Microfibers are a Macro Issue: Interagency Report on Microfiber Pollution

Carlie Herring, National Oceanic & Atmospheric Administration (NOAA), Marine Debris Program
Nizanna Bathersfield, U.S. Environmental Protection Agency, Office of Water
Trash Free Waters Webinar Series | October 17, 2024

Report Preparers & Collaborators

Carlie Herring
Marine Debris Program

Gabriella Neusner
Office of Ground Water & Drinking Water

Romell Nandi & Nizanna Bathersfield
Trash Free Waters Program

Krystle Moody Wood & Carolynn Box
Materevolve

Expert Advisory Committee: **Sam Athey**, PhD Candidate, Rochman Lab/Diamond Group, University of Toronto; **Anna Posacka**, Ocean Diagnostics; **Carlie Herring**, NOAA Marine Debris Program; **Rob Hale**, Virginia Institute of Marine Science; **Scott Coffin**, California State Water Control Resources Board; **Sherri (Sam) Mason**, Behrend Campus of Penn State University; **Diana Lin**, San Francisco Estuary Institute; **S. Karba**, Patagonia; **Roland Geyer**, University of California at Santa Barbara BREN School of Environmental Science and Management

Federal Agency Involvement: Consumer Product Safety Commission (CPSC); Department of Energy (DOE); National Institute of Standards and Technology (NIST); National Oceanic and Atmospheric Administration (NOAA); National Park Service (NPS); National Science Foundation (NSF); U.S. Department of Justice (DOJ); U.S. Department of State (DOS); U.S. Environmental Protection Agency (EPA); U.S. Fish and Wildlife Service (FWS); U.S. Food and Drug Administration (FDA); U.S. Geological Survey (USGS)

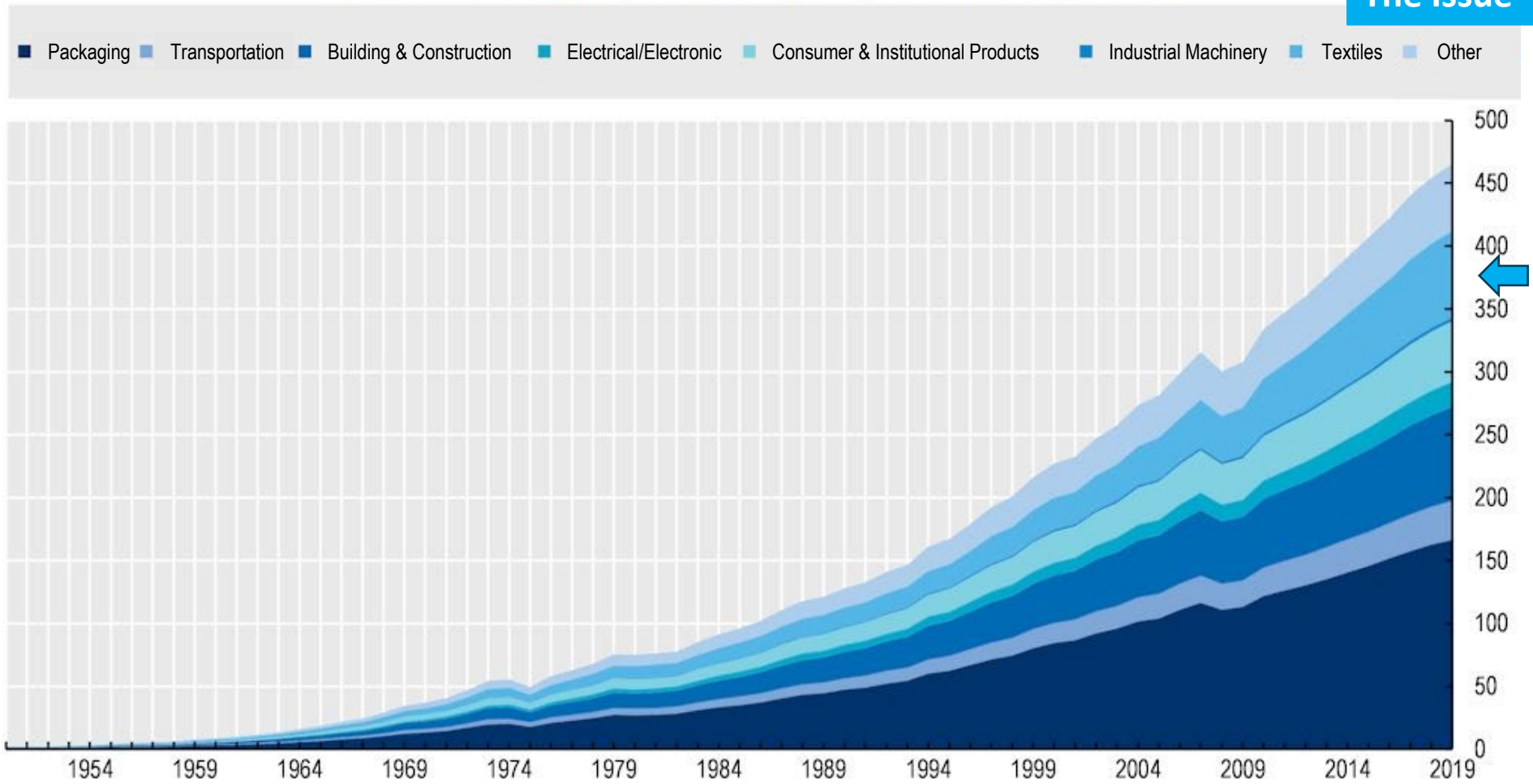
Outline


Credit: NOAA

Credit: Sam Athey and Lisa Erdle

- Microfibers – The Issue
- Review of the SOS 2.0 Act
- Report Overview
  - Definition of Microfiber
  - Sources, Prevalence, & Causes of Microfiber Pollution
  - Recommendations for a Standardized Methodology to Measure Microfibers
  - Solutions & Recommendations
  - Federal Plan

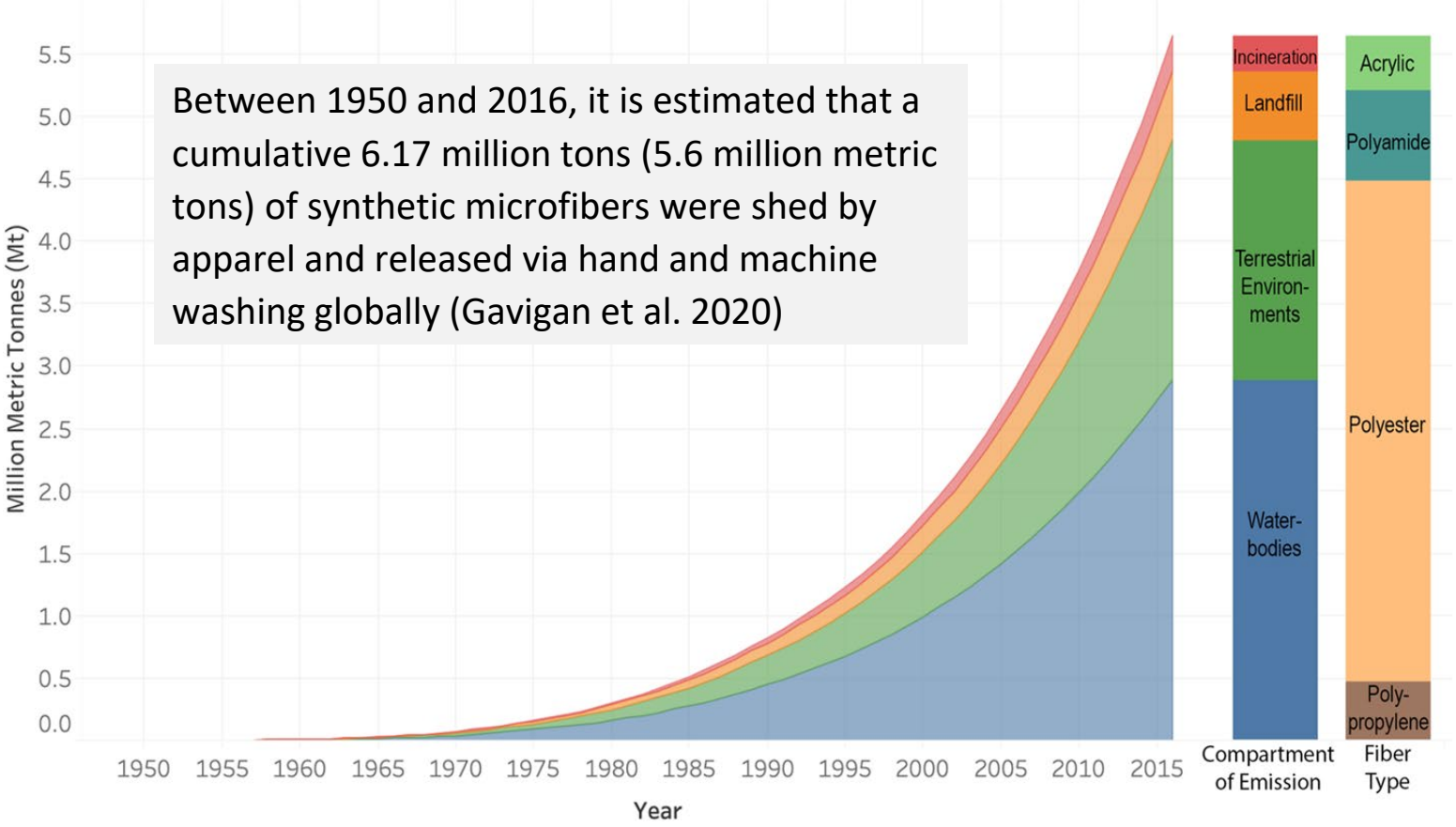
Global Primary Plastics Production by Sector, 1950 to 2019 (million tonnes)



Source: OECD (2021), Update by the authors of (Geyer, Jambeck and Law), 2017

Microfibers Pollute Land and Water

Between 1950 and 2016, it is estimated that a cumulative 6.17 million tons (5.6 million metric tons) of synthetic microfibers were shed by apparel and released via hand and machine washing globally (Gavigan et al. 2020)

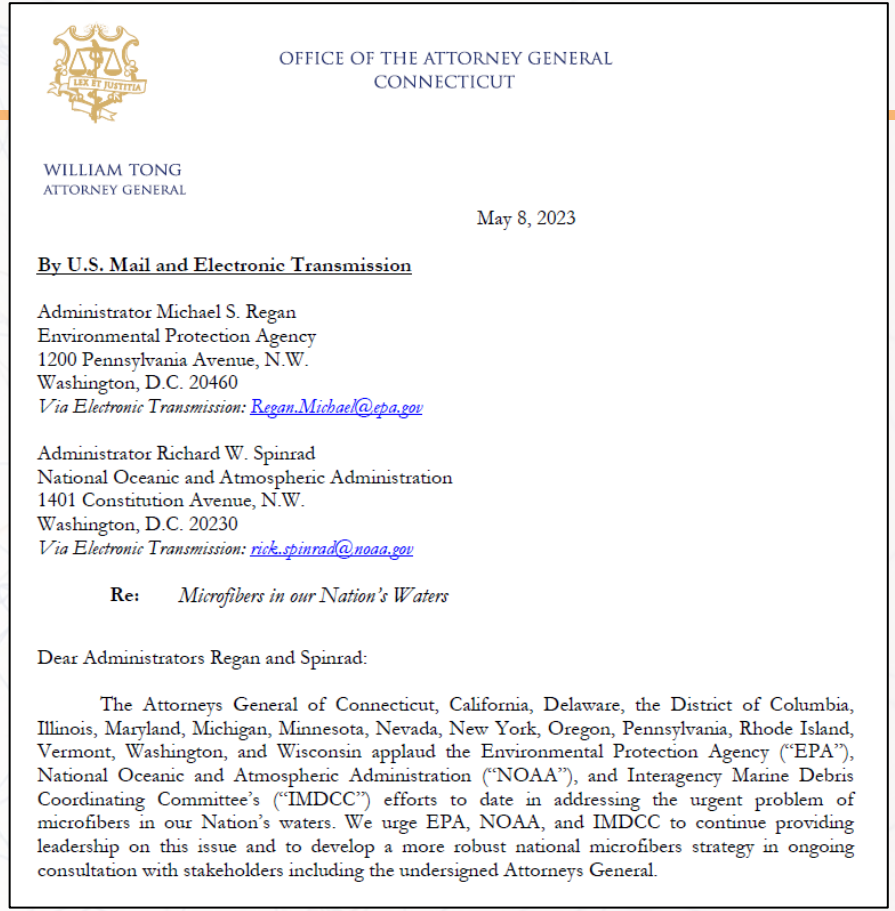


Gavigan et al. (2020), *PLOS One.* https://doi.org/10.1371/journal.pone.0237839

Microfibers – The Issue

- Interest from congressional offices
- Predominate type of particle found in the environment
- Actionable solutions

