACCELERATING SOLUTIONS VIA PARTNERS: AN ACADEMIC-INDUSTRY APPROACH

Textile industry is a critical sector across the globe. In collaboration across sectors, disciplines and the borders, we collectively have an opportunity to learn from science, re-engineer processes and rethink practices and policies to forge a future path for textiles. This path will accelerate collective understanding, actions and collaborations to reduce microfiber pollution and its impacts on human and environment health and create equitable and sustainable materials, markets and jobs of the future. Join our facilitators in designing an approach that can build capacity and solutions.

Facilitators: Lisa Erdle, Director of Science & Innovation at the 5 Gyres Institute and Rob Torgerson, Kestrel Innovative Fibers, LLC, VP of Operations

NBC Plastics Fellow: Rosemary Leger

# TUESDAY, MAY 16

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## SESSION GOAL: POOL RESOURCES + PLAN INITIATIVES

### QUESTIONS

1. What is the state of the knowledge for microfibers (sources, fate and transport, effects)?
  2. What are the biggest challenges in researching microfibers? Reducing microfibers across the supply chain (production to end of life)?
  3. What should be the top research priorities?
  4. What strategies should be taken at a high level to reduce microfiber pollution?
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## FACILITATORS | LISA ERDLE + ROB TORGERSON

### Rob Torgerson

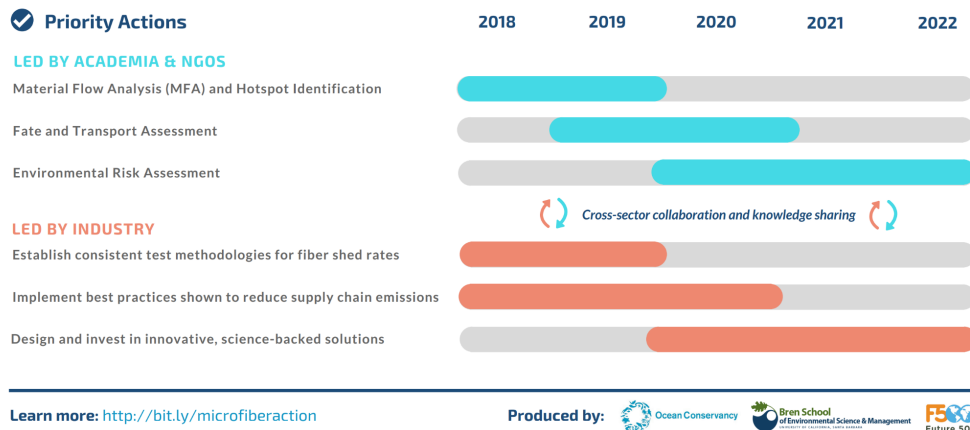
- [Kestrel Innovative Fibers](#)
  - recycling polymers into textiles
- What can we do with this technology on the microfiber side?

### Lisa Erdle

- [5 Gyres Institute](#)
- [Building off 2017 work at UToronto](#)
  - Continuing roadmap for microfiber pollution
  - Look ahead to next meeting in early 2024
  - Consider: who needs to be at the next step (industry, researchers/scientists, policymakers)

# MICROFIBER ACTION ROADMAP

Priority actions that key stakeholders should take over the next five years to systemically understand and address microfiber pollution, from source to sea



- Questions:
  - What are we missing
  - How do we build solutions?
  - What are the relative contributions of clothing and other sources (laundry, etc)?
  - What is the state of the science?
- Ideas to explore:
  - Compare clothing and fabric types
  - Best practices to reduce emissions across supply chain
  - How much is shed in the pre-consumer stage?
  - Who needs to be in the room?
  - Standardizing test methods for microfiber shed
    - ... [AATCC TM212-2021](#): Test Method for Fiber Fragment Release During Home Laundering

## ATTENDEES

- [Dr. Martin Bide](#), retired Professor of Textile Science, URI
- [Dr. Karl Aspelund](#), cultural anthropologist, designer, Professor of Textile Merchandising and Design, URI
- [Yaw Amo Sarpong](#), Environmental Scientist/Biometrician/M&E Expert/Development Practitioner, Kwame Nkrumah University of Science and Technology (KNUST)
- [Jen Bissonette](#), marine scientist, RISD
- [Jenn Brackett](#), grant writer, URI

- [Senator Angèle Prévaille](#), French-elected official from Parliament
- [Dr. Kay Ho](#), US Environmental Protection Agency, Atlantic Coastal Environmental Sciences Division
- [Lena Weiss](#), Fisheries Specialist at the New England Aquarium
  - [BlueSwell Business Incubator Program](#)
- [Marnie Hooker](#), “concerned consumer”, GE Healthcare
- [Birgit Leitner](#), product design and development, Propel LLC
- [Philippe Bolo](#), député at Assemblée Nationale
- [Alexia Ortion](#), plastics researcher, French Embassy, Washington D.C.
- [Dr. Jaime Ross](#), Assistant Professor of Neuroscience, URI
- [Bryan James, PhD](#), Postdoctoral Scholar at Woods Hole Oceanographic Institution
- [Dr. Melissa Omand](#), Associate Professor of Oceanography, URI
- [Jonathan Gillibrand](#), Senior Advisor on Plastics, US Department of State, Bureau of Oceans and International Environmental and Scientific Affairs
  - [White House Council on Environmental Quality PFAs Report](#)
  - Winnie Lau + Pew: [Microplastics Study](#)
  - [National Academies’ Roundtable on Plastics](#)
  - [Closed Loop Partners](#)
- [Clare Romanik](#), USAID Senior Urban and Ocean Plastics Specialist
- [Jean-Philippe Nicolai](#), Science + Tech, Consulate General of France in Boston
- [Doug Johnson](#), US Extruders
- [Rosemary Leger](#), Marketing + Consumer Behavior PhD student, URI
- [Robert Allen](#), Bioenergy Science and Technology directorate, National Renewable Energy Laboratory
- [Dr. Bethany Jenkins](#), Professor of Cell and Molecular Biology, URI

## AGENDA

The room is split into four groups who have 30 minutes to discuss one of the assigned questions, and then present their conclusions to the group.

## GROUP ONE: WHAT IS THE STATE OF THE KNOWLEDGE FOR MICROFIBERS?

- The knowledge varies significantly across stakeholders
  - Consumers know very little
  - Government does not have a lot of knowledge
    - … lack of regulations around labeling
- Avenues, sectors, and products made of/with microfibers are overwhelming
  - Clothing, carpets, upholstery, hygiene, diapers, medical, furniture, vehicle, cleaning, market, cigarettes, freight, transportation
- Movement into body:
  - trophic transfer across species through consumption
  - dermal absorption of plastics
- Co-pollutants + additives of concern:
  - dyes, plasticizers, PFAs, flame retardants
- Ingestion of these chemicals leads to:
  - Alzheimer's, cancer, lung issues, disease, disability, premature death
- Most vulnerable persons:
  - workers, fenceline communities
- There is a pig pen effect because fibers are all around
- Microfibers are the #1 particle in contamination
- Most common anthropogenic in lungs
- Industry and consumers need to prioritize essential uses of plastics in textiles, threads, fibers
- Remaining questions:
  - Do nanofibers exist?
    - … yes, they are highly specialized and not an overwhelming issue
  - What is a microplastic versus a microfiber?
    - … sources, fate, transportation
  - What is the added value of talking fibers versus plastics?
    - … textile start in fine form, other plastics break down to get there
    - … of concerning materials of this dimension, most are fibers
    - … plastic microfibers have distinct effect versus spherical microplastics
    - … distinct source, distinct solutions
    - … due to aspect ratio, concerns are:
      - ★ similar to asbestos toxicity

- \* cannot remove from the body
- \* Pacman example

State of Knowledge Varies ①

Sectors / Products

- clothing
- carpet
- hygiene (diapers, global)
- Medical (gowns, masks, sutures)
- furniture
- vehicles interior
- cleaning products (eg. Swiffer)
- markers
- cigarette butts

