CalSPEC
California State Policy Evidence Consortium

Microplastics Occurrence, Health Effects, and Mitigation Policies

Legislative Briefing

Full Report: bit.ly/microplasticsreport

Friday, June 2, 2023
1:30-2:15 pm

Photo Source: Cole Brookson

Agenda

1:30-1:35 pm	Introduction About CalSPEC	Richard Kravitz, MD, MSPH
1:35-1:40 pm	Overview of Microplastics	Katrine Padilla, MPP
1:40-1:50 pm	Health Effects of Microplastics	Tracey Woodruff, PhD, MPH Courtney Cooper, MPH
1:50-2:00 pm	Microplastics Policies	David Wooley, JD
2:00-2:15 pm	Questions and Discussion	All

About the California State Policy Evidence Consortium (CalSPEC)

Presenter: Richard Kravitz, MD, MSPH

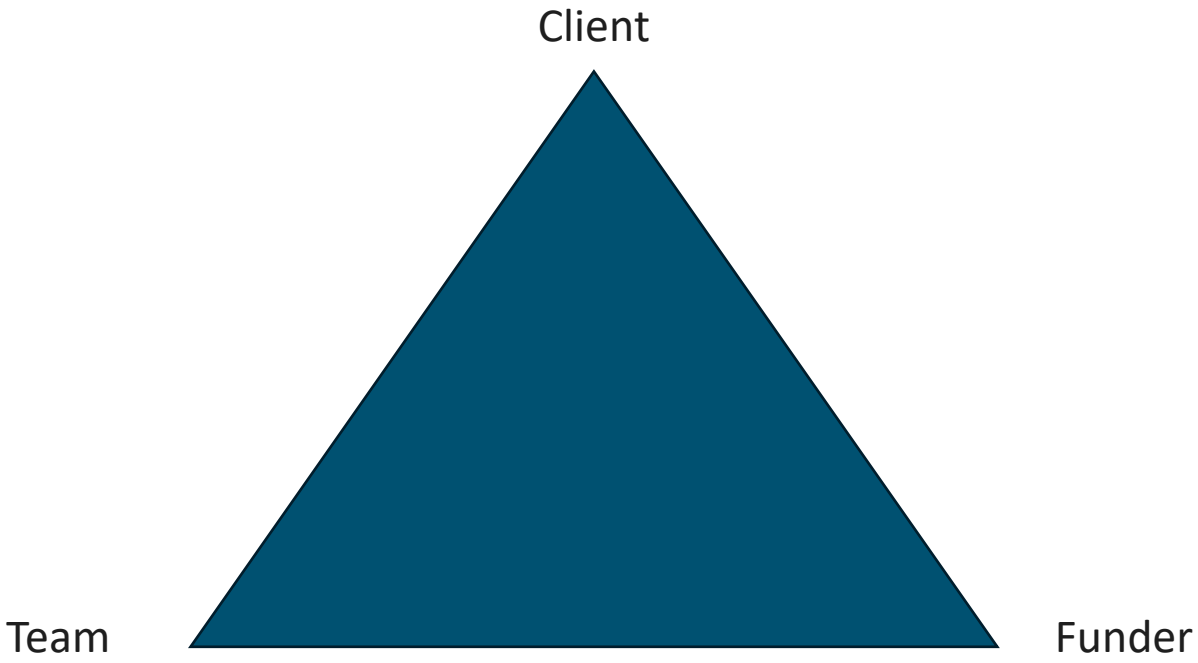
Co-director, CalSPEC

Director, UC Center Sacramento

Aims

- Enlist California's premier public research university in supporting public policy
- Synthesize evidence that informs state legislative deliberations

Essential ingredients



Overview of Microplastics

Presenter: Katrine Padilla, MPP

Project Coordinator, CalSPEC

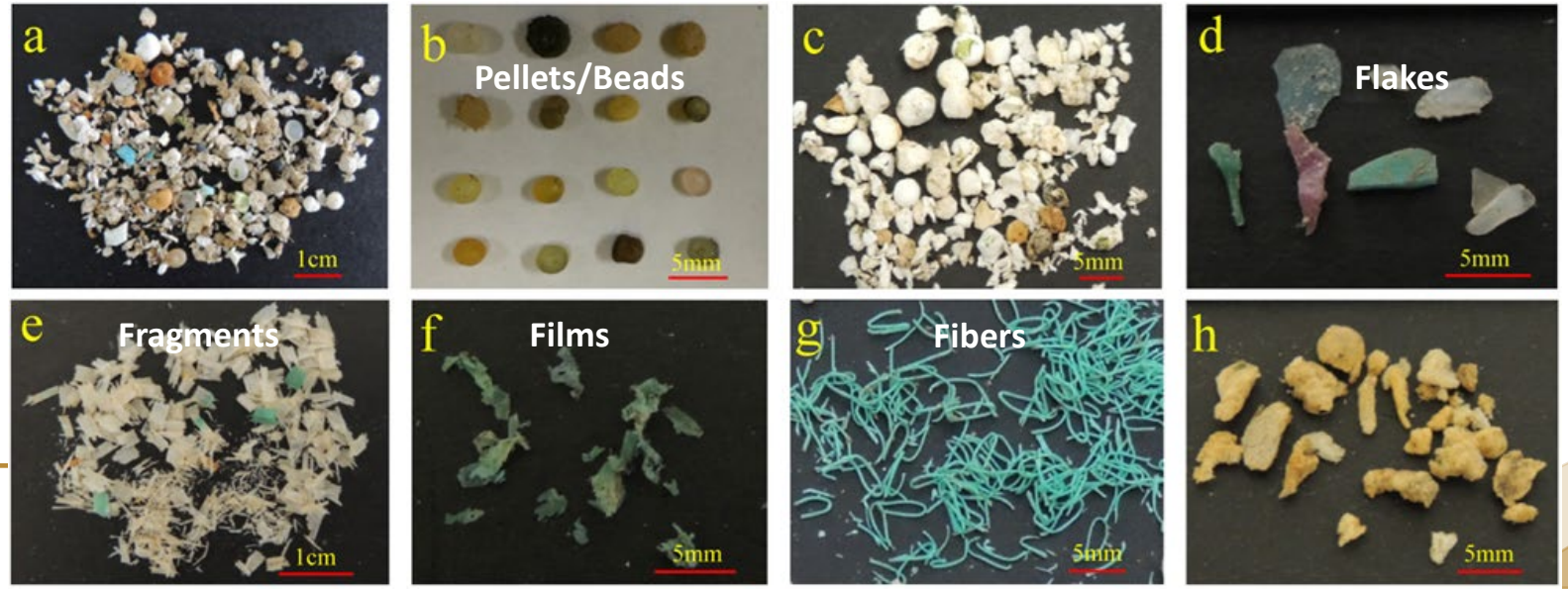
Project Policy Analyst,
UC Davis Center for Healthcare Policy and Research

What Are Microplastics?