Recent example of microfiber interest by various States



OFFICE OF THE ATTORNEY GENERAL
CONNECTICUT

WILLIAM TONG
ATTORNEY GENERAL

May 8, 2023

By U.S. Mail and Electronic Transmission

Administrator Michael S. Regan
Environmental Protection Agency
1200 Pennsylvania Avenue, N.W.
Washington, D.C. 20460
Via Electronic Transmission: Regan.Michael@epa.gov

Administrator Richard W. Spinrad
National Oceanic and Atmospheric Administration
1401 Constitution Avenue, N.W.
Washington, D.C. 20230
Via Electronic Transmission: rick.spinrad@noaa.gov

Re: *Microfibers in our Nation's Waters*

Dear Administrators Regan and Spinrad:

The Attorneys General of Connecticut, California, Delaware, the District of Columbia, Illinois, Maryland, Michigan, Minnesota, Nevada, New York, Oregon, Pennsylvania, Rhode Island, Vermont, Washington, and Wisconsin applaud the Environmental Protection Agency ("EPA"), National Oceanic and Atmospheric Administration ("NOAA"), and Interagency Marine Debris Coordinating Committee's ("IMDCC") efforts to date in addressing the urgent problem of microfibers in our Nation's waters. We urge EPA, NOAA, and IMDCC to continue providing leadership on this issue and to develop a more robust national microfibers strategy in ongoing consultation with stakeholders including the undersigned Attorneys General.

Section 132 of the Save Our Seas 2.0 Act, 2020 (Public Law 116-224)

SOS 2.0 Act

Not later than 2 years after the date of the enactment of this Act, the Interagency Marine Debris Coordinating Committee shall submit to Congress a report on microfiber pollution that includes—

(1) a definition of microfiber;
(2) an assessment of the sources, prevalence, and causes of microfiber pollution;
(3) a recommendation for a standardized methodology to measure and estimate the prevalence of microfiber pollution;
(4) recommendations for reducing microfiber pollution; and
(5) a plan for how Federal agencies, in partnership with other stakeholders, can lead on opportunities to reduce microfiber pollution during the 5-year period beginning on such date of enactment.

Definition of Microfiber

Definition Considerations:

- ALL types of fibers or synthetic (plastic) fibers?
- Shape & size
- Differences in terminology across sectors
- Not a regulatory definition…

Feedstock
(base material used to create fibers/yarn)

Plastic

Non-Plastic

Fiber/Fabric Production
(turning feedstock into fibers/yarns & eventually fabric)

Manufactured

Natural

Plastic Manufactured

Non-plastic Manufactured

Non-plastic Treated Natural

Dyeing, Mechanical & Chemical Treatments
(gives textiles desired colors, properties and functions)

Biodegradability rates? Release of toxic chemicals?

What is a Microfiber?

PROPOSED DEFINITION: Microfibers are solid, polymeric, fibrous materials that include plastic and non-plastic fibers less than 5 millimeters in all dimensions.[a]

According to this proposed definition, a microfiber should meet criteria for all three traits (composition, shape, and size) within the Microfiber column. For each trait, examples of what are NOT microfibers are also provided:

	Microfiber	NOT a Microfiber
Polymer Composition, Chemical Additives and Treatments	Plastic Polymers[b] Man-Made Cellulosics[b] Treated Natural Polymers[a,b]	Polymers found in nature (e.g., wool, cotton, flax, silk) not chemically modified or treated by humans[c]
Shape	Shape must be fibrous. It can also be knotted and wrapped together in bundles	Non-fibrous morphologies including fragment, foam, sphere, film
Size	Fibers with any dimension less than or equal to 5 millimeters	Fibers with a dimension of more than 5 millimeters

[a] This definition does not include fibers that are made solely of natural, non-treated materials.
[b] Further research should be conducted to better refine toxicity and biodegradability criteria related to composition and chemical additives and treatments.
[c] Scientific research may opt to include these fibers for tracking and comparative purposes.

