

**U.S. ENVIRONMENTAL PROTECTION AGENCY**

**FY 2025-2028 6PPD/6PPD-quinone Action Plan**



**November 22, 2024**

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## Executive Summary

EPA developed this agency-wide Action Plan to address 6PPD-quinone, an emerging chemical contaminant. The 6PPD/6PPD-quinone Action Plan envisions that EPA activities will align with one or more of three thematic areas. The agency will support efforts to increase understanding of 6PPD-quinone through research, information-gathering and outreach. Additionally, it will support efforts of states, Tribes, and territories to reduce impacts of 6PPD-quinone. Finally, the agency will support innovation of effective interventions and alternatives that incorporate the best available science. The Action Plan will focus and coordinate activities across EPA's programs to support progress towards Action Plan activities over the next four years.

## Background

### 6PPD and 6PPD-quinone

Vehicle tires contain the chemical known as [6PPD](#) that helps prevent degradation and cracking of rubber compounds.<sup>1</sup> According to the U.S. Tire Manufacturers Association, "6PPD serves an essential safety function in tires as an antioxidant and antiozonant, protecting the components of the tire from attack by ozone, oxygen, and other factors. Without 6PPD, a tire's integrity would be severely and quickly compromised, jeopardizing driver and passenger safety."

When [6PPD reacts with ozone](#) in the air, it forms a transformation product called [6PPD-quinone](#) that has been shown to exhibit acute toxicity towards organisms. Tires wear down through contact with hard surfaces such as paved roads, releasing particles into the environment. During rain events, stormwater may wash these tire particles into streams and other water bodies. As a result, 6PPD and 6PPD-quinone may be present in aquatic environments, and aquatic organisms can be exposed to these chemicals. Aquatic and terrestrial species may also be exposed through transport and deposition of airborne tire wear particles. Although 6PPD-quinone has primarily been studied in water, it has been observed in multiple media in a wide variety of locations on multiple continents.

Available information on 6PPD-quinone indicates that it is toxic enough to quickly kill some fish. A [2021 publication Science](#) linked coho salmon death to 6PPD-quinone in stormwater. Concentrations in stormwater were found to be lethal for coho salmon following [exposures lasting only a few hours](#). Subsequent work identified some other fish species including highly sensitive brook trout as vulnerable to 6PPD-quinone.<sup>2</sup>

The potential of 6PPD-quinone to have ecotoxic effects and impact salmon populations is a key issue and was the initial basis for EPA's engagement. These fish species have cultural, commercial, and ecological importance, and some coho salmon populations are endangered

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<sup>1</sup> [U.S. Tire Manufacturers Association](#).

<sup>2</sup> [Brinkmann et al. 2022](#); [Roberts et al. 2024](#); [Di et al. 2022](#).

and threatened. Many Tribes rely heavily on salmon and other aquatic resources for food and cultural practices. Healthy and accessible salmon populations are critical to the health and wellbeing of Tribes, including the practice and protection of Tribal Treaty Rights.

Although emerging studies have demonstrated the potential of 6PPD/6PPD-quinone to contaminate other environmental matrices through a variety of exposure pathways, limited information is available regarding releases, fate and transport, and human health effects of 6PPD-quinone. [Research regarding promising stormwater mitigation options](#), such as engineered green infrastructure systems, is ongoing. EPA's researchers and its public and private sector partners across the country are working hard to address these information gaps about 6PPD-quinone and to explore safer alternatives. This will help EPA and state, local, territorial, and Tribal partners make more informed decisions on how best to protect human health and the environment.

### EPA's Foundational Work

EPA Region 10 funded the foundational stormwater science that led to the [discovery of 6PPD-quinone](#) as the causal toxicant for urban runoff mortality syndrome, including acute toxicity to coho salmon. Following the 2021 *Science* publication on the discovery of 6PPD-quinone, multiple EPA offices proceeded to consider opportunities for addressing it within their respective jurisdictions.

EPA convened an internal cross-EPA workgroup on 6PPD/6PPD-quinone starting in November 2022. This group was co-chaired by the Office of the Administrator/Office of Policy and Office of Water, with staffing support from both offices and Region 10. It was initiated to provide a forum for programs within EPA to coordinate activities and external communication and to strategize on future activities.

In 2023, EPA piloted the agency's internal Screening Risk of Emerging Contaminants (SIREN) process using 6PPD-quinone. SIREN is part of the agency's Contaminants of Emerging Concern Framework that fosters coordinated agency identification, review and, where appropriate, the development of an action plan in an expedited manner. In the case of 6PPD-quinone, the Science and Technology Policy Council, EPA Science Advisor, EPA Chief Scientist, and Office of the Administrator have concurred on development of the 6PPD/6PPD-quinone Action Plan within 12 months of the start of the review of available technical information.

