



# It's everywhere, but is it toxic? A Basin-Wide Survey of 6-PPDq in Brook Trout water of the Delaware River Basin

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**Delaware River Basin Commission**

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# Death by dirty water: Storm runoff a risk for fish



POULSBO, Wash. -- Just hours into the experiment, the prognosis was grim for salmon that had been submerged in rain runoff collected from one of Seattle's busiest highways. One by one, the fish were removed from a tank filled with coffee-coloured water and inspected: They were rigid. Their typically red gills were gray.

"He's way dead," David Baldwin, a research zoologist with the National Oceanic and Atmospheric Administration's Northwest Fisheries Science Center, declared at the four-hour mark.



Monday, November 17, 2014

**AP**



# In the Pacific Northwest, contamination in rain runoff is killing salmon before they can spawn



Monday, November 17, 2014



# Tire Wear Particles

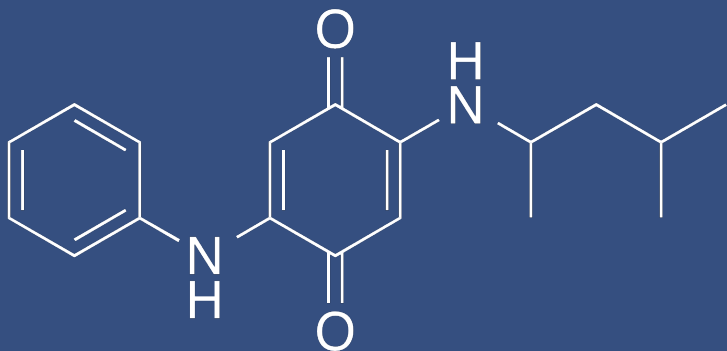


7-12 lbs generated annually per person in the U.S.



**What Makes Tire  
Wear Particles  
Toxic?**

## 6-PPD & 6-PPDq: *Background and Properties*



- 6-PPD is used in tires and other rubber car parts
- 6-PPDq environmental behavior & properties not well known
  - Solubility 0.67 mg L<sup>-1</sup>
  - Half-life in water is 33 hrs
  - Bonds with sediment

## 6-PPDq Toxicity... so far

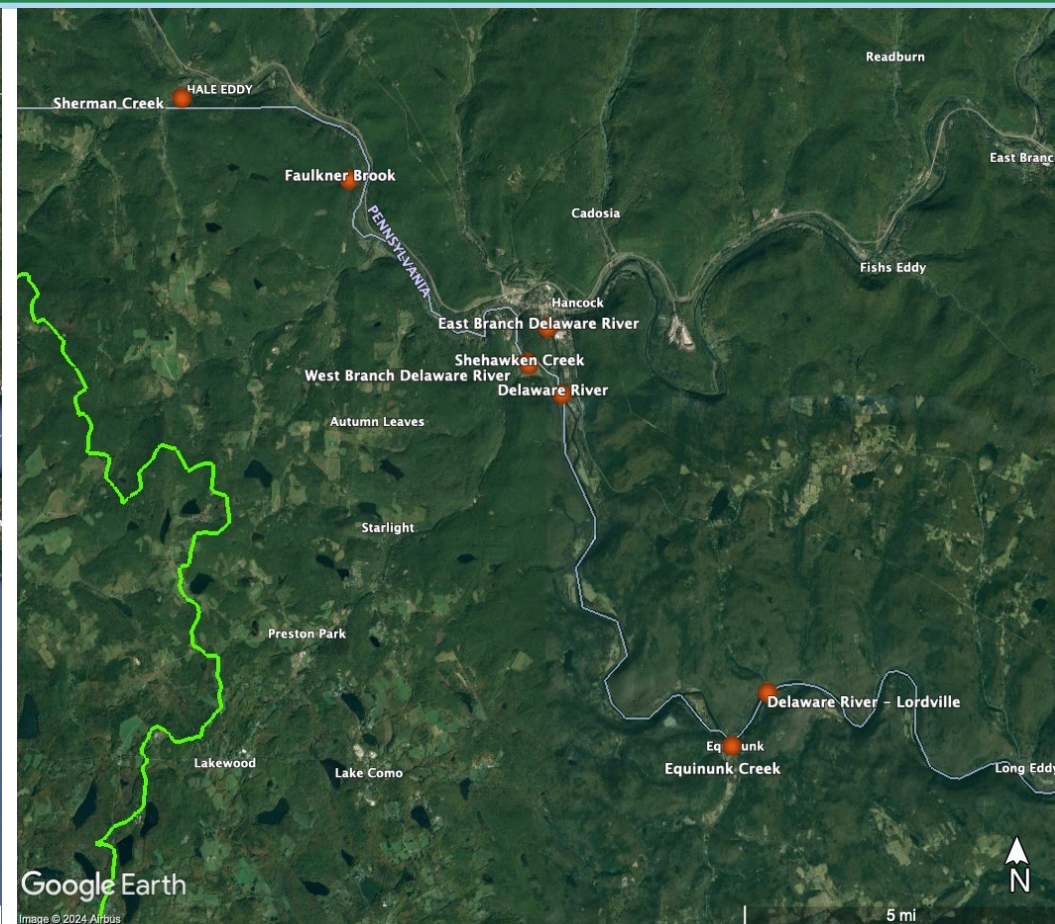
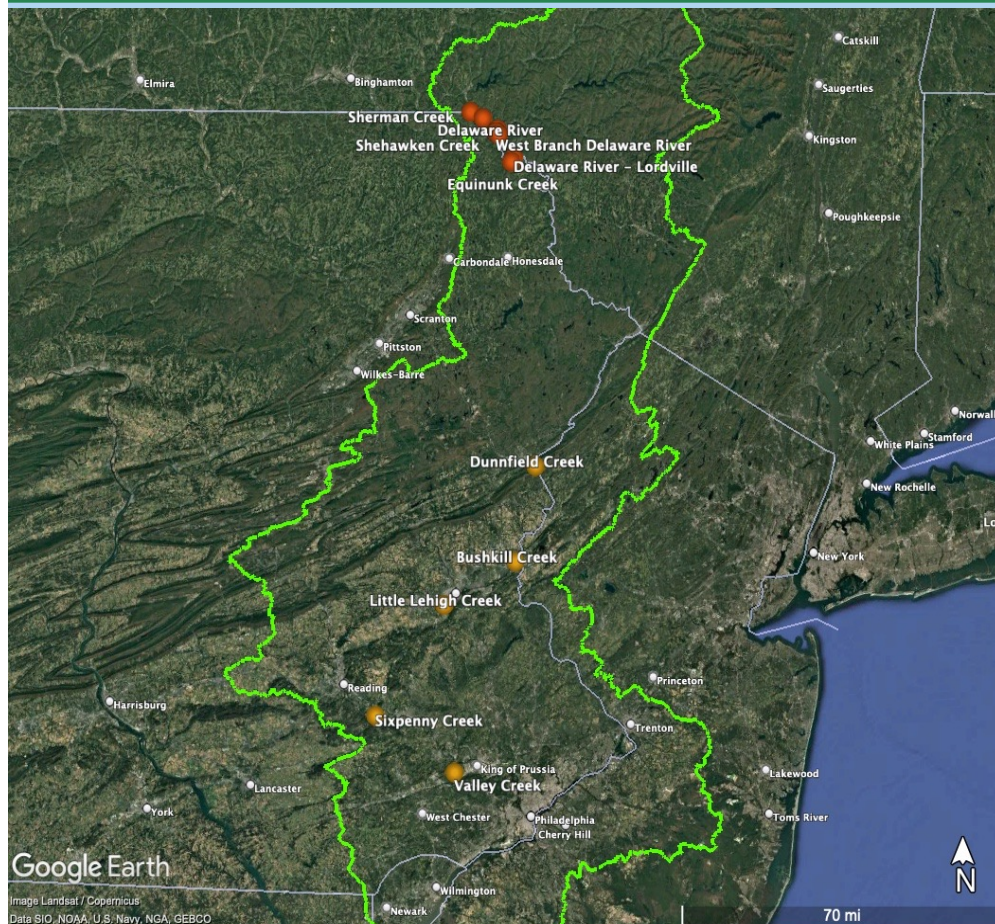
| Common Name     | Species               | LC <sub>50</sub> (ng L <sup>-1</sup> ) | Test Duration | Endpoint  | Reference               |
|-----------------|-----------------------|----------------------------------------|---------------|-----------|-------------------------|
| Coho Salmon     | Oncorhynchus kisutch  | 41                                     | 24h           | Mortality | (Lo et al. 2023)        |
|                 |                       | 80.4                                   | 24h           | Mortality | (Greer et al. 2023)     |
|                 |                       | 95                                     | 24h           | Mortality | (Tian et al. 2022)      |
| Brook Trout FRY | Salvelinus fontinalis | 200                                    | 24h           | Mortality | (Philibert et al. 2024) |
| Brook Trout     | Salvelinus fontinalis | 590                                    | 24h           | Mortality | (Brinkmann et al. 2022) |
| Rainbow Trout   | Oncorhynchus mykiss   | 640                                    | 96h           | Mortality | (Nair et al. 2023)      |
|                 |                       | 1000                                   | 96h           | Mortality | (Brinkmann et al. 2022) |
|                 |                       | 2260                                   | 96h           | Mortality | (Di et al. 2022)        |
| Brown Trout     | Salmo trutta          | > 12160                                | 48h           | Mortality | (Foldvik et al. 2022)   |

Not yet published USGS Study by David Soucek – Columbia, MO  
 3 week old Brook Trout: 96 hr LC<sub>50</sub> = 90 ng L<sup>-1</sup>

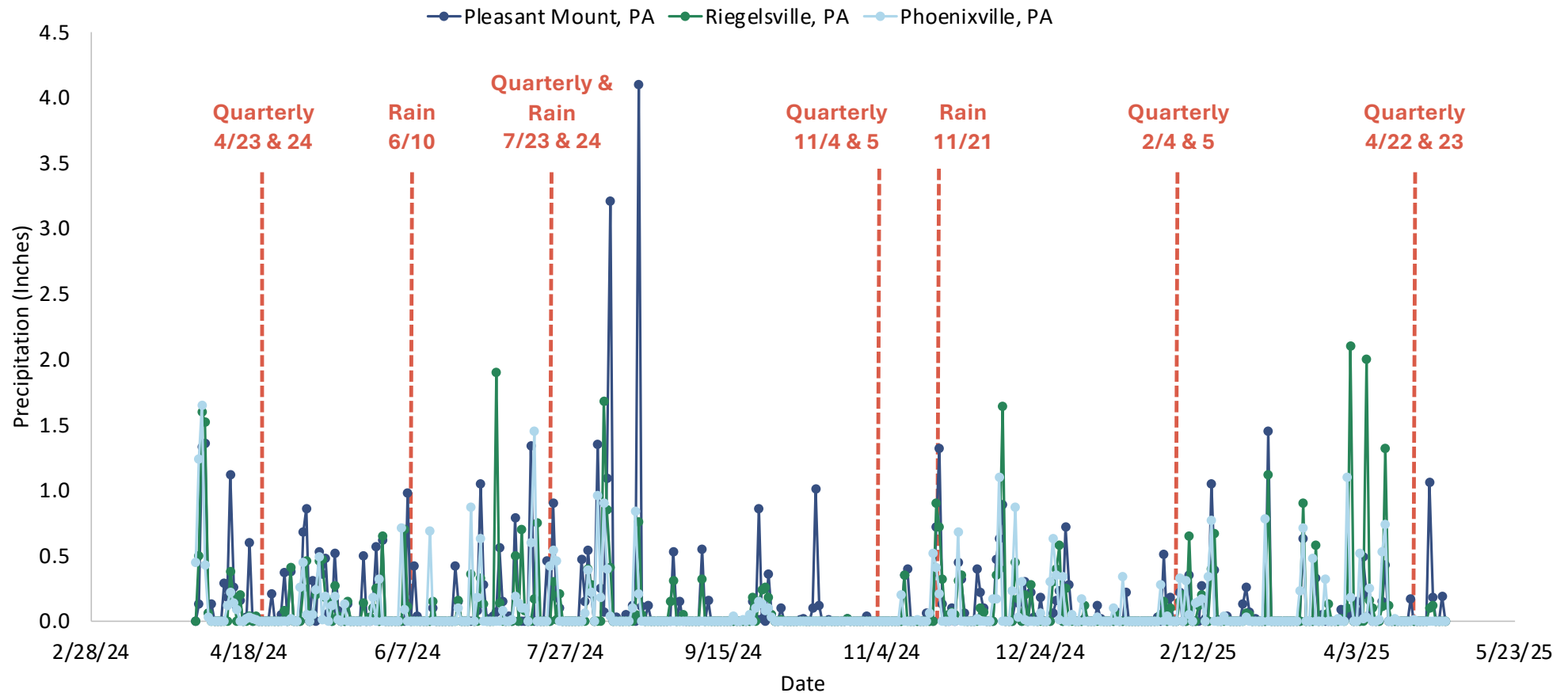
ITRC (Interstate Technology & Regulatory Council). 2024. 6PPD & 6PPD-quinone  
**Table 2-1.** Washington, D.C.: Interstate Technology & Regulatory Council, Tire Anti-degradant (6PPD) Team. [www.itrcweb.org](http://www.itrcweb.org).



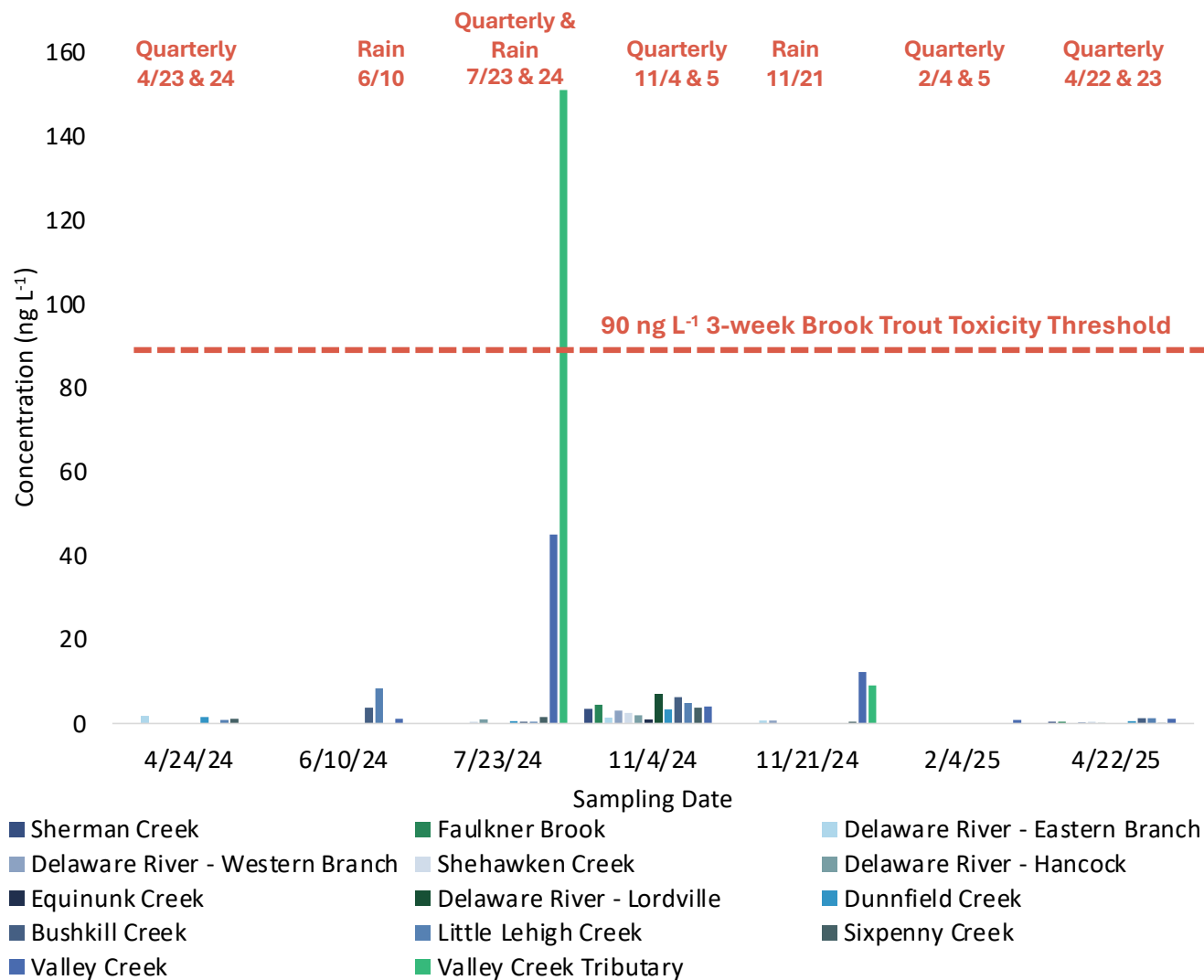
# Studying 6-PPDq in the Delaware River Basin



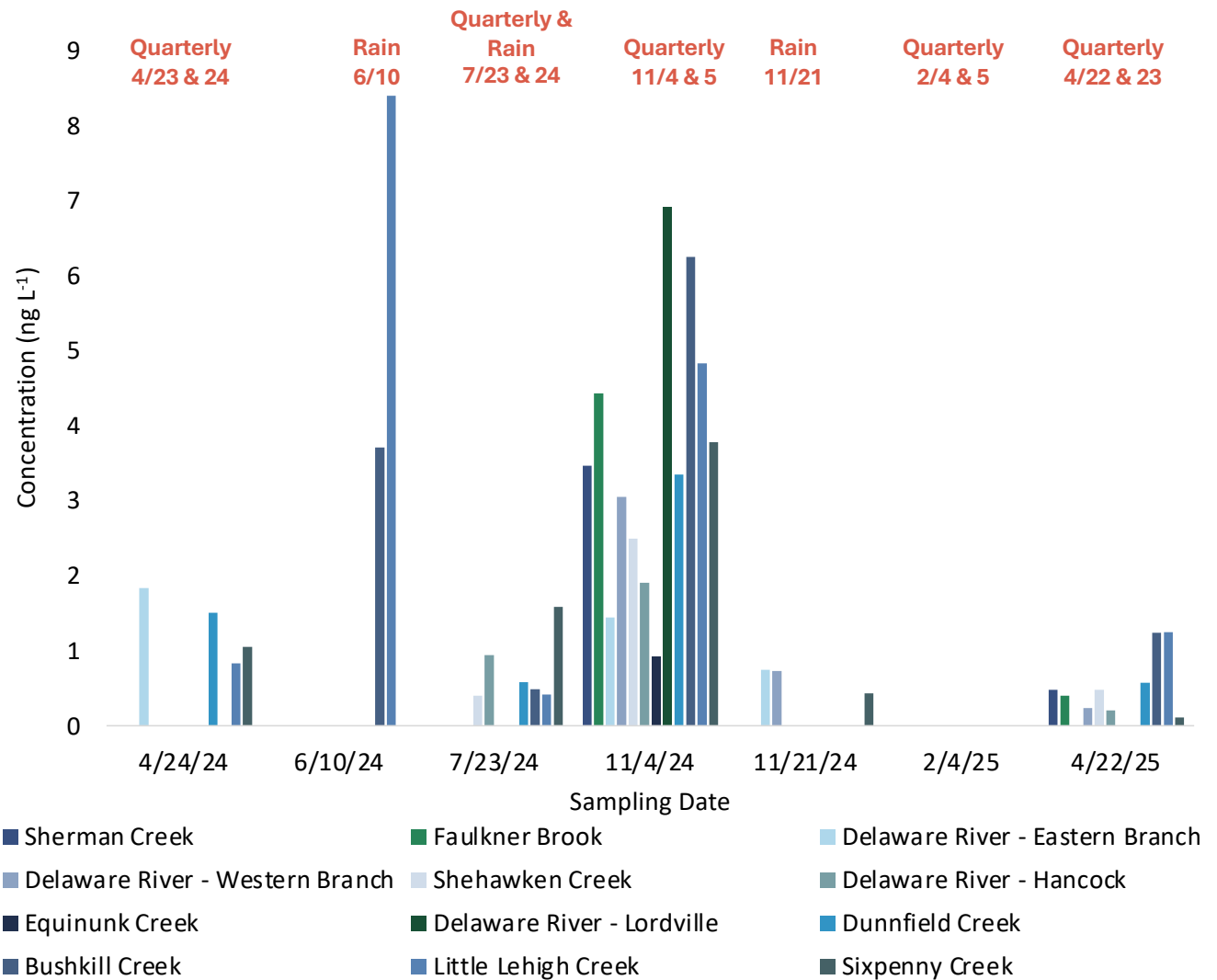
# Precipitation During the Study



# Valley Creek Stands out



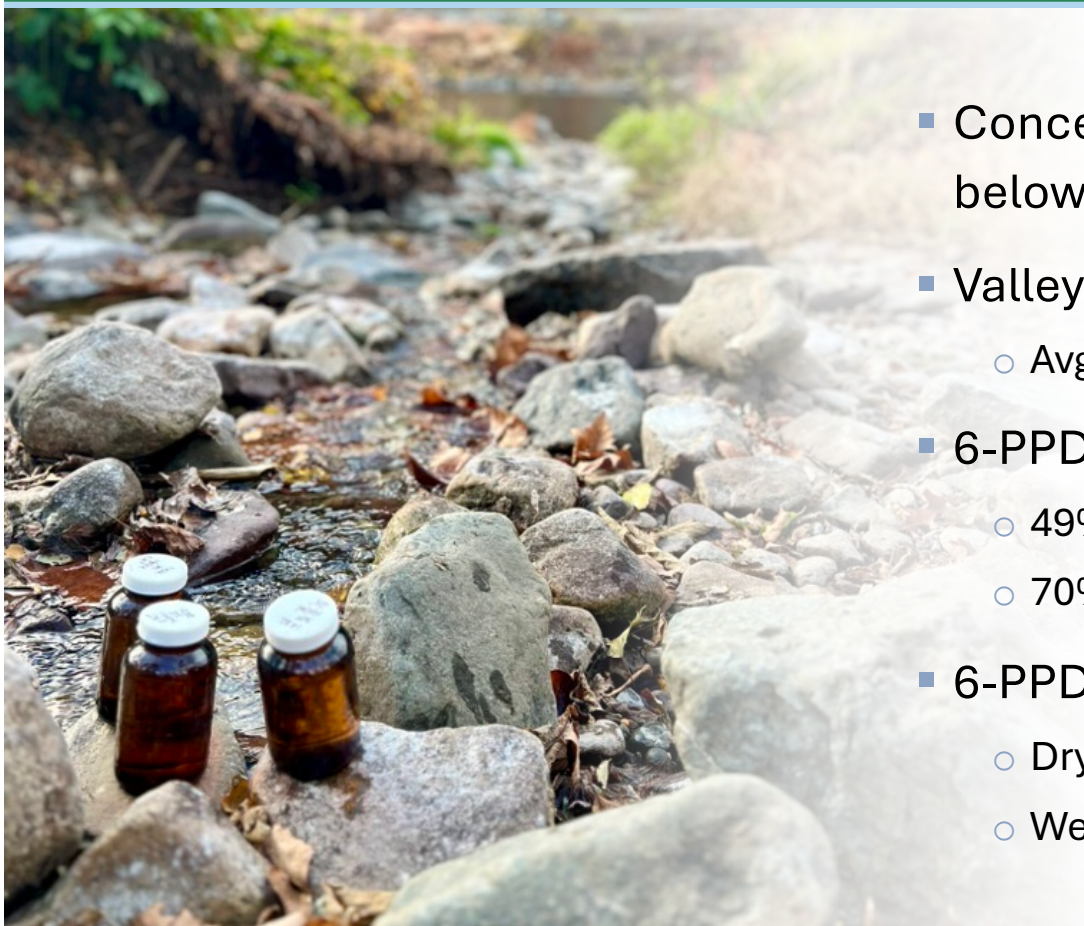
# 6-PPDq Was Found at Every Site



# Present, but largely below Toxicity Thresholds



- Concentrations varied, but nearly all were well below known acute toxicity thresholds
- Valley Creek was the outlier during wet weather
  - Avg: 19 ng L<sup>-1</sup>, but ranged from 0.86 to 44.97 ng L<sup>-1</sup>
- 6-PPDq was found at every site sampled
  - 49% detection during dry weather
  - 70% detection during wet weather
- 6-PPDq Basin Averages
  - Dry: 2.2 ± 1.9 ng L<sup>-1</sup>
  - Wet: 1.7 ± 2.4 ng L<sup>-1</sup> (excluding Valley Creek)



# Additional Points & Future Efforts



- During November drought, 6-PPDq detected at every site
  - Reason Unknown
  - Background concentration not diluted below detection?
- Sublethal toxicity thresholds are not well known
- Future
  - Planning a study for additional streams using a USGS tool that scores watersheds based on 6-PPDq threat



<https://geonarrative.usgs.gov/6ppdq sourcedashboard/>





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6-PPDq is present daily, but not at acute levels. