U.S. TIRE MANUFACTURERS ASSOCIATION

The role zinc oxide serves in manufacturing safe tires

July 28, 2021
DTSC

Speakers

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USTMA Members - https://sustainability.ustires.org/

BRIDGESTONE

Continental
The Future in Motion

COOPERTIRES

Giti

GOODYEAR
MORE DRIVEN

Hankook
driving emotion

KUMHO TIRE
Better, All-Ways

MICHELIN
A BETTER WAY FORWARD

nokian TYRES

PIRELLI

SUMITOMO
RUBBER INDUSTRIES

TOYO TIRES
driven to perform

YOKOHAMA

What we will cover

- What is needed to address zinc water quality issues in CA
- Overview of tire materials and tire manufacturing
- Overview of the role of zinc oxide in manufacturing safe tires
- Overview of why zinc in tires does not meet the criteria for listing as a Priority Product
- Request that DTSC pause work related to zinc in tires to allow the Biotic Ligand Model to be implemented

WHAT IS NEEDED TO ADDRESS WATER QUALITY ISSUES RELATED TO ZINC IN CA

The focus on zinc oxide in tire tread is misplaced

- "Even if approved, a DTSC-based zinc phase-out will not impact zinc in runoff in a timely manner and allow dischargers to meet the TMDL final wasteload allocations."
  - Fred Krieger, Comments on 2017 Los Angeles Region Triennial Review, dated December 5, 2017 (https://www.waterboards.ca.gov/losangeles/water_issues/programs/basin_plan/Triennial_Review/2017-2019/FredKriegerPrivateCitizen_CommentsonNotification.pdf, at 9)

Water Quality Criteria for Metals

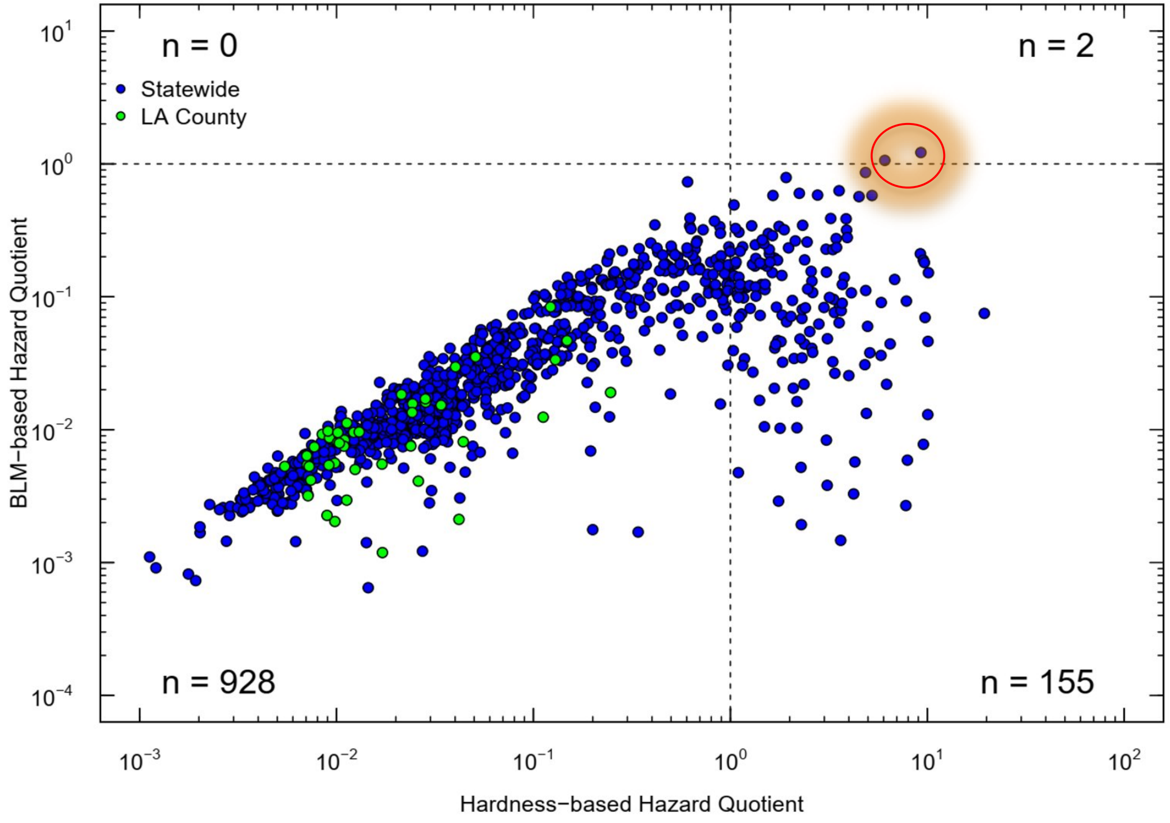
- Water quality criteria (WQC) for metals have evolved
    - Simple hardness equations → sophisticated bioavailability models
        - increased understanding of the forms of metals responsible for aquatic toxicity
        - factors that influence the interaction of these forms with aquatic organism (i.e., bioavailability)