The SIREN process does not prescribe the format of the Action Plan but provides that implementation will include communicating to the public about the agency's chosen course of action and risk communication. The existing cross-EPA workgroup on 6PPD/6PPD-quinone served as the convening body for development of the Action Plan and will commence coordination of the plan's implementation.

## FY 2025-2028 Action Plan for 6PPD/6PPD-quinone

6PPD is a chemical that is nearly ubiquitous in tires and provides an important safety function. Its transformation product, 6PPD-quinone, has been identified as an emerging contaminant. Given 6PPD's extensive current use, EPA recognizes the importance of approaching the potential effects of 6PPD-quinone across multiple pathways.

EPA's current work focuses on several themes to:

1. Support efforts to **increase understanding** of 6PPD/6PPD-quinone.
2. Support efforts to **reduce impacts** of 6PPD/6PPD-quinone.
3. **Support innovation** of effective interventions and alternatives that incorporate the best available science.

The Action Plan will focus and coordinate activities across EPA's programs to provide timely progress towards these three thematic areas over the next four years. While the Action Plan does not impose any requirements or restrictions on the use of 6PPD, it envisions that EPA activities will align with one or more of these thematic areas. EPA acknowledges that actions under the Action Plan are subject to resource availability.

EPA acknowledges the leadership taken and work already being conducted by states, Tribes and other federal agencies, as well as internationally, and the important role these entities will play to inform and advance the objectives of this Action Plan. In particular, EPA participated on the Interstate Technology and Regulatory Council's Tire Anti-Degradants Team which recently published an extensive [6PPD and 6PPD-quinone guidance document](#). EPA remains committed to continued engagement and collaboration with partners moving forward.

EPA will also continue to develop educational and outreach materials (including on [EPA's 6PPD-quinone webpage](#)) to inform the public about emerging science on 6PPD-quinone, efforts to identify alternatives that can replace 6PPD in tires, and mitigation opportunities to minimize environmental impact in the near term.

### Action Plan Themes

Theme 1: Support efforts to increase understanding of 6PPD-quinone.

Examples include:

- Conducting research to address data gaps, including work on tire wear emissions, fate and transport, ecotoxicity, human health effects, and management solutions to mitigate stormwater contamination. (*Office of Research and Development*)
- Providing up-to-date information on 6PPD-quinone for stakeholders, partners and the public to learn about EPA's work on the issue across the agency. (*All programs*)
- Taking final action on a rule proposed under [section 8\(d\) of the Toxic Substances Control Act](#) that would require manufacturers (including importers) of 6PPD to submit lists and copies of certain unpublished health and safety studies to EPA. (*Office of Chemical Safety and Pollution Prevention*)

- Developing a tool that provides information on the effectiveness of technology for removing emerging contaminants including 6PPD-quinone from stormwater, using currently funded Clean Water State Revolving Fund emerging contaminant projects in Washington and Oregon. *(Office of Research and Development and Office of Water)*

**Theme 2: Support efforts to reduce impacts of 6PPD-quinone.**

Examples include:

- Communicating opportunities for EPA’s testing method ([Draft Method 1634](#)) to be used by states, territories, localities, and Tribes to monitor their waterways and test for the presence of 6PPD-quinone in local stormwater and surface waters. *(Office of Water and Regions)*
- Communicating opportunities for EPA’s acute screening values for 6PPD-quinone and 6PPD to be used by states, territories, local governments, and Tribes to protect sensitive salmon and other aquatic life. *(Office of Water and Regions)*
- Leveraging existing funding opportunities in the 2024-2026 funding cycle to address emerging contaminants from the Clean Water State Revolving Fund, Clean Water Act Section 319 Nonpoint Source Program, Geographic Programs, and the Clean Water Indian Set Aside for Tribal communities to pursue stormwater mitigation strategies. *(Office of Water)*

**Theme 3: Support innovation of effective interventions and alternatives that incorporate the best available science.**

Examples include:

- Leveraging the 2024 cycle of EPA’s [Small Business Innovation Research](#) award program to provide funding to support development and commercialization of rubber anti-degradant technologies for tires and other rubber products that are of lower concern for human health and the environment. *(Office of Research and Development)*
- Researching stormwater management solutions such as modeling for optimal green infrastructure placement and regularly share information reciprocally with states, Tribes, territories, localities, and other organizations and entities working in the innovation space. *(Office of Research and Development, Office of Policy and Regions)*

Appendix A provides a longer list of EPA program activities.