- **Microplastics** polymer particles ≤ 5mm (5,000 µm) in one dimension

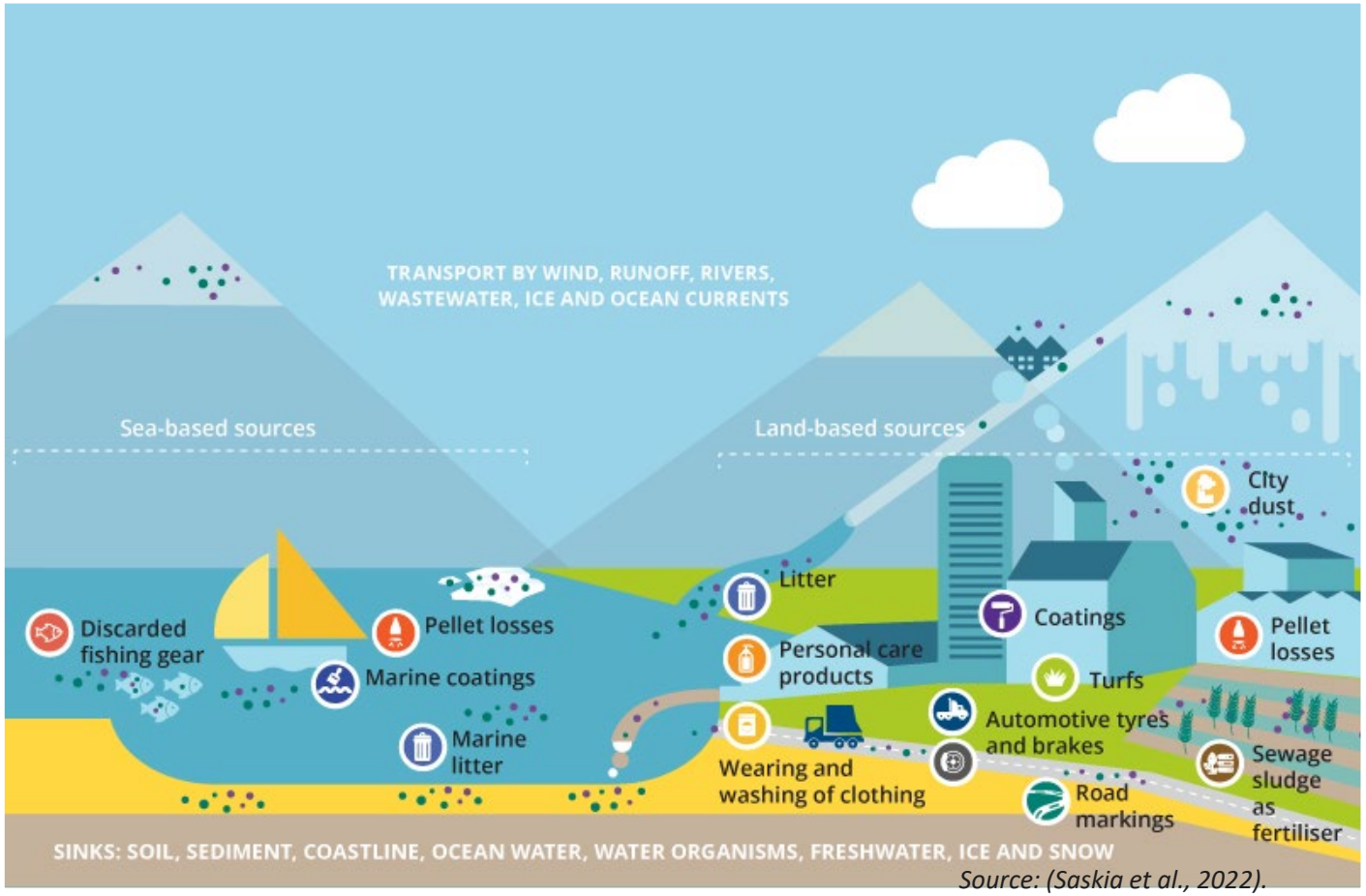
*µm (micron or micrometer) = 1 thousandth of a millimeter (mm)

  - ***primary microplastics*** purposefully manufactured
  - ***secondary microplastics*** generated from degradation of plastic products
  - differ in size, shape, and chemical composition (including additives)



How Do Microplastics Move Through The Environment?

- Introduction of microplastics to environment occurs throughout the plastics life cycle, though **mostly during disposal**
- Transport occurs via wind, storm runoff, rivers, wastewater, evaporation, rain, and ocean currents
- **Final deposition is frequently unknown** due to the prolonged biodegradation process



Source: (Saskia et al., 2022).

How Prevalent Are Microplastics in the Environment?

- Microplastics (MP) cross geographic and environmental boundaries and **have been found everywhere** (in humans, food, biota, water, soil and air)

	Examples of microplastic prevalence or occurrence in various environmental compartments
Food	Humans consume ~140,000-155,000 particles annually; sea salt up to 1674 MP/kg; lake salt up to 462 MP/kg; sugar appears comparable
Flora/Fauna	MP detected in aquatic plants (coral, seagrass, duckweed) and agricultural products (cucumbers, carrots, radish, lettuce); 220 of 800 animal species studied had ingested MP
Water	Sea surface=.02-8,654 MP particles/m^3; tap water 0-628 particles/L and bottled water 0-4,889 particles/L; daily wastewater discharges 50k – 15M particles/day
Soil	Ag fields 62.5-1,075 particles/kg soil; ~7% topsoil weight from MP near roads/industrial areas
Air	Indoor air=3.3-12.6 particles/m^3; outdoor air=0.6-5.6 particles/m^3
Humans	Detected in blood, breast milk, Placenta/meconium, colon, hair, liver, lung, saliva, skin

Conclusion

- Microplastics research is an **emerging field dominated studies of occurrence and size rather** than intermediate and long-term environmental and health effects.

- Microplastics experience long-range transport across environmental and geographic boundaries ➡ increases environmental and human interactions
  - The growing body of **evidence shows increasing human exposure to microplastics** due to accumulation in the ecosystem

- Increasing rate of plastics production **+** persistence from long half-life **=** bioaccumulation of microplastics with toxic properties

Health Effects of Microplastics

Presenters: Dr. Tracey Woodruff, PhD, MPH & Courtney Cooper, MPH

University of California, San Francisco

Program on Reproductive Health and the Environment (PRHE)

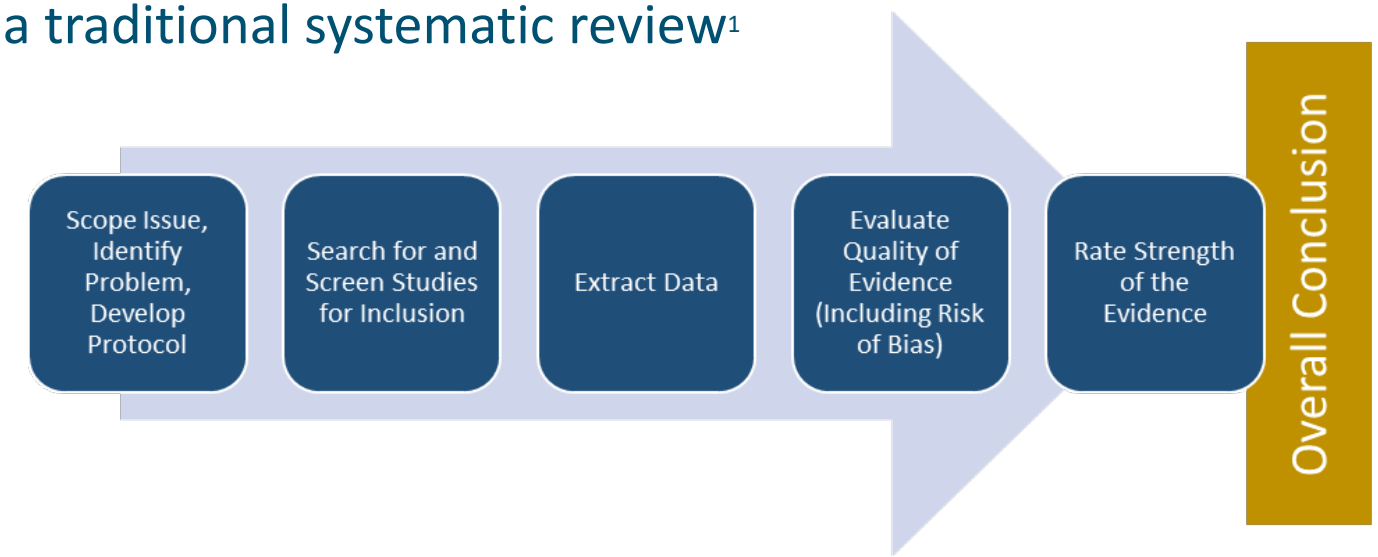
Health Effects - Background

- Humans are exposed to microplastics
  - We consume ~a “credit card” worth every week[1]
- Plastic production is set to triple by 2060[2]
- Microplastics are persistent & bio-accumulative
- Previous systematic reviews on the topic were insufficient
  - CalSPEC conducted a rapid systematic review
- **Research question: What are the human health effects from microplastics exposure?**

[1]Senathirajah K, Attwood S, Bhagwat G, Carbery M, Wilson S, Palanisami T. Estimation of the mass of microplastics ingested - A pivotal first step towards human health risk assessment. J Hazard Mater. 2021 Feb 15;404(Pt B):124004.
[2]The Organisation for Economic Co-operation and Development (OECD). Global plastics outlook: Policy scenarios to 2060. 2022. https://aboutblaw.com/3ke