Assessment of the Sources, Prevalence, & Causes of Microfiber Pollution

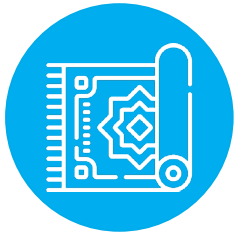
The report provides an overview of the…

1) Microfiber sources & pathways to the environment
2) Causes of microfiber pollution
3) Prevalence of microfibers in the environment
4) Impacts of microfibers

Sources

The **items** from which fibers are released

Clothing, blankets, and bedding



Carpets, curtains, and upholstery

Cleaning wipes, PPE, and PCP

Construction, geo- and agrotextile materials

Cigarette butts (filters)

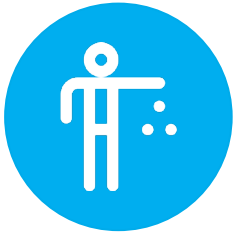
Fishing/boating nets & ropes

The **activities** which release fibers into the environment

Laundering Textiles

General Use/Wear

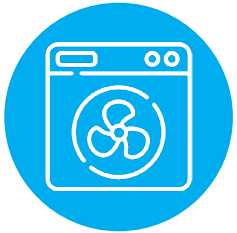
Cleaning



Littering

Causes

Fibers may be released due to…



Aggregation from laundering

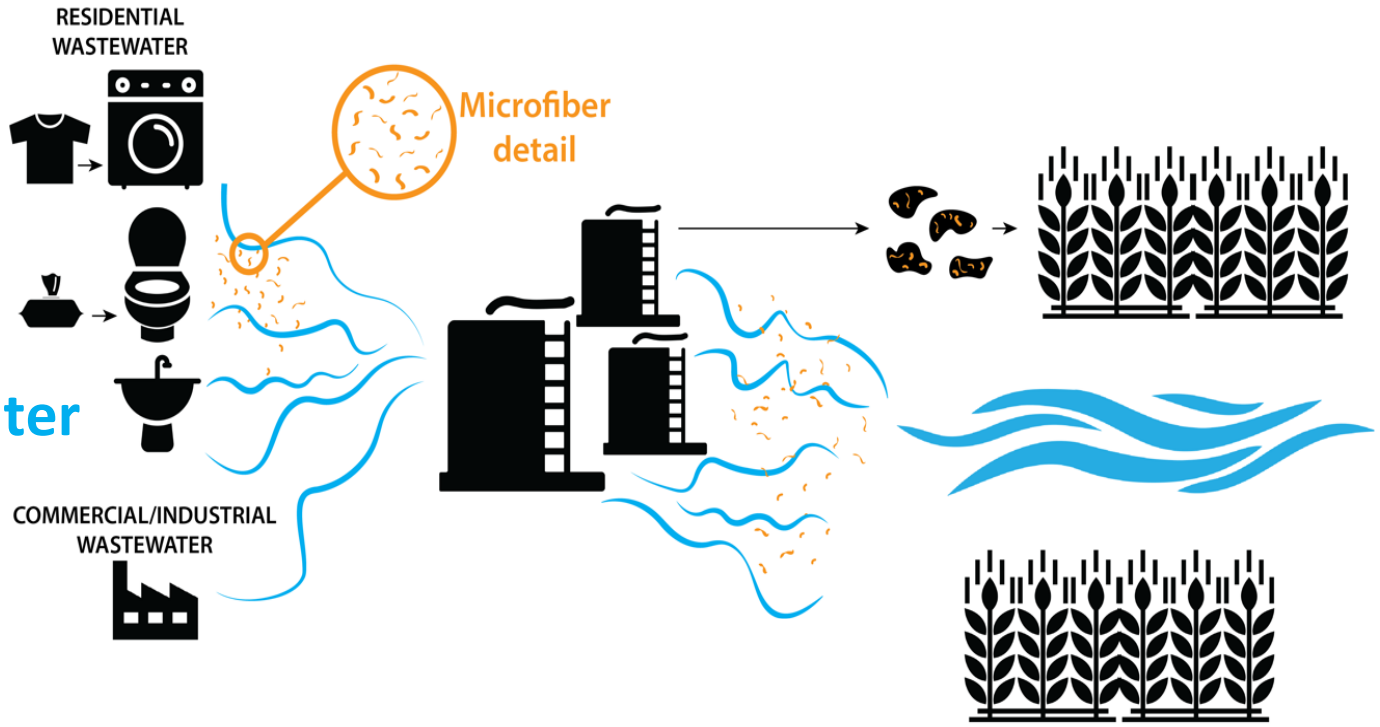
Friction

Mechanical stress

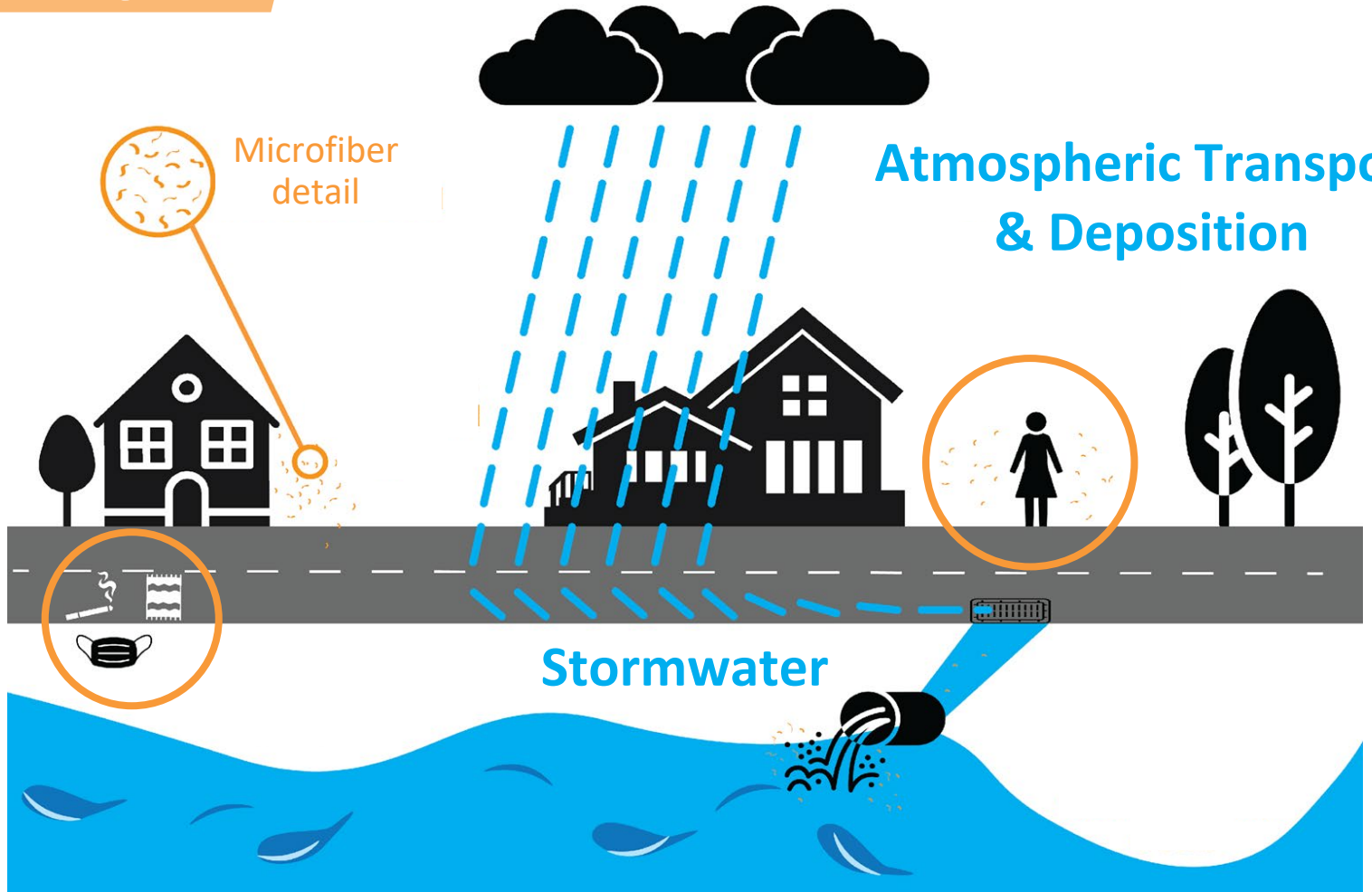
Weathering

Manufacturing processes: Cutting, trimming, & mechanical treatments

Pathways


RESIDENTIAL
WASTEWATER
Microfiber
detail
Wastewater
COMMERCIAL/INDUSTRIAL
WASTEWATER
Runoff