## Appendix A: Compendium of EPA Activities

Since 2021, multiple EPA programs have been working to better understand emerging science on 6PPD/6PPD-quinone and identify activities within their equities that can help address concerns. The Action Plan incorporates input from all relevant programs on past, ongoing, and recommended future actions. The Action Plan itself focuses on the broader themes, like **increasing understanding, reducing impacts, and supporting innovation**. It highlights examples of specific EPA activities related to those themes.

Appendix A provides a longer list of activities that EPA programs are engaged in. The below list captures completed, ongoing, and potential future activities by EPA programs. The list is non-exhaustive and may be amended over time. In addition, representatives from across the agency are engaging with external partners and stakeholders, coordinated by EPA's Smart Sectors program. Agency representatives have ongoing communication with key stakeholders, including the U.S. Tire Manufacturers Association, the California Department of Toxic Substance Control, the Washington State Department of Ecology, and the science community.

Activities are subject to resource availability.

### Office of the Administrator/Office of Policy

#### Communicate with Industry *(as needed)*

Through its Smart Sectors program (now part of the OP's Office of Climate Adaptation and Sustainability), OP staff serve as liaison between the agency and private sector entities on an as-needed basis and have facilitated key engagements with entities including the U.S. Tire Manufacturers Association to keep lines of communication going and learn private sector perspectives.

#### Potential Future Multi-Stakeholder Engagement on Alternatives *(future, resource dependent)*

If additional resources become available, OP proposes to organize a charrette or workshop to create accelerated, multi-stakeholder solutions for alternatives development, assessment and deployment. For example, further engagement could involve participation in relevant voluntary consensus standards development and/or consideration of economic incentive programs.

### Office of Air and Radiation

#### Research on Roadside and Ambient Air 6PPD-quinone *(ongoing)*

OAR continues to collaborate with ORD and Region 3 on the Regional-ORD Applied Research project investigating airborne emissions, impacts, and health effects of 6PPD, 6PPD-quinone, and other tire wear emissions.

#### Research on the Benefits of Green Infrastructure *(ongoing)*

OAR is leading a project that assesses and evaluates multiple stressors and benefits of urban green infrastructure. Tools are being evaluated and developed to optimize benefits associated

with green infrastructure designs related to air quality, stormwater management, urban cooling, carbon sequestration, noise, and other ecosystem services. While 6PPD/6PPD-quinone is not directly addressed in this project, the developed tool may be useful in identifying and optimizing 6PPD-quinone mitigation options across multiple media.

#### Continued Effort to Characterize Disproportionately Exposed Communities (*ongoing*)

OAR continues efforts related to demographics analyses of communities near roadways and near goods-movement facilities.

#### Potential Research on Tire Wear Emissions Including 6PPD-quinone (*future, resource-dependent*)

OAR sees a need for additional research and collaboration related to 6PPD airborne emissions, from questions on emissions rates, fate and transport, and mitigation.

### Office of Chemical Safety and Pollution Prevention

#### Advance Notice of Proposed Rulemaking under Section 6 of the Toxic Substances Control Act (*ongoing*)

The Office of Pollution Prevention and Toxics received an August 2023 [petition under TSCA section 21](#) from the Yurok Tribe, the Port Gamble S'Klallam Tribe, and the Puyallup Tribe of Indians to take regulatory action on the use of 6PPD in tires. OPPT granted the petition in November 2023. In granting the petition, EPA committed to “promptly commence an appropriate proceeding.” In November 2024, EPA published an [ANPRM under section 6 of TSCA](#) to gather more information that could be used to inform a potential subsequent regulatory action. OCSPP continues its meaningful engagement with Tribal leaders.

#### Take Final Action on Rule Proposed under Section 8(d) of the Toxic Substances Control Act (*ongoing*)

By the end of 2024, OPPT plans to take final action on a rule proposed under [section 8\(d\) of TSCA](#) that would require manufacturers (including importers) of 6PPD to report lists and provide copies of certain unpublished health and safety studies to EPA. The proposed rule was published on March 26, 2024 (89 FR 20918).

#### Next Steps (*future, information and resource dependent*)

TSCA provides EPA with authority to require reporting, record-keeping and testing requirements, and restrictions relating to chemical substances and/or mixtures. As appropriate and relevant for 6PPD/6PPD-quinone and potential future alternatives, OPPT may engage the [review process for new chemicals](#) and/or the [prioritization, risk evaluation, and risk management](#) process for existing chemicals.



## Office of Enforcement and Compliance Assistance

### Electron Hydro Dam Enforcement Action (*completed*)

OECA worked with Region 10 and the Department of Justice to [settle a case involving permit violations](#) and unauthorized discharges of tire crumb rubber to the Puyallup River. An expert opinion report pointed to 6PPD-quinone found in the turf and crumb samples as being responsible for toxicity to fish in the river. The settlement included a penalty and injunctive relief.

