Lessons from Tires: New CECs & New Transport Pathways

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RMP

Tire-related toxicant in Bay Area urban runoff

Los Angeles Times

Health and Science

December 5, 2020

Scientists solve the mystery of mass salmon deaths. The killer? A chemical from car tires

After 20 years of investigation, researchers say they have figured out why coho salmon along the West Coast died off en masse after it rained. The culprit: a very poisonous yet little-known chemical related to a preservative used in car

San Francisco Chronicle

The New York Times

THE SACRAMENTO BEE

The Guardian

CNN

FOX NEWS channel

POPULAR SCIENCE

Source: Tian et al. 2021

Tire-related toxicant in Bay Area urban runoff

Photo: M. Eliot

Ozone in air

6PPD-quinone

Source: Tian et al. 2021

Lessons from Tires

What's happening?

- Tire particles & chemicals wash into storm drains
- Flow directly to surface water with little or no treatment
- Particles and leachate both toxic to aquatic organisms
- Potential to harm fish and ecosystems

Particle toxicity: Baensch-Baltruschat et al., 2020; Camponelli et al., 2009; Chibwe et al., 2021; Halle et al., 2020; Khan et al., 2019; Panko et al., 2013; Redondo Hasselerharm et al., 2018; Wagner et al., 2018; Wik and Dave, 2009
Leachate toxicity: Capolupo et al., 2020; Gualtieri et al., 2005; Halle et al., 2020; Halsband et al., 2020; Kolomijeca et al., 2020; Wik and Dave, 2009

Tire tread wears off during use

US tire wear particle release estimate:
3.0 - 5.5 kg/y per capita

Particles are tiny (nm - 100 µm)

Release estimate sources: Baensch-Baltruschat et al., 2020; Councell et al., 2004; Kole et al., 2017; Wagner et al., 2018

Reality check – 3 to 5.5 kg

Kelly's niece at birth

One of these cats

Tires contain more than rubber

Compound Type	Content
Rubber	40-60%
Fillers/reinforcing agents	20-35%
Process/extender oils	12-15%
Additives (preservatives, plasticizers, etc.)	5-10%
Vulcanization agents	1-2%

Adapted from Wagner et al. 2018

RMP Studies on Tire Particles & Chemicals

1. Non-targeted analysis

—Abundant in San Leandro Bay

2. Roadway Pollutants

—In runoff (in progress)

—In Bay (in progress)

3. Microplastics

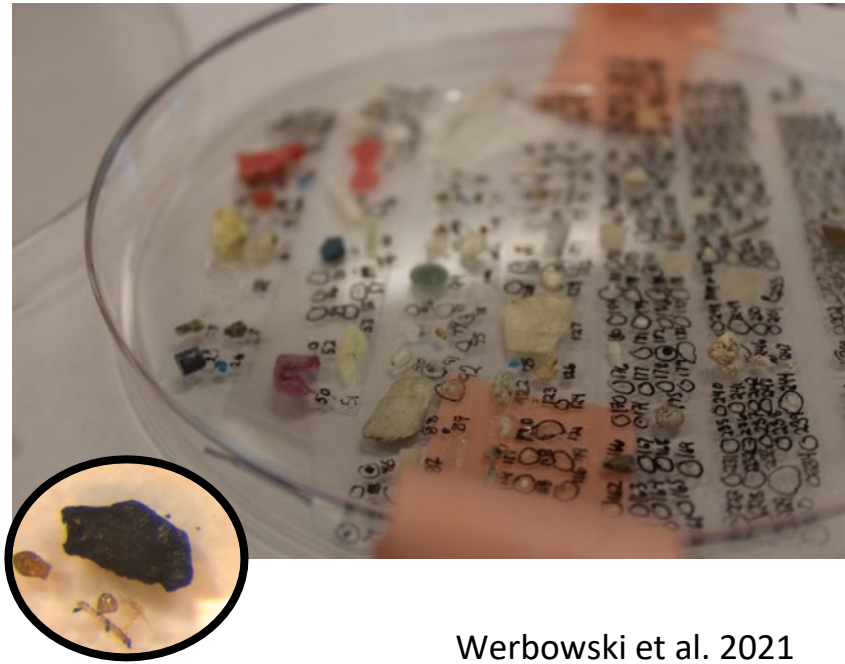
—Tire wear particles in stormwater, sediment (2019)