Fate/Transport

Better known  
laundering clothing

Less known  
atmospheric transfer  
co-pollutants

trophic transfer  
body absorption  
inhalation

Additives of concern

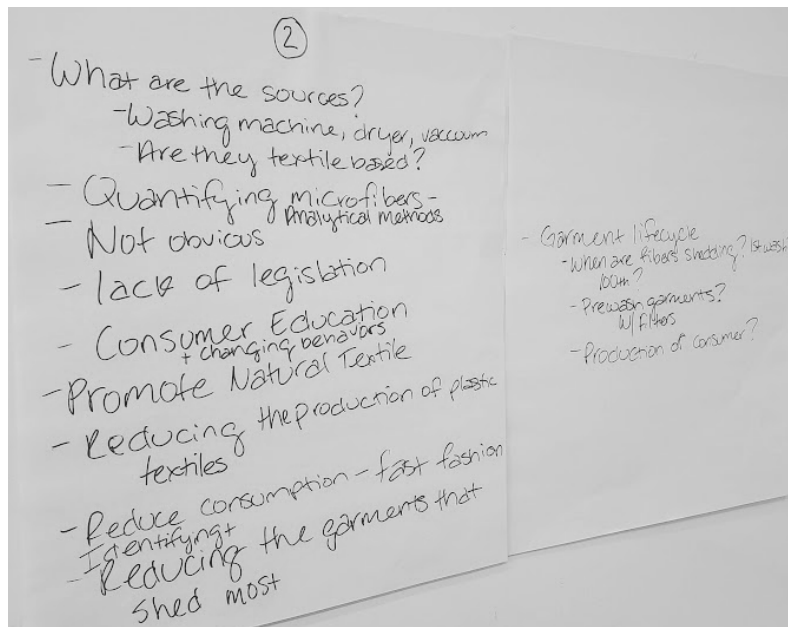
- dye
- plasticizers
- PFAS
- flame retardants

Effects

- Alzheimers?
- Workers & fence line communities (lungs, cancer)
- disease, disability & premature death

## GROUP TWO: WHAT ARE THE BIGGEST CHALLENGES IN RESEARCHING MICROFIBERS? IN REDUCING MICROFIBERS ACROSS THE SUPPLY CHAIN?

- What are the sources or cause of microfiber pollution?
  - quantifying loss, fine tuning analytical methodologies
- Lack of legislation
  - who is looking and why?
- Lack of consumer education
  - it will require an overall behavior change
  - promotion of natural textiles, to reduce additives and chemicals
  - reducing production of plastic textiles in general
  - reduce overall consumption
    - … specifically fast fashion
- Identifying the garment that shed the most
  - looking at garment lifecycles
  - when does shedding occur the most?
  - should they be prewashed in production with good filters?
- Where is most of the loss happening?
  - production versus consumer
- The biggest challenge is that there is lots of questions
  - some answers exist, but they are very niche
  - increased communication about problems



## GROUP THREE: WHAT SHOULD BE THE TOP RESEARCH PRIORITIES?

- Durability versus degradability
  - What's more important in creating a textile that will shed?
  - Durability: materials will persist longer in the environment
  - Degradability: consumers lose quality/useful lifetime of product
    - … weigh tradeoffs of design consideration
- Policy
  - Is it useful?
  - Surrounding sheddable fibers and washing machines
  - Are there more solutions than recycling? (mending, etc.)
- Improving data
  - How many fibers are being shed, and what are the sources of those?
  - Which items shed more than others?
- Opportunities for innovation
  - large-scale filtering
    - … application side
    - … difference between 90% efficiency to 99% efficiency
    - … extended producer responsibility
  - filtering at wastewater treatment plants
    - … is it better for preventative maintenance?
    - … most of the world doesn't have sewage
  - lint trap-similar solutions
    - … empty into garbage!
    - … what does the waste stream become?
    - … already 80-90% end up in biosolids
- Research needs environmentally-realistic microfibers for testing biota and human health
  - in animal food chain
  - absorption from ingestion
  - microfibers found in humans are different than those found in animals