### Continued Engagement on Enforcement and Compliance (*ongoing*)

OECA staff will continue to identify opportunities for engaging enforcement and compliance tools where appropriate.

## Office of Environmental Justice and External Civil Rights

As EPA coordinates its cross-agency work related to 6PPD/6PPD-quinone, it is crucial that the agency prioritizes environmental justice concerns in all aspects of research, planning and mitigation. OEJECR's primary focus is supporting the lead offices, ORD and others in advancing EJ analysis and engagement on 6PPD/6PPD-quinone through consultation on EJ priorities. While little is currently known about human health impacts, OEJECR is particularly concerned about communities that may be disproportionately exposed to the chemicals, including near-roadway communities, communities near goods-movement facilities, communities engaged in subsistence practices, and Tribal and Indigenous communities dependent on salmon fisheries for their cultural, community, spiritual and physical health.

### Grant Resources for Mitigation (*ongoing*)

OEJECR launched a \$2 billion IRA-funded [Environmental and Climate Justice grant program](#) (open through November 2024) that will provide grants for environmental and climate justice activities to benefit underserved and overburdened communities. Because there are clear EJ dimensions to the 6PPD/6PPD-quinone issue, community-led efforts to mitigate the impacts of 6PPD/6PPD-quinone align with the categories of activities eligible for funding, including installation of green infrastructure along roadways to minimize runoff and reduce exposure to PM<sub>2.5</sub> in near-roadway communities.

### Continued Engagement to Support an EJ-Informed Approach (*ongoing*)

OEJECR staff will continue to stay current on research on the EJ dimensions of this issue and potential mitigation strategies and will continue to engage with other offices (including OW, ORD, Region 10, OITA, and others) as necessary to support the agency in pursuing a holistic, EJ informed approach to addressing this issue.

### Potential Support for Research with ORD (*future, resource-dependent*)

Because of the emerging nature of this contaminant, and its near ubiquity in tires, OEJECR developed a 2023 research memo including a compiled set of EJ-informed research priorities to improve understanding of potential environmental justice concerns that 6PPD-quinone presents. Key priorities included: prevalence of 6PPD-quinone in ambient media and fish tissue, exposure levels of 6PPD-quinone in general population, disproportionate exposures to the chemicals for communities with EJ concerns, health effects in humans and safe consumption levels, unique impacts on Tribes and Indigenous populations, and mitigation strategies.

## Office of International and Tribal Affairs

### Financial Assistance (*ongoing*)

OITA administers the Indian Environmental General Assistance Program, providing \$72 million in FY 2024 to Tribes and intertribal organizations to plan, develop, and establish Tribal environmental protection program capacity for EPA-administered programs, including meaningful involvement and program delegation, authorization, or approval of an eligible Tribe to administer an EPA program. Tribes may work with their respective EPA Project Officers to determine GAP-eligible (or other EPA financial assistance program-eligible) activities that may potentially be used to support 6PPD-quinone concerns, such as baselining 6PPD-quinone conditions.

### 6PPD-quinone Tribal Listening Session (*complete*)

OITA organized a national Tribal listening session in November 2023, which included speakers from EPA, Department of Transportation and the United States Geological Survey, as well as Northwest Tribal leadership.

### Tribal Engagement (*ongoing*)

OITA facilitates EPA-related national Tribal engagements with federally recognized Tribes in the United States and is EPA's primary liaison office with the White House Council on Native American Affairs. OITA included 6PPD-quinone as a topic for the National Tribal Operations Committee meeting in October 2023 and October 2024. OITA communicated this effort with the White House Council on Native American Affairs in relation to reporting on the Tribal Treaty Rights Memorandum of Understanding signed by EPA. OITA continues to facilitate national Tribal engagements and information sharing with federally recognized Tribes in the United States, including dialogue with Tribes on their needs, concerns and questions in this area. OITA continues to build awareness with Tribal partners through EPA sponsored Tribal Partnership Groups (including the National Tribal Caucus, the National Tribal Toxics Council, and the Tribal Science Council) and other mechanisms. OITA will include vetted talking points on 6PPD during various tribal meetings across the country. A need for Tribal consultation on a cross-agency or workgroup activity may arise, and OITA's American Indian Environmental Office is committed to help evaluate and support needed EPA consultation actions.

### International Communication *(ongoing)*

OITA identified two points of contact to convene conversations with Canada and the European Union on 6PPD-quinone. Initial meetings with Environment and Climate Change Canada and the European Chemicals Agency occurred in late 2023/early 2024, and OITA continues to communicate with these entities and convene information sharing between EPA and international counterparts on an ad hoc basis.