Pathways


Microfiber
detail
Atmospheric Transport
& Deposition
Stormwater

Prevalence

Microfibers have been found in…

- Marine, freshwater, and terrestrial environments
  - Generally the most prominent type of microplastic found
  - Sinks: Soils vs. water
- Seafood for human consumption (bivalves, fish, sea salt)
- Other food and beverage items (water, alcohol, milk, honey, sugar)
- The air we breath
  - Higher concentrations in indoor air compared to outdoor air

Impacts

WHAT WE KNOW

- Exposure to microfibers
- Reported impacts range from….
  - no effect
  - ↓ feeding behavior
  - ↓ reproduction
  - ↑ mortality
  - tissue inflammation & gut blockage
- Smaller microfibers are more toxic

WHAT WE DON'T KNOW

- Effects at relevant environ. conditions
- Exposure levels vs. rates causing harm
- Toxicity differences between polymers
- Exact mechanisms for causing toxicity

Why are Microfibers a Problem?

Environmental and Human Health Risks of Microfiber Pollution

To estimate risk, we need to understand the exposure and effects

✔ Are microfibers bioavailable to humans and animals? **YES**

✔ Are humans and animals exposed to microfibers? **YES**

- Exposure via ingestion, inhalation, or dermal contact
- 3 key factors: Concentration of fibers + the duration & frequency of exposure

✓ Are there effects to the animal/human from microfiber exposure?

- Effects due to exposure are less well understood; still determining extent of effects

Recommendations for a Standardized Methodology

Current Challenges

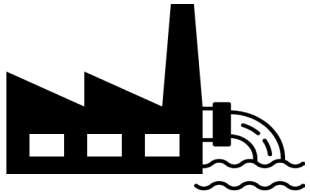
- Comparability and reproducibility across studies
- Reporting inconsistencies (units of measurement, count vs. mass)

Recommendations

- QA/QC measures to minimize & enumerate microfiber contamination
- Standard methods should focus on microplastics in general with…
  - microfibers as a subcategory of microplastics
  - specific procedures included for the recovery and analysis of microfibers

Solutions for Reducing Microfiber Pollution

Design, Production, & Manufacturing Stages

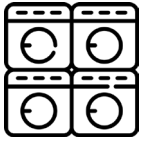


Design

Low-shed fabric

Non-toxic, biodegradable

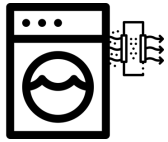
Manufacturing facilities



Pre-wash

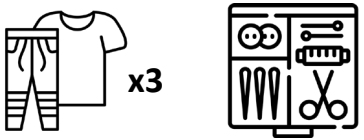
Improve filtration (air/water)

In Use/Wear Stages



Filtration & capture devices

Laundering behaviors



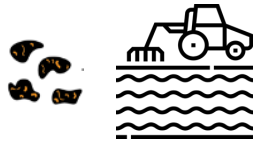
x3

Reuse, re-wear, repair

Green infrastructure

End-of-Life

Advanced treatment options



Selective biosolid application

Recycling?

Key Research Needs & Recommendations

Research Needs / Knowledge Gap

- Microfiber prevalence in environmental compartments
- Rates and mechanisms of microfiber release from various sources
- Impacts of microfiber pollution
- Effectiveness and feasibility of filtration-related mitigation measures

Recommendations

- Address major research needs
- Support upstream efforts to prevent and reduce microfiber pollution
- Implement solutions to capture and remove microfiber pollution
- Evaluate & implement options to minimize microfiber toxicity hazards
- Foster multi-stakeholder collaboration to collectively address the issue