Sources: Overdahl et al. 2020; Sutton et al. 2019; Werbowski et al. 2021; Zhu et al. 2021

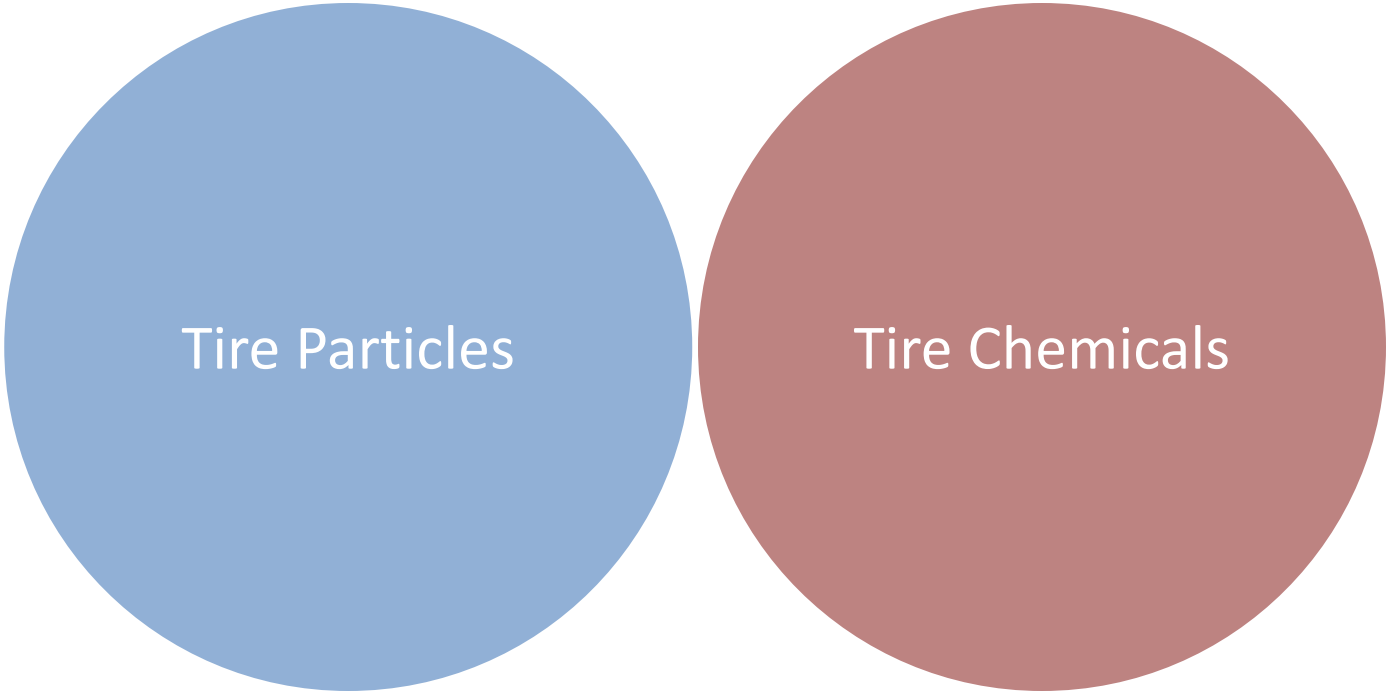
Tire particles are the most common microplastic flowing into San Francisco Bay

SFEI 2019 study:

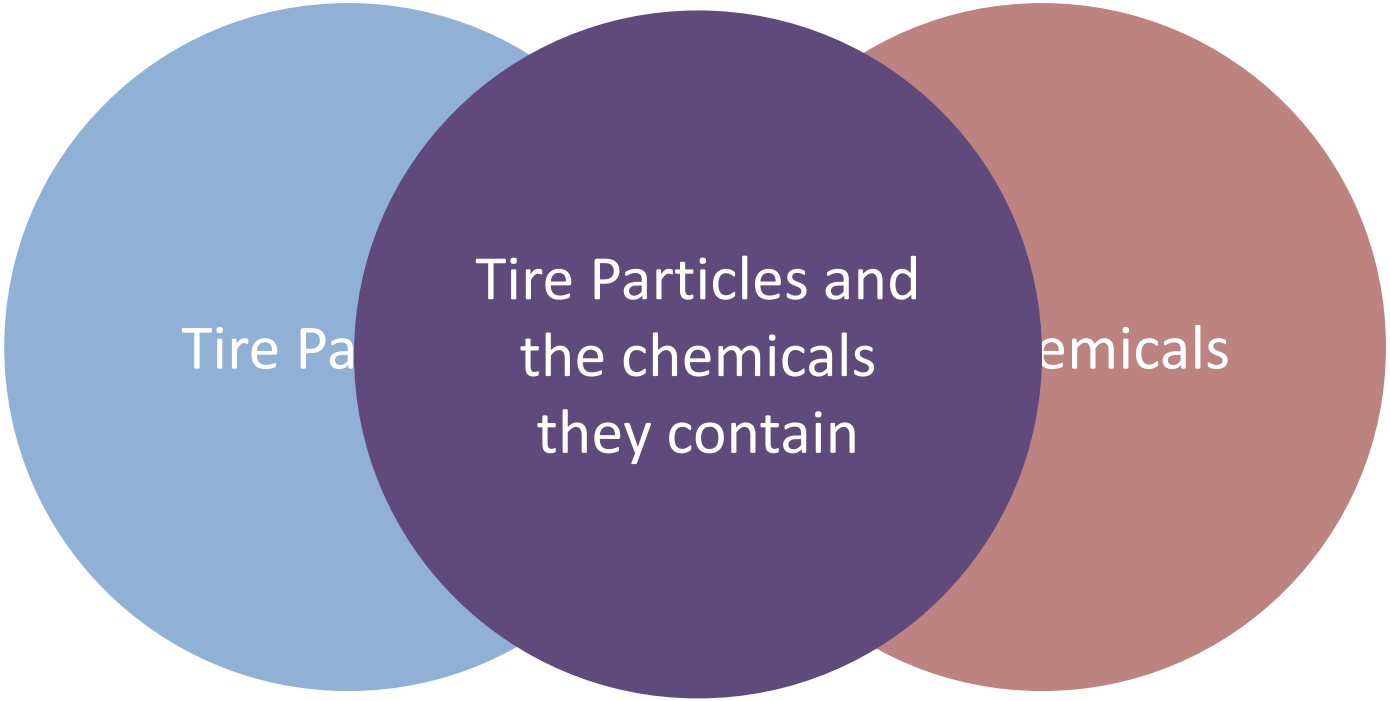
- Common in stormwater and sediment
- Not detected in Bay water, wastewater, prey fish or bivalves
- Study design likely undercounted tire particles



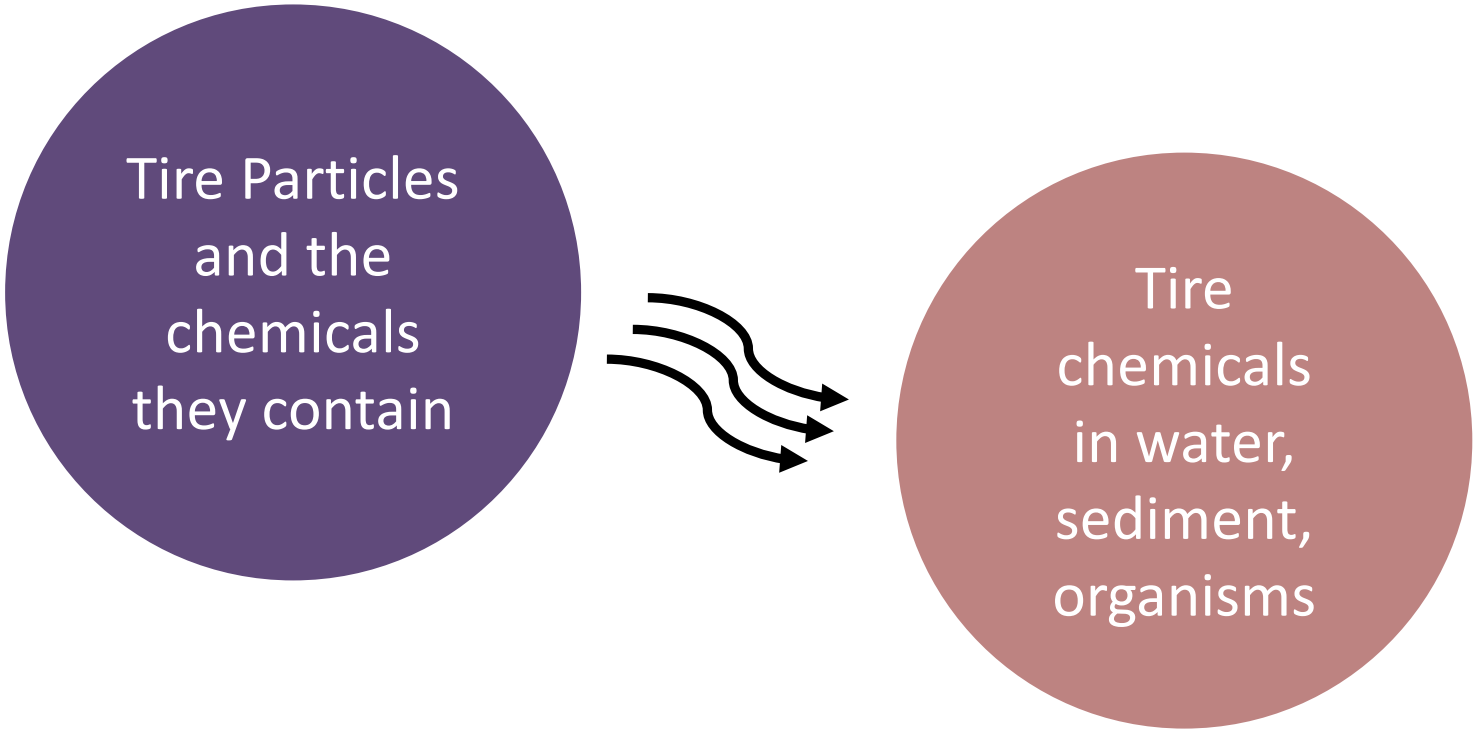
Werbowski et al. 2021


Tire Particles
Tire Chemicals

Tire particles carry chemicals into the environment

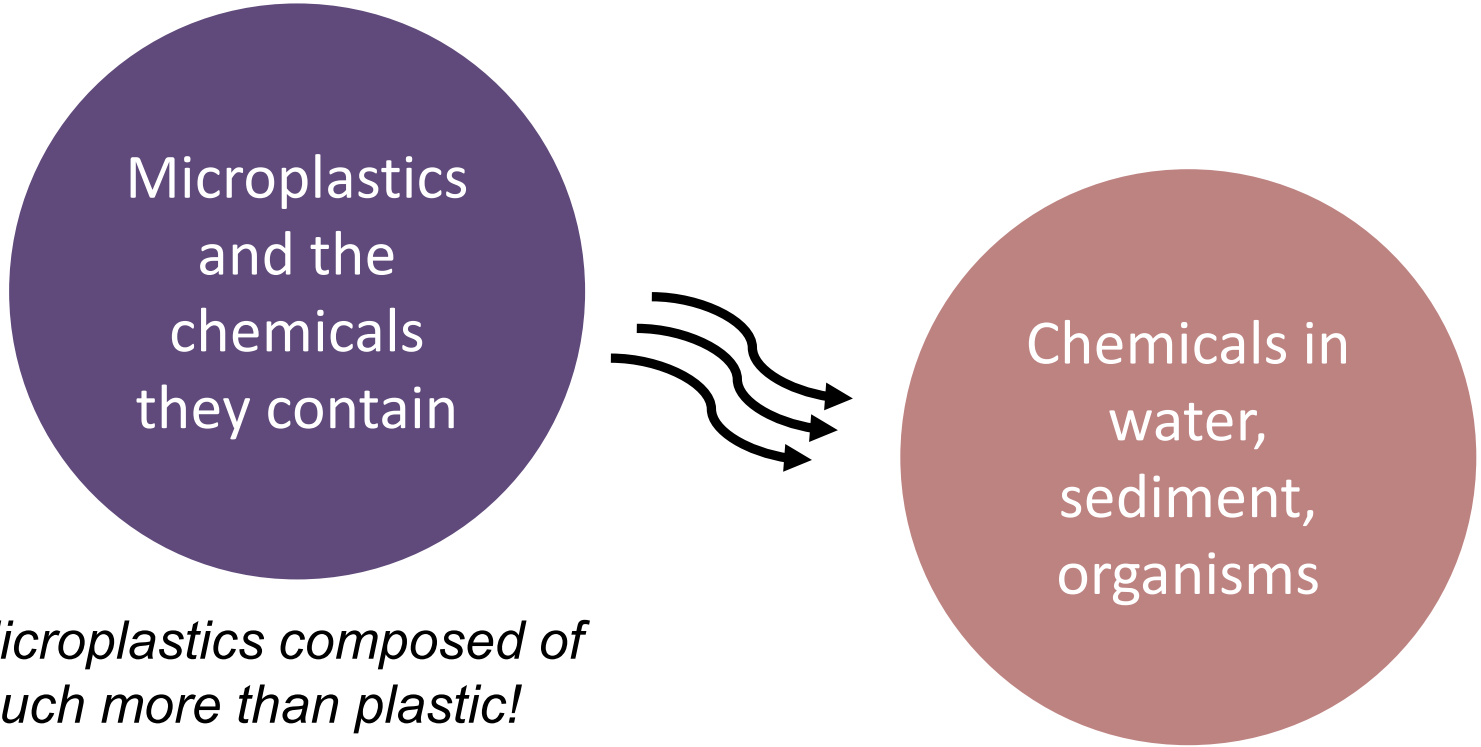


Tire particles are ubiquitous & release tire-related chemicals everywhere they occur



Sources: Baensch-Baltruschat et al., 2020; Leads and Weinstein, 2019; Siegfried et al., 2017; Tian et al., 2017; Werbowski et al., 2021; Wik and Dave, 2009; Huang et al., 2021; Peter et al., 2020, 2018; Tian et al., 2021

New way of thinking about CECs transport



Microplastics composed of much more than plastic!

RMP “Moderate Concern” CECs

- Alkylphenols & Alkylphenol Ethoxylates
- Bisphenols
- Fipronil
- Imidacloprid?
- Microplastics
- Organophosphate Esters
- PFAS