### Office of Land and Emergency Management

OLEM's Office of Resource Conservation and Recovery is focused on finding environmentally protective uses for used tires given the end-of-life management issues many states, Tribes, territories, and local governments face and the significance of 6PPD/6PPD-quinone.

#### Outreach *(ongoing)*

The Office of Resource Conservation and Recovery will continue to share information on 6PPD/6PPD-quinone with our local, Tribal, territorial, and state government contacts. ORCR will include information on 6PPD/6PPD-quinone in future updates to its [Model Recycling Program Toolkit](#), developed in response to direction in the 2021 Infrastructure Investment and Jobs Act.

#### Potential Research with ORD *(future, information and resource dependent)*

ORCR is awaiting the conclusion of research underway led by ORD. Following review of those efforts, ORCR will consider what, if any, additional research may be needed with respect to used tire management and 6PPD/6PPD-quinone.

### Office of Research and Development

ORD will take a multi-faceted One-Health approach to understanding issues and addressing data needs of the agency associated with 6PPD-quinone. The approach will make use of ongoing and complementary activities within the agency and externally to make information available and readily accessible in a timely manner.

Key areas of focus for research now and in the future are:

- Toxicity (including human health and ecological impacts).
- Exposure (including fate and transport, multimedia monitoring, method development).
- Mitigation (including stormwater management and control of airborne tire wear particles).

Activities are described generally below.

#### Conduct Research to Understand the Issues *(ongoing)*

ORD has initiated several projects directly focused on, or applicable to, 6PPD-quinone under its 2023-2026 research cycle, and continues to leverage research activities with EPA Regional partners.

In the current ORD Strategic Research Action Plan (2023-26), there are multiple efforts that focus solely or in part on further investigation of 6PPD-quinone, including work on fate and transport, ecotoxicity, and green infrastructure solutions for stormwater contamination. Areas of research activity are provided below.

- Emission rates from motor vehicle brake and tire wear.
- Urban green infrastructure design and assessment resource to promote public health, climate, and equity benefits for air quality and other ecosystem services.
- Ecological effects of tire wear particles and 6PPD-quinone on marine benthic communities.
- High-throughput hazard screening for 6PPD-quinone, a high priority contaminant.
- Development of metrics, models, and monitoring techniques to determine optimal green infrastructure placement and size for urban stormwater control for Municipal Separate Storm Sewer Systems (MS4) and combined sewer communities.
- Identify, assemble, and curate toxicity data for ecologically relevant species for risk assessment (ECOTOX).
- Remediation of tire-related pollutants in stormwater.

#### Leverage Regional Partnerships *(ongoing)*

ORD will continue leveraging regional partnerships to better understand the hazard and potential exposure to 6PPD-quinone. There are several ongoing activities that can be refined and updated, as needed.

Some examples from the Regional-ORD Applied Research and Regional Research Partnership Program include:

- Understanding the fate and transport of tire-derived pollutants, including 6PPD-quinone, in urban streams. *(Region 2, Region 3 and ORD)*
- Understanding airborne emissions and public health impacts of 6PPD from tires. *(Region 3 and ORD)*
- Evaluating the bioactivity of the ubiquitous tire preservative 6PPD-quinone. *(Region 10 and ORD)*
- The fate, transport, and treatment of tire-derived pollutants in stormwater. *(Region 4 and ORD)*
- Development of a rapid, low-cost bioassay to guide stormwater management and evaluate the potential toxicity of 6PPD alternatives. *(Region 10 and ORD)*

#### Coordinate Among External Partners and Stakeholders *(ongoing)*

ORD is participating in and partially funding the [Interstate Technology and Regulatory Council 6PPD-quinone team](#) to identify and translate research in cooperation with states, Tribes, and other external entities. ORD is participating with federal partners in a [National Science and Technology Council/National Toxicology Program Working Group on 6PPD-quinone](#), which is focused on coordination of 6PPD-related research across federal agencies.

### Provide Support to Development of Innovative Alternatives *(ongoing)*

ORD's SBIR program is providing funding to support development and commercialization of rubber anti-degradant technologies for tires and other rubber products that are of lower concern for human health and the environment through a [2024 Small Business Innovation Research award](#). Projects resulting from the current EPA solicitation on "Rubber Anti-degradants that are Lower Concern for Human Health and the Environment" should be awarded prior to the end of 2024.

### Maintain EPA's Webpage on 6PPD-quinone *(completed, ongoing updates)*

Website will be updated regularly.

### Provide Data Resources on 6PPD and 6PPD-quinone *(ongoing)*

ORD maintains multiple hubs of chemical and toxicology information, as well as a searchable database for recent EPA publications.

- [CompTox Chemicals Dashboard: 6PPD](#)
- [CompTox Chemicals Dashboard: 6PPD-quinone](#)
- [ECOTOX Knowledgebase: 6PPD and 6PPD-quinone](#)
- [ChemExpo Knowledgebase: 6PPD](#)
- Science Inventory: [Recent EPA publications about 6PPD and 6PPD-quinone](#)

## Office of Water

### Grant and Loan Resources for Mitigation *(ongoing)*

OW provides grant and loan support that can be used for mitigation of 6PPD-quinone in stormwater. OW is providing funding to support implementation of stormwater management practices, including green infrastructure via the [Clean Water State Revolving Fund](#) (including the \$1 billion appropriation to address [emerging contaminants](#)), as well as the [Clean Water Indian Set-Aside program](#) (including the appropriation to address emerging contaminants in tribal communities).

### Case Study of Clean Water State Revolving Fund-Eligible Emerging Contaminants Project Related to 6PPD-quinone *(completed)*

Find the study, [City of Seattle \(Washington\) Public Utilities South Thornton Natural Drainage System Installation](#).

### Stormwater Web Content *(completed)*

The National Pollutant Discharge Elimination System's Stormwater Program created a landing page to share information on [stormwater contaminants of emerging concern](#), including 6PPD-quinone, as a way to reach stormwater permit writers and permittees.

### Convening Stormwater Programs from West Coast State Departments of Transportation and Departments of Environment *(ongoing)*

The NPDES stormwater program convenes a quarterly roundtable of West Coast State Departments of Transportation and Departments of Environment for peer learning on managing 6PPD-quinone in stormwater in municipal separate storm sewer systems (MS4s).

### Potential Web Content on Effective Stormwater Controls to Reduce 6PPD-quinone *(future, information and resource dependent)*

EPA will continue to share specific information related to reducing 6PPD-quinone in stormwater discharges. EPA could add web content to share such information once robust data are available in the literature regarding effectiveness and design considerations for stormwater control measures to reduce toxicity associated with 6PPD-quinone.

### Draft Analytical Methods for Surface Water and Stormwater *(completed)*

In 2024, OW and Region 10 developed and published a draft laboratory method for detection of 6PPD-quinone in surface water and stormwater ([Draft Method 1634](#)). This method will enable government agencies, Tribes, territories, and other groups to determine where and when 6PPD-quinone is present in local stormwater and surface waters.

### Screening Values to Protect Aquatic Life *(completed)*

In 2024, OW developed acute [screening values for 6PPD-quinone and 6PPD](#) to protect sensitive salmon and other aquatic life. EPA developed these screening values in accordance with Section 304(a)(2) of the Clean Water Act to provide states, authorized Tribes, territories, and other stakeholders with the best available information on the toxicity of 6PPD-quinone to aquatic organisms. The screening values are not regulations and states do not have to adopt them. The assessment of the available data for fish and invertebrates indicates these screening values are expected to protect the freshwater aquatic community, including sensitive salmonid species, from acute exposures to 6PPD-quinone and 6PPD. EPA expects to update these screening values in the future as additional aquatic toxicity data become available. EPA is working across the federal government to leverage expertise and relevant toxicity data.

### Finalized Analytical Methods and Additional Matrices for 6PPD-quinone Analytical Methods *(future, resource-dependent)*

OW supported Region 10 in single-lab validating a laboratory method for 6PPD-quinone for surface water and stormwater. The next step would be to single-laboratory validate the wastewater matrix, and then multi-laboratory validate the method to facilitate use in NPDES permits (per 40 CFR 136). In addition, there is interest in developing analytical methods for 6PPD-quinone in additional matrices (including fish tissue, and sediments). This work would enable states and others to have common methods to test for 6PPD-quinone.

### Nonpoint Source Program Updates to the Clean Water Act Section 319 Guidelines *(completed)*

In May 2024, the NPS Program updates the [Clean Water Act Section 319 Guidelines](#), which clarifies that grantees can identify emerging pollutants such as 6PPD-quinone in their state

Nonpoint Source Management Plans. About a quarter of the EPA's annual Section 319 grant funds support addressing urban nonpoint sources of pollution, which includes implementing green infrastructure. The NPS program is assessing how grantees are considering emerging pollutants in their NPS programs and screening literature for best management practice effectiveness to inform future technical support (ongoing).

Tire Wear Particles Roundtable Discussions Summary (completed)

EPA's Trash Free Waters program announced the publication of [Where the Rubber Meets the Road: Opportunities to Address Tire Wear Particles in Waterways](#).

## Region 1

Region 1 is doing extensive work to encourage the use of green infrastructure to address stormwater-driven water quality impairments; more widespread adoption of such practices will help ameliorate 6PPD issues. As one example, the Region is issuing stormwater permits with pollution reduction requirements that are expected to result in a significant increase in green infrastructure. The Region is also providing support for green infrastructure through our geographic programs and nonpoint source programs.

## Region 2

Research on the Fate and Transport of Tire-Derived Pollutants, including 6PPD-quinone, in Urban Streams (*ongoing*)

Region 2 and Region 3 are collaborating with ORD through the Regional-ORD Applied Research Program. This is an evaluation of 6PPD-quinone loading in urban streams across different land uses, road densities, and location of stormwater drains, outfalls, and stormwater management features, using high-resolution spatial and temporal synoptic sampling. Study locations include the Anacostia River in DC/Maryland and the Bronx River in New York.

Proposed follow-up work to this research will include coordinated air, road dust, and water sampling along the same transect in Washington, DC to the Anacostia River to simultaneously identify atmospheric and water concentration gradients for 6PPD/6PPD-quinone and other tire wear particulate and gaseous compounds during different meteorological conditions.

## Region 3

Research on Understanding Airborne Emissions and Health Impacts of 6PPD from Tires (*ongoing*)

Region 3 and ORD are collaborating through the Regional-ORD Applied Research Program and Regional Research Partnership Program. This is an investigation of the potential prevalence and extent of 6PPD compounds in ambient air particulate matter (PM), the extent of potential exposures to these compounds, and the potential toxicity to humans and nearby ecosystems.



Region 3 is also a collaborator to the Region 2 ORD project, [Research on the Fate and Transport of Tire-Derived Pollutants, including 6PPD-quinone, in Urban Streams](#) (*ongoing*).

## Region 4

Research on the Fate, Transport and Treatment of Tire-Derived Pollutants in Stormwater (*ongoing*)

Region 4 and ORD are collaborating through the Regional-ORD Applied Research Program. This is an evaluation of fate and transport of tire pollutants from stormwater under varying traffic and weather conditions, to provide the necessary technical basis for the design of effective stormwater treatment facilities.

## Region 7

Research on the Fate, Transport and Treatment of Tire-Derived Pollutants in Stormwater (*ongoing*)

Region 4 and ORD are collaborating through the Regional-ORD Applied Research Program. This is an evaluation of fate and transport of tire pollutants from stormwater under varying traffic and weather conditions, to provide the necessary technical basis for the design of effective stormwater treatment facilities.

Region 7 is also a collaborator to the Region 4 ORD project, [Research on the Fate, Transport and Treatment of Tire-Derived Pollutants in Stormwater](#) (*ongoing*).

## Region 8

Region 8 works with states to encourage the use of green infrastructure through MS4 permits. Region 8 also issues NPDES permits to federal facilities in Colorado, including nine MS4 permits for military installations and other federal installations. Region 8's next MS4 permits will consider inclusion of an infiltration standard that includes green infrastructure as a practice. Green infrastructure will help reduce the release of 6PPD-quinone to surface waters.

## Region 9

California State Water Control Board Monitoring

California has included a 6PPD and 6PPD-quinone project in its statewide pilot monitoring effort for Constituents of Emerging Concern. The Water Board's CEC Program is also developing a mapping project to identify areas at risk for 6PPD-quinone contamination, considering factors like high traffic volumes, arterial roadways, and stormwater discharge. These factors are then compared with the distribution of salmon species to assess potential impacts. EPA supported this work through \$305,985 in the Clean Water Act 205(j)/604(b) funds.



## San Francisco Bay Regional Monitoring Program

The Regional Monitoring Program recently concluded a multi-year study to quantify a number of contaminants in Bay Area stormwater, as well as in Bay water samples collected following storm events, finding high concentrations of 6PPD-quinone in stormwater and at nearshore sites. Concentrations of 6PPD-quinone were below toxicity thresholds in samples collected in the open Bay during the wet and dry season. EPA Region 9 has provided approximately \$99,000 in San Francisco Bay Program competitive grant funding to support this water quality sampling and will provide approximately \$182,000 for future sampling.

RMP is partnering with EPA's Center for Computational Toxicology and Exposure and Region 10 to pilot using a rainbow trout gill cell bioassay to detect toxicity of stormwater samples and assess the portion of toxicity attributable to 6PPD-quinone.

An EPA-funded study to examine the efficacy of San Francisco rain gardens for capture of tire-derived chemicals and particles from stormwater will be completed in 2025.

## California Department of Toxic Substances Control Listing

On October 1, 2023, the California DTSC Safer Consumer Products Program became the first agency in the world to regulate 6PPD in tires, using San Francisco Bay Regional Monitoring Program data to show 6PPD-quinone occurrence and the potential for impacts to the California environment. Under this regulation, tire manufacturers were required to submit Preliminary Alternatives Analysis Reports on March 29, 2024. This submittal will be followed by a more in-depth analysis of promising alternatives, currently due in 2026. DTSC's work relies on the best available science, including EPA Region 9-funded RMP water quality monitoring data.

## Collaboration with Tribes and California on Research Related to Impacts of 6PPD-quinone on Coho Salmon, Ecology, Human Health, and Tribal Practices in the California North Coast Range Streams and Rivers

Region 9 is providing Region 9 Tribes with informational updates on 6PPD-quinone including current and projected EPA activities. EPA recently presented 6PPD-quinone updates at the annual meeting of the Regional Tribal Operations Committee, including technical information and available funding for Tribal sampling and infrastructure to address 6PPD-quinone.

- Region 9 is also meeting regularly with staff from north coast Tribes and California's State and Regional Water Quality Control Boards to pool ideas on identifying 6PPD-quinone hot spots and reducing 6PPD-quinone impacts to coho salmon, ecology, and human health in California's north coast region. As part of that effort, Region 9 is collaborating with ORD on a Regional-ORD Community of Science Networking Program (ROCS-Net) project to build networking among EPA, the state of California, and California north coast Tribes on 6PPD-research needs and monitoring strategies. The ROCS-Net team includes members of the Yurok, Pinoleville Pomo Nation, and Wiyot Tribes.
- Pinoleville Pomo Nation is actively working on a soil and ground-water monitoring strategy for 6PPD-quinone at the site of an auto dismantlers yard that is adjacent to Ackerman Creek (historical spawning tributary for coho, Chinook and Central Coast

steelhead) in the center of Pinoleville Reservation and is hoping to begin sampling within six months. The Environmental Director has provided Tribal input to the California Department of Toxic Substances Control for the listing of 6PPD-quinone.

- The Klamath Tribal Water Quality Consortium (made up of Yurok, Karuk, Quartz Valley, Hoopa, and Pulikla [formerly Resighini] Tribes) conducted its first 6PPD-quinone sampling in the mid and lower Klamath Basin in October 2023. The consortium is seeking to refine sampling design to effectively monitor 6PPD-quinone levels in the Klamath Basin.

## Region 10

### Draft Analytical Methods for Surface Water and Stormwater (*completed*)

In 2024, OW and Region 10 developed and published a draft laboratory method for detection of 6PPD-quinone in surface water and stormwater ([Draft EPA Method 1634](#)). This method will enable government agencies, Tribes, and other groups to determine where and when 6PPD-quinone is present in local stormwater and surface waters.

### 6PPD and 6PPD-quinone Methods Development

6PPD and 6PPD-quinone methods development for as many matrices as possible is a high priority for the agency. In the short-term, priority is placed on methods development for 6PPD-quinone in sediment, fish tissues, and wastewater. Region 10 will work with OW to develop and test Method 1634 in these matrices. As part of this process, EPA may consider additional related analytes that are stable, commercially available and could be easily added to the method. OW could consider conducting a multi-lab study for the revised Method 1634.

As time and resources allow, other methods needed include methods for air (particulate or gas phase to be determined), and ambient marine waters and sediment. Ideally these would include the parent, 6PPD, if analyte stability issues can be addressed.

### Water Quality Standards Guidance, including Screening Values/Thresholds Development (*ongoing*)

Region 10 will continue to coordinate with OW on thresholds development, including tracking the literature to see if the agency can build upon the 6PPD and 6PPD-quinone screening values so that OW could develop nationally recommended criteria. Further, chronic toxicity data for 6PPD-quinone across a range of species, with a focus on salmonids is needed to further the development of benchmarks/thresholds. At this time, we do not know if the acute threshold is protective for longer term exposures because there are insufficient data.

### 6PPD/6PPD-quinone science coordination with ORD (*ongoing*)

6PPD/6PPD-quinone science coordination with ORD is happening via the Regional-ORD Applied Research Regional-ORD Applied Research and Regional Research Partnership Program.

**Convening/Coordinating (*ongoing*)**

Region 10 convenes a 6PPD-quinone Analytical Method and Research Coordination monthly roundtable that includes federal, state, and tribal staff.

**Funding Support (*ongoing*)**

Region 10 provides grant support to investigate stormwater data gaps and fund green stormwater infrastructure and/or stormwater retrofits.