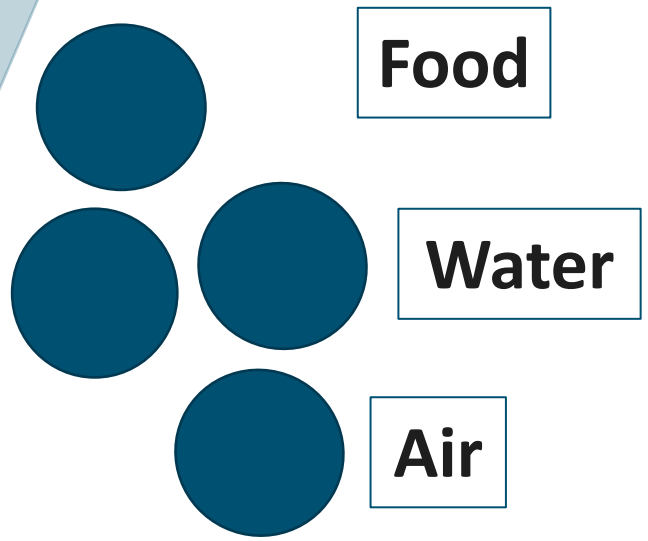
Rapid Systematic Review Process

- **Systematic review:** rigorous method to evaluate available evidence on a research topic and inform decision-making
  - UCSF PRHE developed a systematic review method for environmental health science (the Navigation Guide) - endorsed by National Academy of Sciences, Engineering, and Medicine (NASEM)
- **Rapid systematic review:** systematic review that omits certain steps to accelerate the process of completing a traditional systematic review[1]

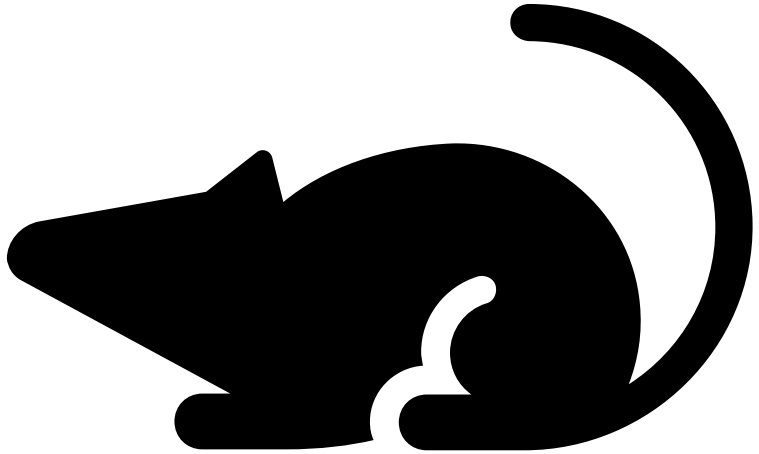


Overview

- **No human studies were identified**
- **Study population:** Rats & mice
  - Rats & mice are used to evaluate environmental chemical exposures and health effects
  - Health effects in rats/mice are generally concordant with effects in humans
- **Primary microplastics**



Microplastics



Length of Exposure: 14-180 days

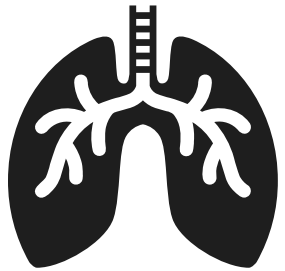
Evaluate health effects

Study Outcomes

- Studies covered a range of outcomes including cardiovascular, digestive, reproductive, neurological, musculoskeletal
- Due to time constraints, CalSPEC focused on 3 body systems that are relevant to human health:

Digestive

Reproductive



Respiratory

Key Finding #1

Possible Classifications
Presumed to be a hazard to humans.
Suspected to be a hazard to humans. ✓
Not classifiable as a hazard to humans.

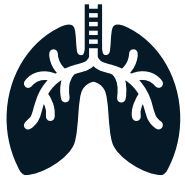
Exposure to microplastics is **suspected to be a digestive hazard to humans, including a suspected link to colon cancer.**

Key Finding #2

Possible Classifications
Presumed to be a hazard to humans.
Suspected to be a hazard to humans. ✓
Not classifiable as a hazard to humans.