③  
DURABILITY VS. DEGRADABILITY

- designing for
- lifecycle assessment

NEED FOR POLICY +

- at all EDUCATION levels
- recycling not only solution
- mending

IMPROVED DATA

- micro fiber shed sources/types

OPPORTUNITIES FOR  
INNOVATION

- larger-scale filtering
- laundromats + wastewater
- overall efficiency  
(% removal)
- apparel construction
- packaging materials

## GROUP FOUR: WHAT STRATEGIES SHOULD BE TAKEN AT A HIGH LEVEL TO REDUCE MICROFIBER POLLUTION?

- Move the solution up the supply chain
  - it's too late once they're in the home
  - prewashing in factories?
- Changing consumption models
  - less/no fast fashion
  - how can we shift consumer culture?
  - raise appreciation of durability and quality
  - example of 13 year old at the English shirt shop
  - would have to happen quickly!
  - example: smoking
- Legislation
  - Extended Producer Responsibility
    - … will lead to a shift in design culture
    - … reprioritize durability, recycling, materials
    - … profit model
  - washing machine filters
  - wastewater treatment plants
  - proper disposal
- Reconsider production model that demands pro-environmentalism
  - initiate a race to the bottom, mitigated by EPR?
  - undercut versus overtake
- Educating the consumer
  - leads to consumer demand
  - then governmental and industry pressure
- Remember the issue is global!
  - consumption is west
  - production in east
  - [Nature Conservancy Report](#)
  - built environment: labeling systems to empower consumers and manufacturers
- Academia
  - teaching chemists toxicology
  - polymer scientists

- integrating widespread knowledge about what makes a material bad
- Role of washing machine manufacturers and detergent manufacturers
  - settings impact shedding
  - top-loader vs front-loader
  - type of detergent (liquid vs powder vs pods vs softener)
  - amount of water
- White goods lobby
  - consumer reports, ratings, legislation
  - acceptance criteria
  - [Samsung washer that reduces microplastic shed](#)
- Consider labeling and all other plastics involved in production and distribution
  - attachments, tags
  - poly bags for chipping
  - coalitions to eliminate ([Consumer Goods Forum](#))
  - end of life
  - bringing all pieces into the conversation
- Alternatives:
  - PHA, PHB/PHVB, PHA/PHP
    - … not new material
    - … not great textile in terms of strength, biodegradable, dyeable
    - … all have different properties
    - … challenges in maintaining properties through recycling process
    - … 4-5x more expensive
    - … potentially more toxic in freshwater marine environments
  - Hemp, linen, jute fibers
    - … more supple with washing
    - … 60% less water
    - … initiatives to bring back in China
    - … naturally antimicrobial + hypoallergenic
    - … [hemcrete - cement](#)
    - … ghana jute plantations
      - ★ 50% of fibers in India
      - ★ suits, shoes
  - natural vs plastic microfiber leaching
    - … additives and coatings
    - … anthropogenic modifications

○ Toxicology education

○ Global not local  
(How is it over there)

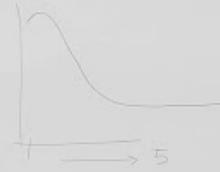
○ What of washing machines  
& detergent mfgs?

○ Shipping materials?

○ Rating system?

○ Tags? Labels? Bags?

(4)



Pre-wash  
Filters in factories

★ Material Design - Fibers that shed less.  
Washing Machine Filters. (Vive la France!)

Waste Water Treatment Plants  
+ Sludge used as fertilizer

Fibers wind up in landfill

⊕ Change consumption models ⇒ Culture of clothing ⇒ 6-year old

○ INTENTIONALITY

○ Consider production models that demand/afford "cheap goods"

○ Change design culture → design for reuse, repair, recycle

○ Science of chemical recycling

○ Create incentives to support proper disposal at all levels/supply chains

★ Extended responsibility for clothing Producers  
E.O.  
the value of name