- Biotic ligand model (BLM) is the state-of-the-art model for assessing water quality criteria for metals

Use of Biotic Ligand Model (BLM) for Zn Shows No Significant Impairment

- International Zinc Association (IZA) performed modeling to demonstrate the application of the biotic ligand model.

- Of the 1085 samples (from 196 waterbodies) evaluated in the state only 2 showed impairment using the BLM



What is needed to address zinc water quality issues in CA

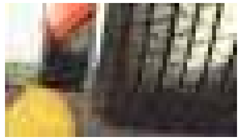
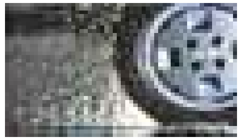
- The Safer Consumer Products Regulations should not operate in a vacuum and should assess and consider work of other state agencies

- USTMA strongly recommends that:
  - DTSC pause work related to zinc in tires under the Safer Consumer Products Regulations until the State Water Resources Control Board or the LA Water Board have implemented the biotic ligand model for zinc
  - If application of the biotic ligand model for zinc demonstrates that only two state waterbodies in California are impaired for zinc, we recommend DTSC remove zinc in tires from the Priority Products Work Plan

- We welcome the opportunity to work with CA regulators to advance implementation of the Biotic Ligand Model

WHAT MUST TIRES DO?

The functions of the tire


- Support weight of the vehicle
- Provide precise/effortless everyday steering
- Provide stable & effective emergency steering
- Grip to accelerate
- Grip to brake
- Perform in wet conditions
- Perform in winter conditions
- Provide a quiet ride
- Absorb vibrations and impacts
- Provide long wear life
- Resist heat overload, speed, and low inflation
- Improve vehicle fuel economy (low rolling resistance tires)
- Comply with NHTSA Federal Motor Vehicle Safety Standards

HOW ARE TIRES REGULATED?

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Safety is our Priority

Tires are highly regulated products to ensure consumer safety

The National Highway Traffic Safety Administration (NHTSA) regulates new tires. The Safety Act, 49 U.S.C. §§ 30103-30105 et seq.

Changes in tire materials may change a tire's ability to meet NHTSA safety standards

Federal Motor Vehicle Safety Standards

Safety Act, 49 U.S.C. §§ 30103-30105 et seq.

FMVSS Number	CFR Citation	Title
Standard No. 109	49 CFR 571.109	New pneumatic and certain specialty tires. (FMVSS 109)
Standard No. 110	49 CFR 571.110	Tire selection and rims and motor home/recreation vehicle trailer load carrying capacity information for motor vehicles with a GVWR of 4,536 kilograms (10,000 pounds) or less.
Standard No. 119	49 CFR 571.119	New pneumatic tires for motor vehicles with a GVWR of more than 4,536 kilograms (10,000 pounds) and motorcycles.
Standard No. 120	49 CFR 571.120	Tire selection and rims and motor home/recreation vehicle trailer load carrying capacity information for motor vehicles with a GVWR of more than 4,536 kilograms (10,000 pounds).
Standard No. 129	49 CFR 571.129	New non-pneumatic tires for passenger cars.
Standard No. 138	49 CFR 571.138	Tire pressure monitoring systems.
Standard No. 139	**CFR 571.139**	**New pneumatic radial tires for light vehicles. Durability test.**