Exposure to microplastics is **suspected to be a hazard to the human reproductive system for both males and females.**

Preliminary Finding



- Exposure to microplastics may harm the respiratory system
- We are investigating this preliminary finding further

Limitations

- The conclusions of this rapid systematic review are **likely an underestimation** of the human health harms from microplastic exposure:
  - Only evaluated 3 outcome types, studies on other outcomes may also find effects
  - Rodents in studies exposed to manufactured, pure microplastics and not chemicals that degrade from plastic (e.g., PFAS or BPA)
  - The studies only evaluated one route of exposure at a time

Conclusion

Microplastics have been a problem for a long time and **science is just catching up**

- First report to make a succinct statement about human health hazards of microplastics
- How findings can be used:
  - **For research:**
    - ✓Prioritize other human health outcomes impacted by microplastics exposure
    - ✓Identify strategies to reduce microplastics exposures
  - **For regulators:**
    - ✓Inform policy on production, distribution, and disposal of microplastics

Microplastics Policies

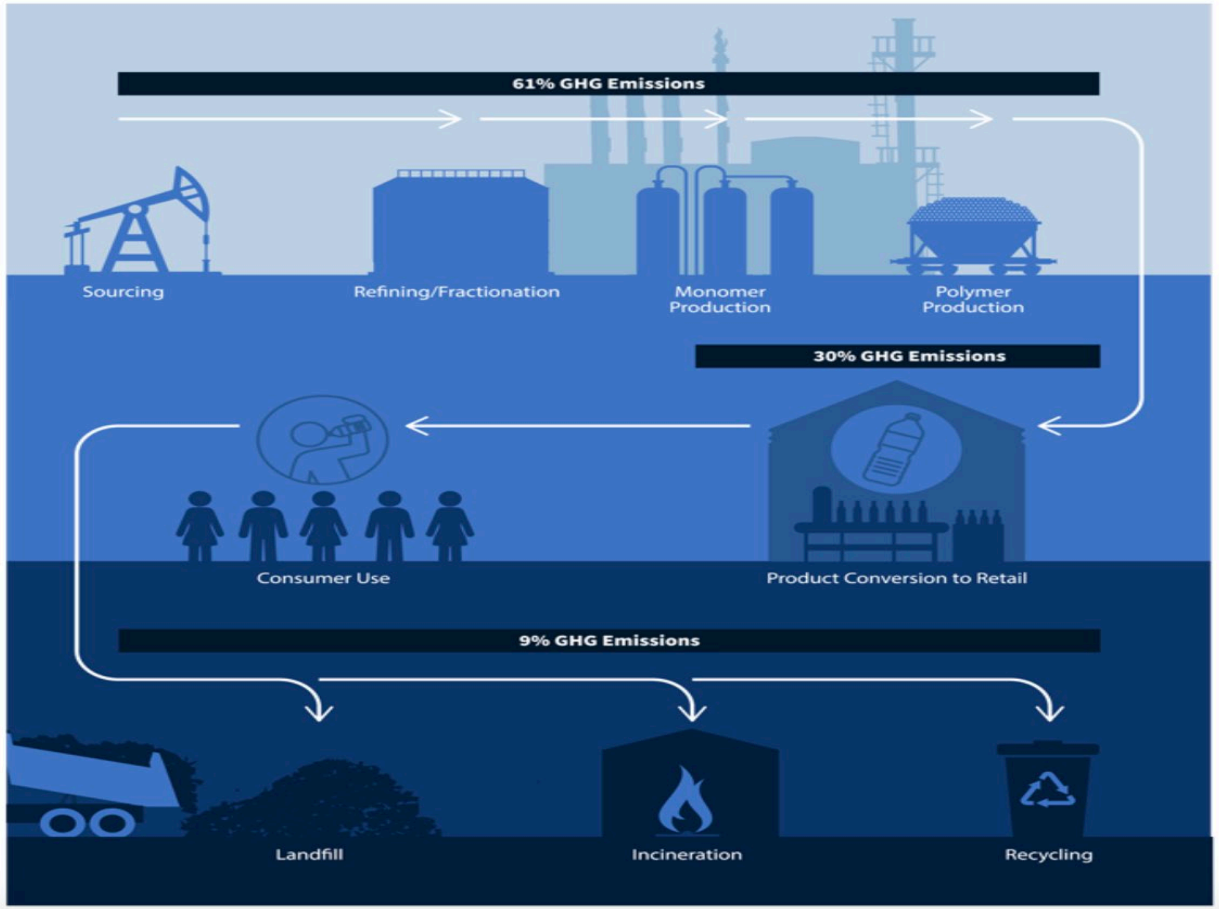
Presenter: David Wooley, JD

Director, Environmental Center, Goldman School of Public Policy

UC Berkeley

Public Awareness of Microplastic Impacts

- Scientific & policy research is accelerating.
- Growing public attention: news, NGO publications Gov't & industry reports.
- Rising awareness of microplastic links to climate change
  - Virtually all plastics are made from oil and gas

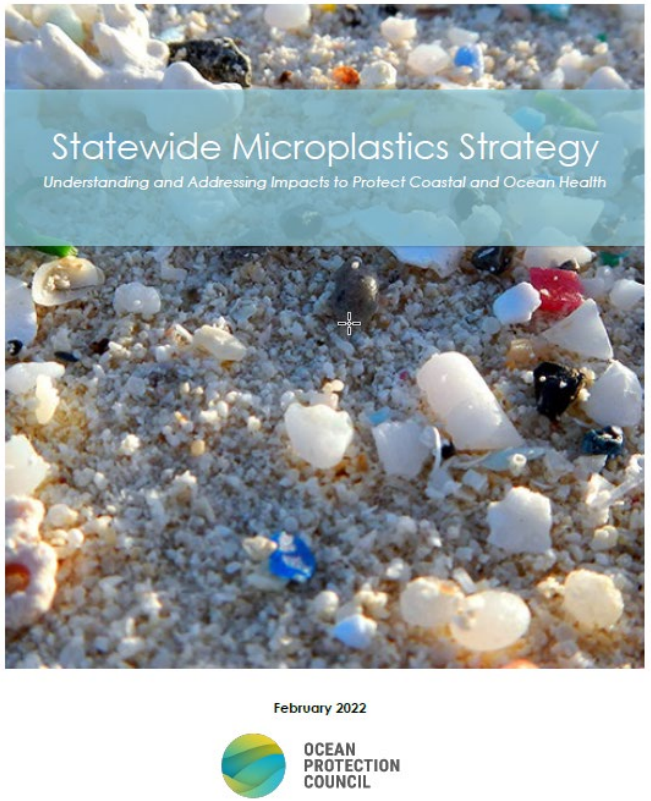


Main Findings - Policy Chapter

- **Policies to reduce exposure to microplastics**
  - Primarily California and EU
  - Microbeads in Cosmetics;
  - Research
- **Policy development is nascent, largest exposure pathways uncontrolled**
  - Microfibers, tires/brakes, plastic production
- **International negotiations underway to limit plastic production**
  - US in Key Role; CA Influence
- **Urgency/Dilemma:**
  - Rapid increase in plastic production/exposure
  - Large research gaps remain
  - Need to act in face of uncertainty
- **Future Policy Focus:**
  - Highest volume exposure pathways
  - Most toxic compounds
  - Fund research
- **As policy measures expand, fund research assess effectiveness**

California Leadership

- Microbeads (cosmetics)
- SB 54 (2022) requires 65% of packaging to be recyclable or compostable & 25% reduction of all plastic packaging by ‘32
- Research: testing & standards for microfibers in drinking water
- Ocean Protection Council’s February ‘22 *Statewide Microplastics Strategy*



Impressions from the Research

Near term policy options

- Expand microbead prohibition to household/industrial cleaning products.
- Microfibers: establish filter standards for clothes washers/driers
  - (residential, industrial, institutional, commercial).
- Tires/brake dust: identify reformulation and on-board capture options
  - Note equity issue - heightened exposure in minority communities.
- Ban specific polymers and additives known to endanger public health or environment
    - (e.g., PFAS compounds, phthalates – see AB 1290 introduced 2/16/23)

Impressions from the Research

Longer Term Actions

- Research:
  - To support standards for synthetic textiles to reduce fiber shedding, impose producer responsibility (e.g. clothing).
  - On impact of microplastics on air quality and human lung function.
    - potential solutions include building filtration, enhanced street sweeping tech.

Impressions from the Research

Research – Knowledge Gaps

- Paint derived microplastics
- Improve labeling requirements to aid toxicity assessment & waste disposal of hazardous polymers/additives
- Optimize micro & macro-plastics capture systems for waste- and storm-water systems

Expand engagement and education on microplastics

- General public, food and packaging industries.

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