Almost all are plastic additives

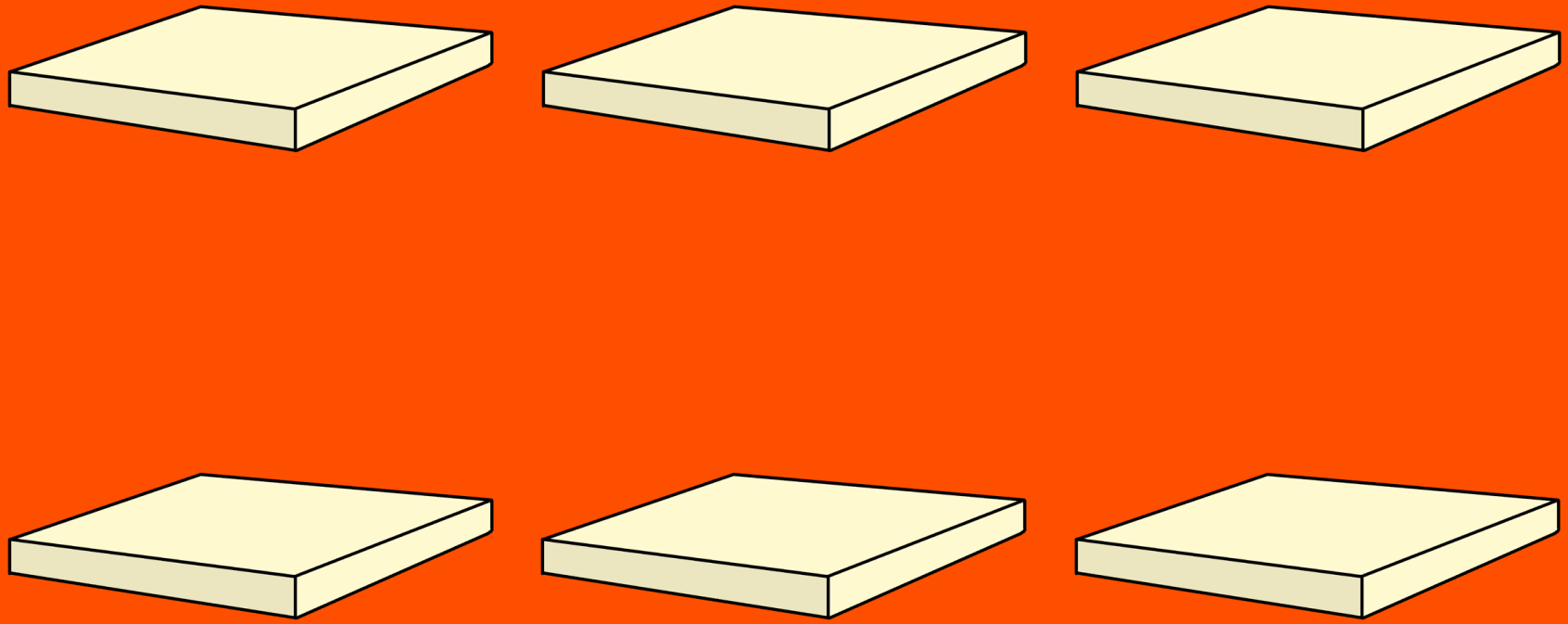


Image: Giphy

THE FOLLOWING **PREVIEW** HAS BEEN APPROVED FOR

ALL AUDIENCES

- RMP Tires Strategy – focus on Bay, tire-related chemicals
- SETAC Conference – International Tires Session (co-chair)
  - Covering aquatic toxicity, chemistry, monitoring, management
- RMP-specific stormwater conceptual model report
- Provide data to DTSC Safer Consumer Products Program
- UC Berkeley BEACN Tire Industry Assessment (pro bono)

Meet the BEACN Team

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Thank you to our funders

Tire chemicals found in Bay & Watersheds

Not comprehensive * = RMP Moderate Concern # = RMP Possible Concern + = DTSC Tire-derived chemical of interest

Compound	Bay Water	Sediment	Stormwater	Wildlife
6PPD/6PPD-quinone			X	
Benzothiazoles+, DPG+, HMMM+	X	X	X	
Chlorinated paraffins+#				X
Phthalates#	X	X	X	
Octyl phenol ethoxylates+ (type of alkylphenol ethoxylates*)			X	
PAHs+	X	X	X	X
Bisphenols*	X			

Source: RMP data (some yet to be published)