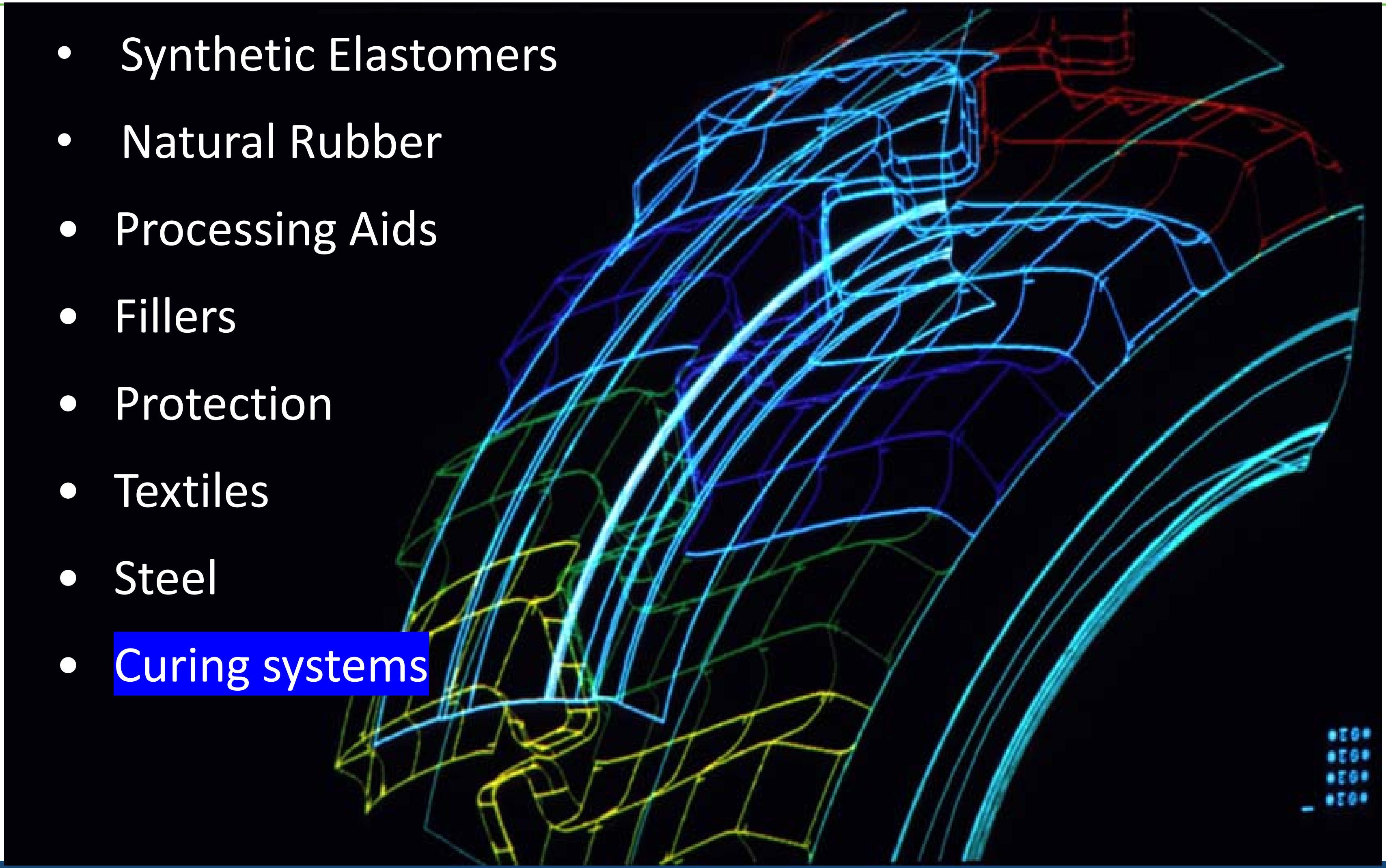
HOW ARE TIRES MADE?

Tires are Highly Engineered Products

In General:

- *10-15 Rubber Compounds*
  - Each formulated for a unique function
    - Air Retention, tread wear, wire adhesion, etc…
- *45-60 Unique materials per tire*

Raw Materials Used in Tires



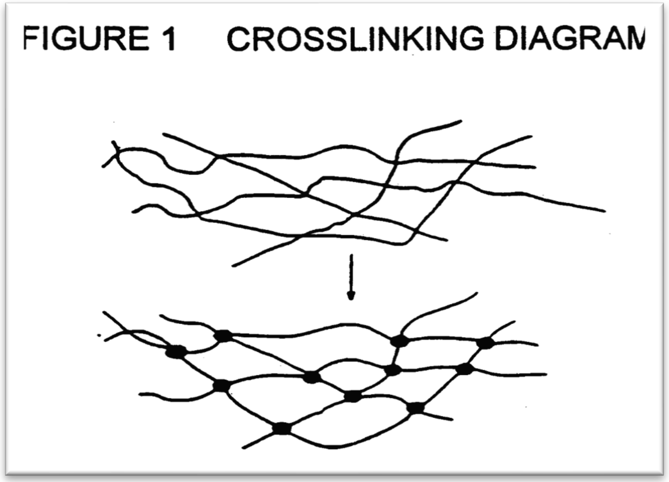
- Synthetic Elastomers
- Natural Rubber
- Processing Aids
- Fillers
- Protection
- Textiles
- Steel
- Curing systems

Example of a Tread Rubber Compound

Material	Function	Percentage (%)
SBR, BR, Natural Rubber	Elastomer	50
Carbon Black / Silica	Filler	22
Naphthenic Oil	Processing Aid	21
Stearic Acid	Component of Curing System	0.7
Zinc	**Component of Curing System**	**0.7**
6PPD	Protection Material	1
Wax paraffin	Protection Material	0.7
Silane	Coupling Agent	1.8
Sulfur	Component of Curing System	0.7
DPG	Component of Curing System	0.5
CBS	Component of Curing System	0.6
Total		100

Rubber Vulcanization

- Vulcanization converts “green” rubber to a cured state by forming chemical crosslinks thus imparting strength, stability, elasticity and other useful properties.
- The most effective tire crosslinking chemistry requires heat be applied to a mixture of elastomers with double bonds, sulfur, accelerators, and **zinc**.
- Changes the chemical composition of the chemicals formulated into the tire in the initial stages of the manufacturing process



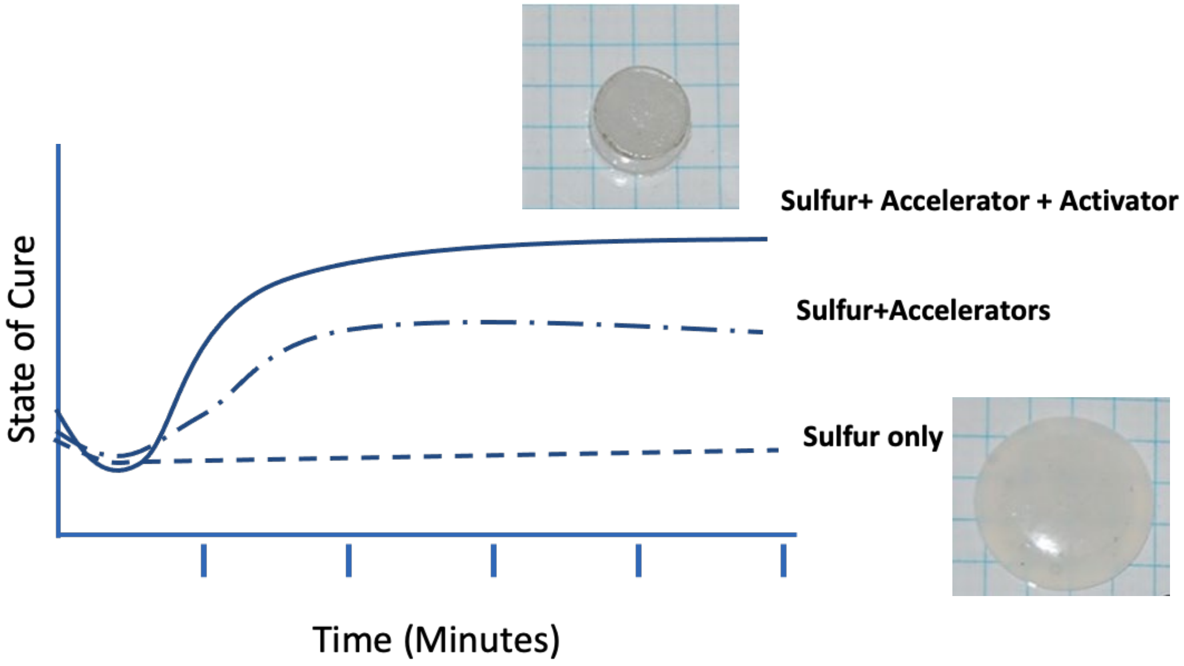
Polymer without crosslinks – polymer flows and loses it's shape

Polymer with crosslinks – maintains it's shape

https://images.search.yahoo.com/search/images;_ylt=AwrJ7Jz5vMJeDpYAuIdXNyoA;_ylu=X3oDMTEyNnI1aGthBGNvbG8DYmYxBHBvcwMxBHZ0aWQDQjk5MTNfMQRzZWMDc2M-?p=Diagram+of+Fatigue+and+rubber+cross+links+types&fr=yfp-t#id=64&iurl=http%3A%2F%2F3.bp.blogspot.com%2F-lVAXqTmxovg%2FVNnJBnuYj5I%2FAAAAAAAAArA%2Fj9dxUCIGNlk%2Fs1600%2F2.9.3.jpg&action=click

Curing Systems

- Curing systems include:
  - Sulfur
  - Accelerators
  - Activators (for example – zinc)
  - All components required for proper cure
- Curing systems are required to ensure cross linking in the rubber chain and prevent reversion or the loss of the rubber cross links
- The use of zinc oxide provides an optimized cross link network



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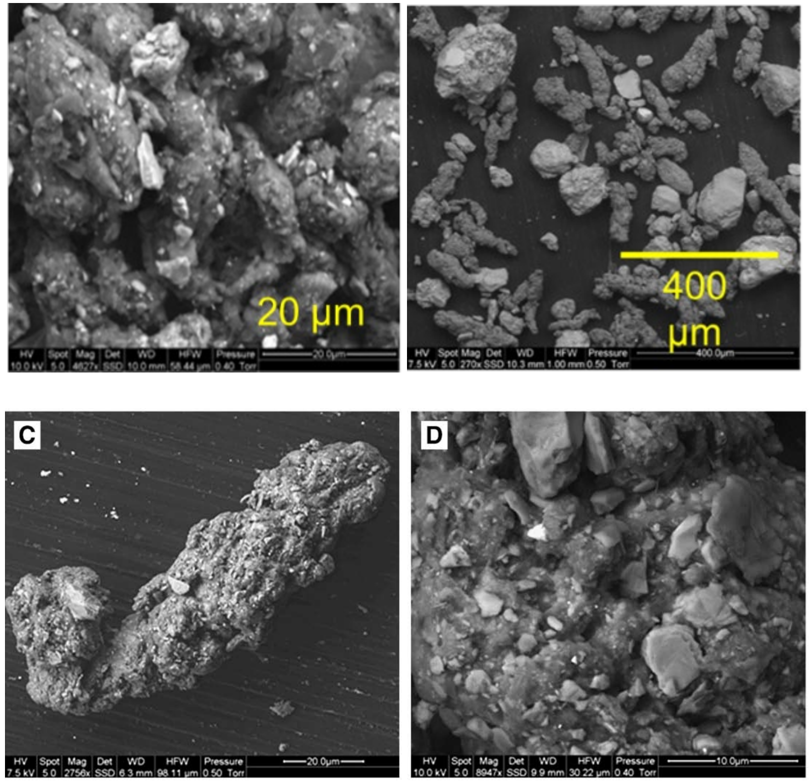
ZnO is Critical to Tire Safety

- Tire manufacturers utilize zinc oxide because it **activates** and **promotes** the optimum number and type of crosslinks in the rubber chain imparting strength, stability and other useful properties for every component of a finished tire.
- Zinc oxide is a critical ingredient that allows a tire to perform safely.
- Currently, without zinc oxide, rubber tires cannot be manufactured to meet safety and performance standards.

HOW DOES ZINC FROM TIRES ENTER THE ENVIRONMENT?

Why do tires produce particles?

- Tires are a vehicle's only connection to the road.
- The grip between a tire and the road surface is essential to tire safety and performance.
- The tire's critical grip on the road creates tire and road wear particles (TRWP) due to abrasion that occurs during accelerating, braking and cornering.
- TRWP are a mixture of roughly 50% tire tread and 50% road surface.



Kreider, M.L., J.M. Panko, B.L. McAtee, L.I. Sweet and B.L. Finley. (2010) *Physical and Chemical Characterization of Tire-Related Particles: Comparison of Particles Generated Using Different Methodologies.* Sci Total Environ. 2010 Jan 1;408(3):652-9

ZINC FROM TIRES DOES NOT MEET THE CRITERIA FOR LISTING AS A PRIORITY PRODUCT

Criteria for listing as priority product

SCPR criteria for listing a Priority Product:

1. There must be a potential public and/or aquatic, avian, or terrestrial animal or plant organism exposure to the Candidate Chemical(s) in the product; AND
2. There must be the potential for one or more exposures to contribute to or cause significant or widespread adverse impacts.

See California Code of Regulations, title 22, Division 4.5, Chapter 55. Section 69503.2

Zinc in tires does not meet the criteria for listing:

- There are many sources of zinc in the environment
  - Tire wear typically represents ~10% of zinc loading in jurisdictions that have performed source apportionment
- Zinc from tires is not bioavailable
- Mischaracterization of zinc release from tires

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There are many sources of zinc in the environment

1. Construction Materials		2. Consumer Products		3. Other	
Galvanized metal surfaces	Roofing	Littered products	Batteries	Atmospheric deposition	Wet
	Siding		Other metal products (e.g. coins)		Dry
	Road barriers			Combustion	Coal and waste burning
	Piping				Forest fires
	Light poles	Personal care	Cosmetics	Industrial	Stack emissions
			Soaps		
	Fences		Shampoos		Wastewater
					Runoff
	Scrap Metal		Detergents	Soil runoff	Agriculture
	HVAC units		Pharmaceuticals		Gardening
		Vehicles	Exhaust		Natural
Painted or coated products	Siding		Brake wear	Biological waste	Urine
	Roofing		Tire wear		
	Other products (e.g. wood preservatives)		Engine Oil		Feces

(ATSDR, 2005; Blok 2005; Comber & Gunn 1996; Krouse et al. 2009)

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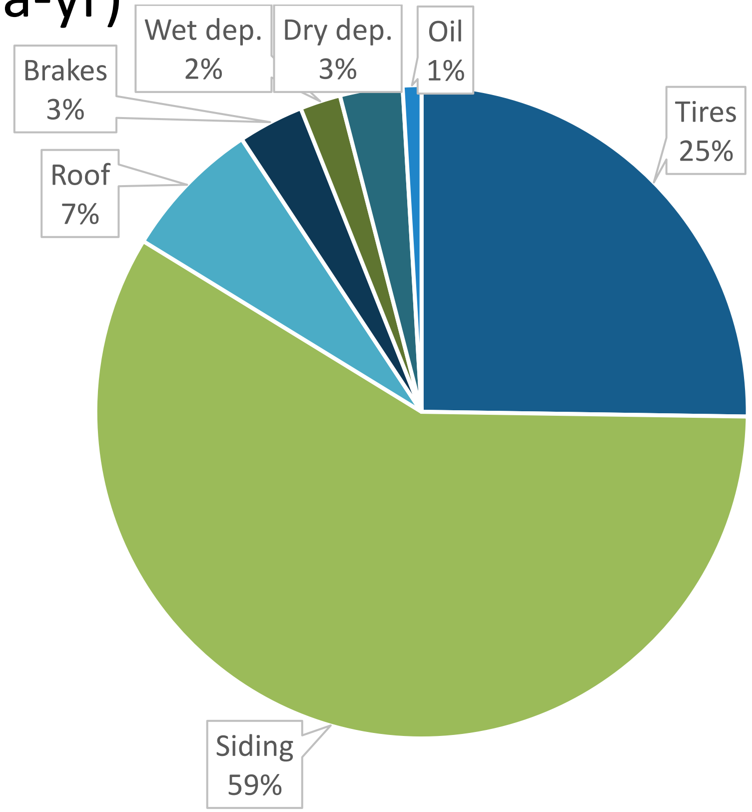
Contribution of Zn from tires

- Where local, state and national level governments have conducted comprehensive inventories, tire wear is one of many sources and where quantified, is a low contributor of Zn to watersheds.

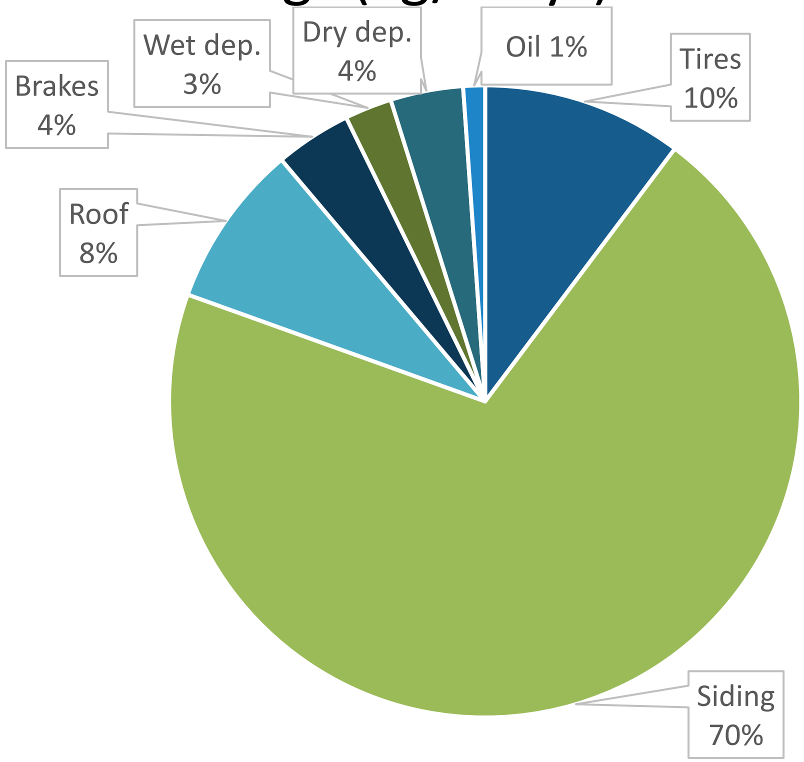
Inventory	Methodology	Sources of Zn Considered	Quantitative Estimate
Washington State Department of Ecology	Published release rates were used to calculate Cu and Zn loading to urban stormwater	Major: moss control products, building siding, parking lots, vehicle tire wear Minor: chain link fencing, roofing material, vehicle brake wear, roof gutters, HVAC, vehicle exhaust, streetlights	Tire wear estimated to contribute 12.6% to overall loading in urban runoff, with moss control and building siding accounting for 68% of load
Alaska Department of Environmental Conservation	Technical report of potential zinc and copper sources in the Kenai River Watershed	Tire wear and traffic intensification, galvanized metal sources including roofing, fences, culverts, drain pipes, construction materials; fertilizers, pesticides, fungicides	None
Netherlands Pollutant Release and Transfer Register	Reported emission data and calculated estimates for diffuse source emissions to air, water, and soil	Major: Galvanized metals; POTW discharges Minor: Tire wear; atmospheric depositions	Tire wear estimated to contribute 8% of the load to sewage waters; galvanized metals and domestic discharge account for 70% of load.
Auckland Regional Council	Technical report estimating diffuse source emissions in urban environment	Major: Galvanized roofing Minor/Major: Tire wear; atmospheric deposition; other galvanized metals	0.070 – 0.677 kg/ha-year, depending on the catchment; roof runoff estimated to contribute 0.265 – 4.297 kg/ha-year