Federal Plan to Address Microfiber Pollution

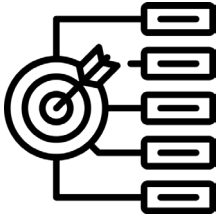
12 federal agencies

2 workshops

1 federal questionnaire

Create Federal Plan

5 goals



18 Objectives

57 Actions

Federal Plan to Address Microfiber Pollution

Goal 1: Support microfiber research

Goal 2: Prevent & reduce microfibers

Goal 3: Capture microfibers

Goal 4: Minimize microfiber toxicity

Goal 5: Share microfiber knowledge

Goal 1: Support microfiber research

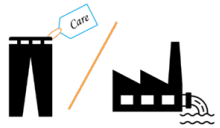
Adopt definition

Standardize methods

Improve knowledge

Goal 2: Prevent & reduce microfibers

Design low-shed textiles

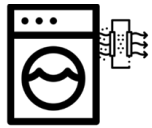


Apply BMPs: Textile care & production

Improve circular economy

Mitigate non-textile microfibers

Goal 3: Capture microfibers



Utilize filters

Minimize dryer emissions

Contain microfibers

Goal 4: Minimize microfiber toxicity

Minimize chemicals

Develop nontoxic degradable textiles

Goal 5: Share microfiber knowledge

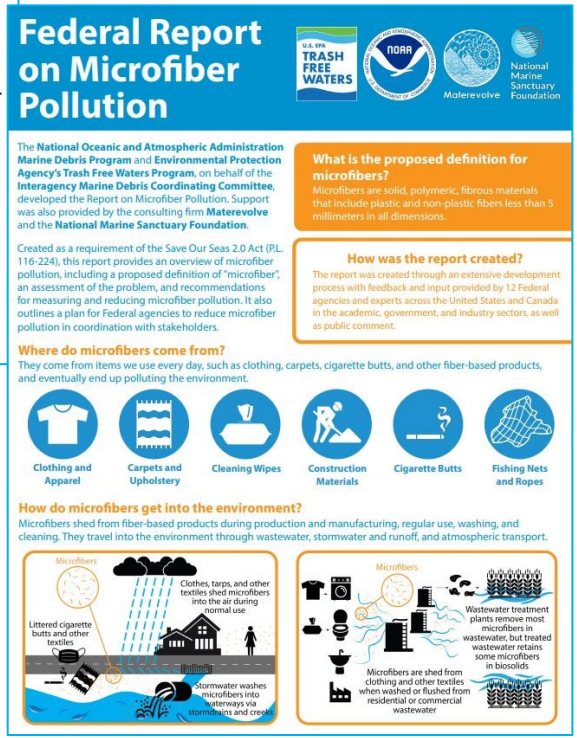
Coordinate across agencies

Create outreach

REPORT TO CONGRESS

INTERAGENCY MARINE DEBRIS COORDINATING COMMITTEE REPORT ON MICROFIBER POLLUTION

Developed pursuant to: Section 132 of the Save Our Seas 2.0 Act, 2020 (Public Law 116-224)



Federal Report on Microfiber Pollution

TRASH FREE WATERS · NOAA · Materevolve · National Marine Sanctuary Foundation

The **National Oceanic and Atmospheric Administration Marine Debris Program** and **Environmental Protection Agency's Trash Free Waters Program**, on behalf of the **Interagency Marine Debris Coordinating Committee**, developed the Report on Microfiber Pollution. Support was also provided by the consulting firm **Materevolve** and the **National Marine Sanctuary Foundation**.

Created as a requirement of the Save Our Seas 2.0 Act (P.L. 116-224), this report provides an overview of microfiber pollution, including a proposed definition of "microfiber", an assessment of the problem, and recommendations for measuring and reducing microfiber pollution. It also outlines a plan for Federal agencies to reduce microfiber pollution in coordination with stakeholders.

What is the proposed definition for microfibers?

Microfibers are solid, polymeric, fibrous materials that include plastic and non-plastic fibers less than 5 millimeters in all dimensions.

How was the report created?

The report was created through an extensive development process with feedback and input provided by 12 Federal agencies and experts across the United States and Canada in the academic, government, and industry sectors, as well as public comment.

Where do microfibers come from?

They come from items we use every day, such as clothing, carpets, cigarette butts, and other fiber-based products, and eventually end up polluting the environment.

Clothing and Apparel · Carpets and Upholstery · Cleaning Wipes · Construction Materials · Cigarette Butts · Fishing Nets and Ropes

How do microfibers get into the environment?

Microfibers shed from fiber-based products during production and manufacturing, regular use, washing, and cleaning. They travel into the environment through wastewater, stormwater and runoff, and atmospheric transport.

Contact Us

carlie.herring@noaa.gov

Bathersfield.Nizanna@epa.gov