

# Why Didn't the Salmon Cross the Road? Toxic Tires and Green Stormwater Infrastructure Treatment



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# So Much Good Work Being Done for Fish in the Johnson Creek Watershed





### Coho spawner mortality is widespread and recurrent in urban creeks

67%



Longfellow Creek 2003

63%



Des Moines Creek 2004

72%



Longfellow Creek 2005

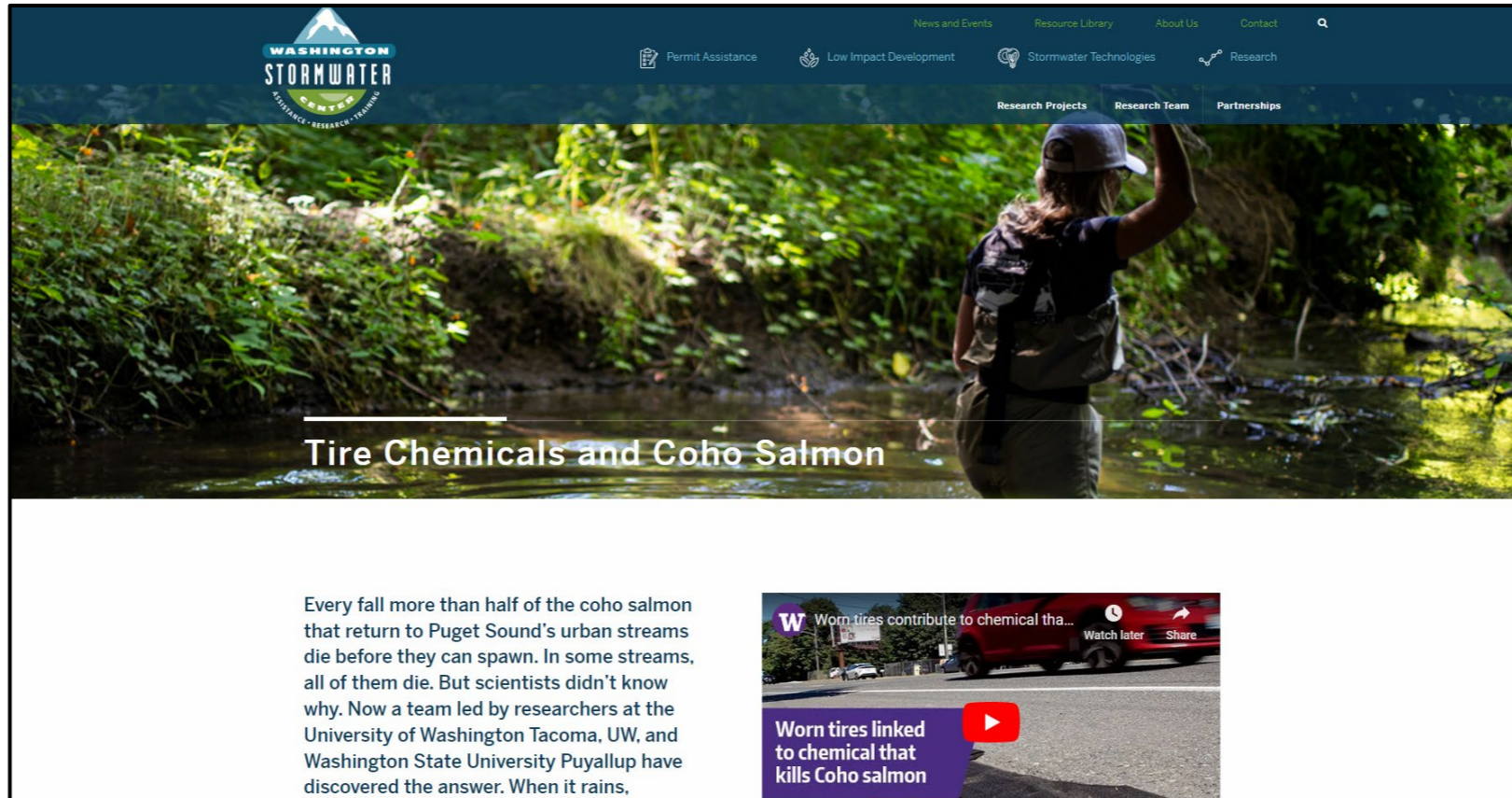
84%



Longfellow Creek 2012

# Decades of Research to Determine Cause

- Research group at the Washington Stormwater Center
  - [wastormwatercenter.org/research/tiresandsalmon/](https://wastormwatercenter.org/research/tiresandsalmon/)
- Drs. Jenifer McIntyre, Nat Scholtz, Ed Kolodziej, Zhenyu Tian, and many others



The screenshot shows the Washington Stormwater Center website. The header includes the logo and navigation links: Permit Assistance, Low Impact Development, Stormwater Technologies, Research, News and Events, Resource Library, About Us, and Contact. Below the header is a navigation bar with Research Projects, Research Team, and Partnerships. The main content area features a large image of a person in a field, with the title 'Tire Chemicals and Coho Salmon' overlaid. Below the image is a text block and a video player.

**Tire Chemicals and Coho Salmon**

Every fall more than half of the coho salmon that return to Puget Sound's urban streams die before they can spawn. In some streams, all of them die. But scientists didn't know why. Now a team led by researchers at the University of Washington Tacoma, UW, and Washington State University Puyallup have discovered the answer. When it rains,

Worn tires contribute to chemical tha...  
Watch later Share

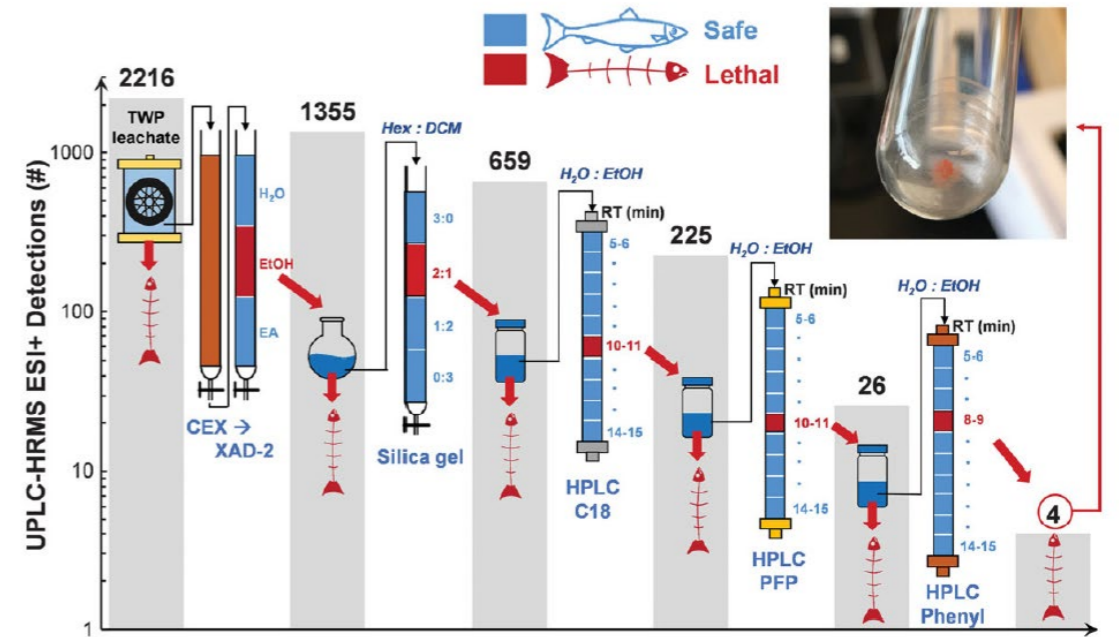
Worn tires linked to chemical that kills Coho salmon

# Narrowing it Down

Urban stormwater runoff

-> tires

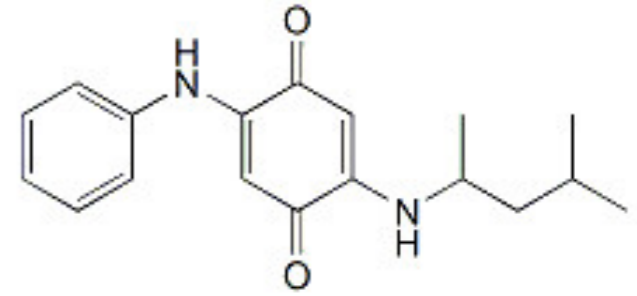
-> specific tire chemical



Toxicant Fractionation Scheme

From Tian et al. 2020

# The Culprit



- N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine quinone
  - Or 6PPD-Q
  - Newly described in December 2020
- Parent compound (6PPD) present in most tires
  - Used for decades
  - Anti-ozonate
  - Safety testing
  - Reacts to form 6PPD-Q in the environment



# 6PPD-Q

- Highly toxic to coho salmon:  $LC_{50} = 95 \text{ ng/L}$
- Varying toxicity to other organisms tested
- Disrupts the blood-brain barrier



## Runoff (& 6PPD-quinone) disrupts blood-brain barrier

Tracer dye injected into heart; rinsed out after 5 min

Runoff

Tracer dye leaked into brain

Brain  
—  
Rosette

Speaking: Jen McIntyre

Jen McIntyre

fish in clean water

# Lot of Research Being Conducted

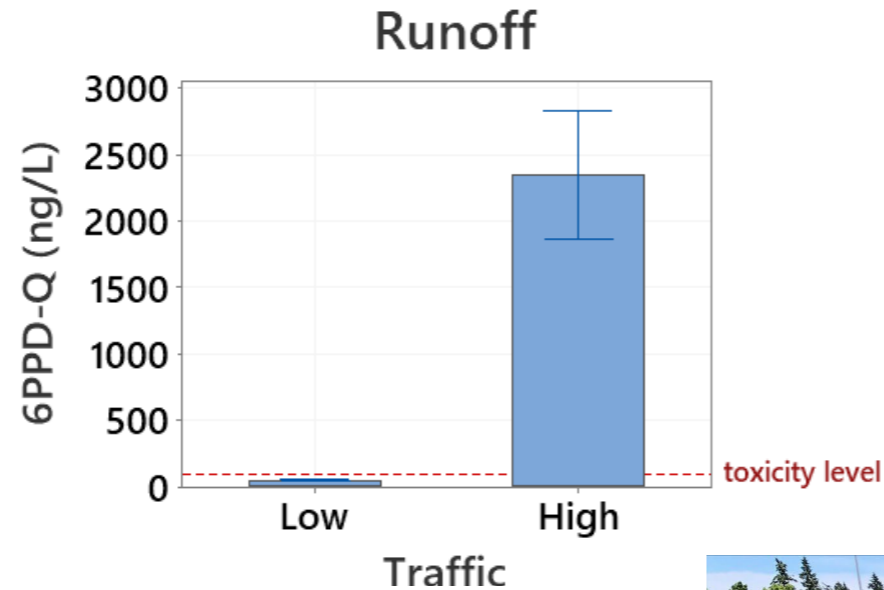
- Alternatives

- Not yet
- Decades to replace all



- Sources

- Large roads
- Turf?

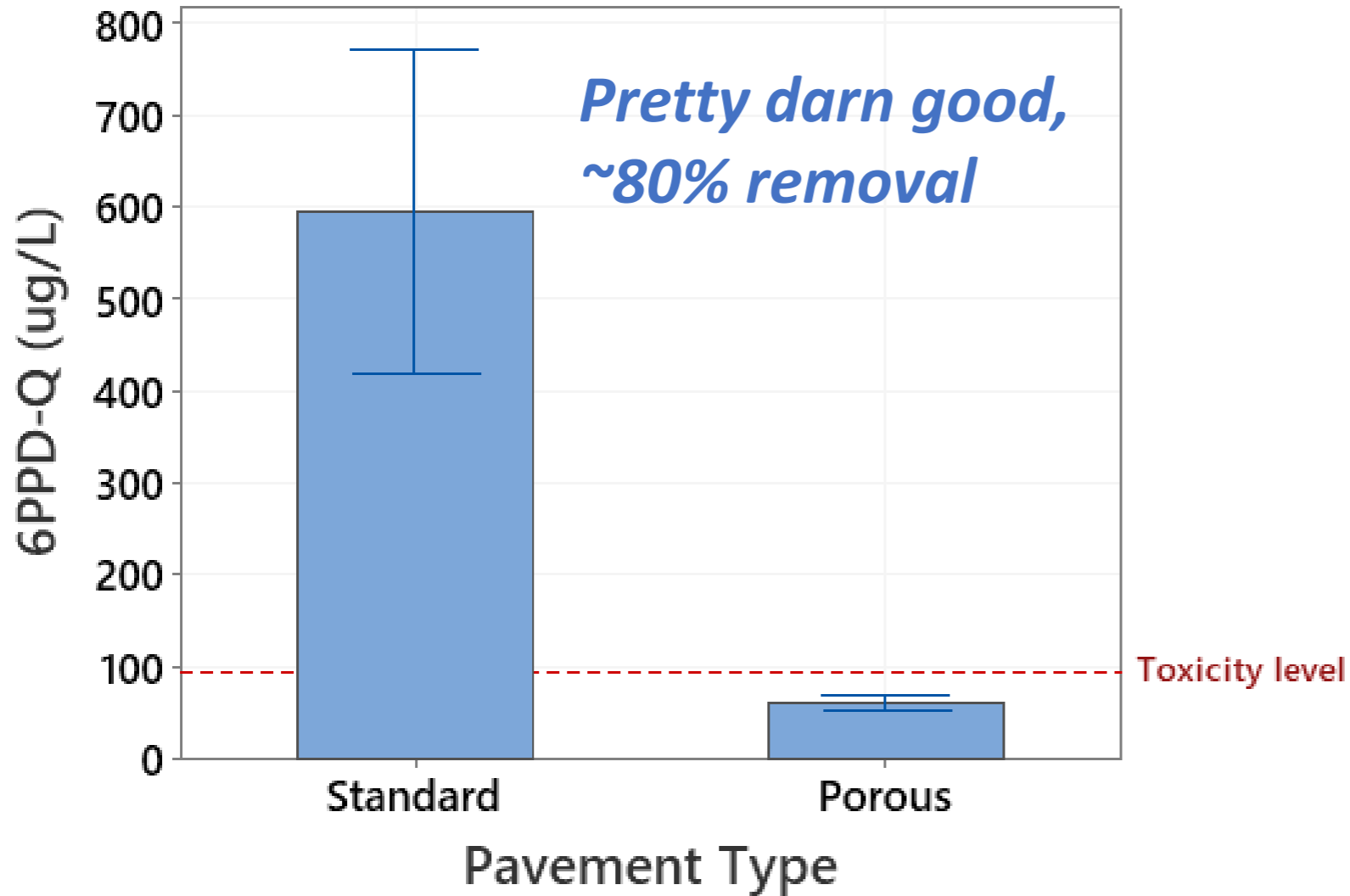


- Treatment...





# Treatment – Porous Pavement



# Treatment – Green Stormwater Infrastructure

- It works great!
- 6PPD-Q sorbs to organic matter
- 90-95% removal



# Green Stormwater Infrastructure Can Provide Habitat



# Green Stormwater Infrastructure as a Community Amenity



# Conclusion

- The fish need clean water to enjoy restoration
- Still a lot to know about pollutants
- Green stormwater infrastructure is the answer to many problems



Thanks!