Davis et. al. (2001)

Davis et al. 2001 – Zinc Runoff in Urban Residential Areas with Brick Buildings (kg/ha-yr)

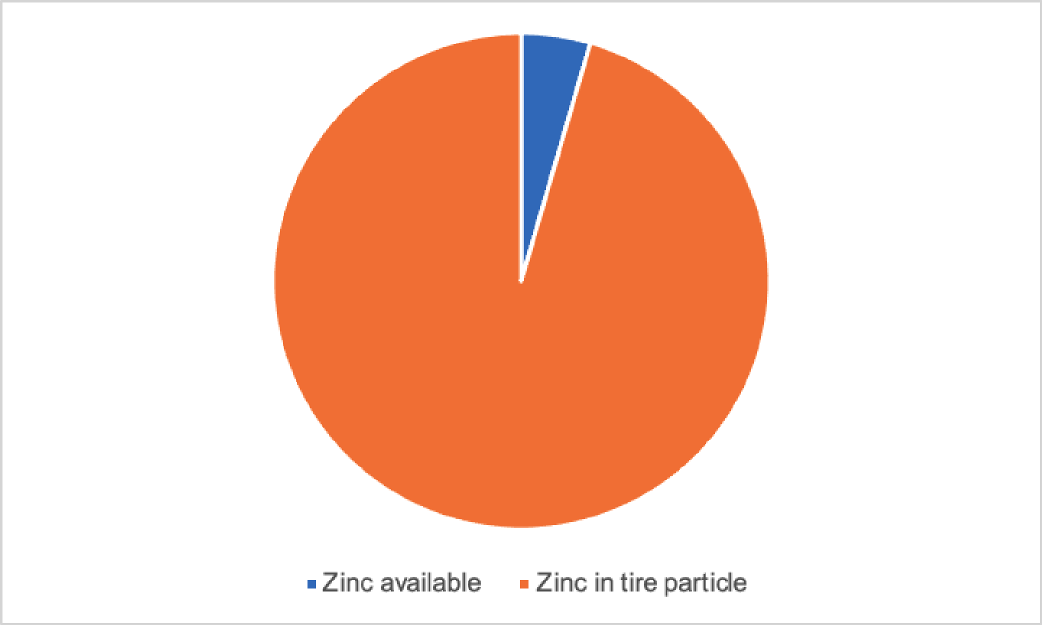


Updated PC Only Davis et al. 2001 - Zinc Runoff in Urban Residential Areas with Brick Buildings (kg/ha-yr)



Zinc from tires is not bioaccessible

- Literature indicates not all Zn present in TRWP will leach out
  - 0.1 – 4.5% (ChemRisk, 2009; Gualtieri, et al. 2005; Nelson, et al. 1994; Redondo-Hasselerharm, et al. 2018)
- Salinity and pH affect the leaching of Zn from TRWP
- Zn released from TRWP following run-off during storm water event would be only a fraction of that estimated from the CASQA release calculations.



Cal-trans Edge of Pavement Study

- CASQA petition relies heavily on the CAL-TRANS "Edge of Pavement Study" indicating that tires were the only source of zinc in the stormwater runoff.
- In contrast to CASQA claims, the study design did not exclude other sources of Zn such as galvanized structures or guardrails
- CalTrans found that factors other than traffic and precipitation contributed to Zn concentrations

Study Locations	Dissolved Zn (ug/L)	Total Zn (ug/L)
Moreno Valley	261.4	351.2
Yorba Linda	137.6	329.8
Irvine	79.8	290.3
San Onofre	77.9	279.5
San Rafael	43.5	119.7
Cottonwood	41.4	130.9
Redding	15.8	39
Sacramento	14.8	74.3

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Photos of Cal-Trans Sample Locations

Moreno Valley

Yorba Linda

Irvine

Concluding Thoughts

- The Safer Consumer Products Regulations should not operate in a vacuum and should assess and consider work of other state agencies.
- USTMA strongly recommends that:
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THANK YOU

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