

Number: 25-64

Proposed Title: Alternative Methods for Reducing 6PPD-Q Tire Toxicity from Highway Runoff

1. Concisely describe the **transportation issue** (including problems, improvements, or untested solutions) that Oregon needs to research.

Recent research findings identified 6PPD-quinone as the major agent responsible for exceptionally high levels of rapid mortality of adult Coho salmon in some urban streams¹. Related studies have found the chemical is also toxic to rainbow trout, King Salmon, and other aquatic species may be at risk as well^{2, 3}. So far, the lethal impact, presumably from 6PPD-quinone, has only been documented in urban streams that receive runoff from high average daily traffic (ADT) highways. 6PPD is a chemical added to tires to increase their life by reducing tire oxidation. It has been used for over 40 years in almost all tires and is assumed to be ubiquitous in roadway runoff, as are tire particulates that have been detected in fish across the country⁴. Potential sources of 6PPD-quinone in stormwater include tire wear particulates, abrasion of pavement that contains tire derived aggregate (TDA), and potentially leachate from fill incorporating ground tires. The Environmental Protection Agency granted a petition from three northwestern Tribes, which now requires the agency to regulate the chemical under the Toxic Substances Control Act. Though ODOT has recently invested in an FHWA Pooled Fund effort for assessing the ability of our current stormwater management facilities to reduce 6PPD-Q, the evaluation of alternative treatment options will not be investigated. One such alternative option that might be promising is the use of low-cost biochar and biochar bags or compost amended soil. Research is needed to both identify (and predict) the Oregon locations of high risk, as well as evaluate the efficacy of the use of biochar or compost amended soil for 6PPD-Q removal. Biochar technology may be ideal given the combination of the fact that ODOT already disposes of large amounts of woody debris, which is currently neither cost effective nor environmentally friendly, but alternatively and fortuitously can be redirected as a revenue stream for the production of biochar for ODOT use.

2. Document how this **transportation issue** is important to Oregon and will meet the [Oregon Research Advisory Committee Priorities](#)

DOTs and other transportation agencies need to meet regulatory standards in order to address 6PPD-quinone toxicity. These regulations aim to protect aquatic species and the surrounding communities that depend on resources associated with the receiving waters affected by highway runoff. The threat to Oregon's salmon industry and the interests of our tribal partners regarding tire pollutants such as 6PPD-Q is likely not sustainable and must be addressed. This research aims to identify the locations in Oregon that are of the highest concern as well as evaluate the mitigation potential of biochar use. Both aims support the RAC priorities for equity, stewardship, and sustainability.

3. What **final product or information** needs to be produced to enable this research to be implemented?

A report that provides a map of predicted and confirmed areas of concern together with an evaluation of biochar and/or compost amended soil as mitigation methods will be delivered. Design criteria for biochar and/or compost amended soil BMPs will also be delivered.

Major tasks or activities:

- Literature review for 1) areas prone for 6PPD-Q and/or tire particulate accumulation (or predicted), and 2) biochar and other low-cost and accessible innovative systems for pollutant removal.

¹ Z. Tian et al., Science 10.1126/science.abd6951 (2020).

² McIntyre, J., Mystery Solved: Tires Kill Coho Salmon, Stormwater Summit, Oregon Association of Clean Water Agencies, May 12th, 2021.

³ Halle, L. L., Palmqvist, A., Kampmann, K., & Khan, F. R. (2020). Ecotoxicology of micronized tire rubber: Past, present and future considerations. Science of the Total Environment, 706, 135694.

⁴ Xinfeng Zhang et al 2020 IOP Conf. Ser.: Earth Environ. Sci. 555 012062

- Identify potential parameters that might affect tire particulate accumulation in receiving waters (AADT, slope, ROW vegetation, weather patterns, etc.), establish field testing method and field strategy for assessing 6PPD-Q for Oregon highway network.
- Field collection of highway runoff and laboratory analyses to:
 - i. Characterize the prevalence and magnitude of 6PPD quinone in Oregon highway runoff and assess the importance of roadway/traffic/pavement or other influencing variables. Prepare preliminary risk map
 - ii. Assess toxicity reduction of high traffic highway runoff routed through bare soil, compost amended soil and biochar
 - iii. Design and conduct a laboratory study to determine filtration material characteristics and mechanisms (such as layer thickness, infiltration rate, contact times, etc.) necessary for effective toxicity and/or 6PPD-quinone concentration reduction by BMPs
 - iv. Identify the components and features of the highway system and receiving waters that affect 6PPD-quinone toxicity and its impacts.

4. (Optional) Are there any individuals in Oregon who will be instrumental to the success of implementing any solution that is identified by this research? If so, please list them below.

Name	Title	Email	Phone
Paris Edwards	Climate Specialist	Paris.b.edwards@odot.oregon.gov	541-282-4900
Katherine Silva	Adaptation and Resilience Program Manager	Katherine.silva@odot.oregon.gov	
Allen Gillette	Fish Passage Lead		
Kira Glover-Cutter	Research Analyst	Kira.M.GLOVER-CUTTER@odot.oregon.gov	
Jennie Morgan	Stormwater Asset Management	Robert.R.MARSHALL@odot.oregon.gov	
Anna Roller	Reg. 3 Clean Water Program Mgr.	Anna.Roller@odot.oregon.gov	

5. Other comments:

NA

6. Corresponding Submitter's Contact Information:

Name:	Paris Edwards
Title:	Climate Office
Affiliation:	ODOT
Telephone:	541-282-4900
Email:	Paris.b.edwards@odot.oregon.gov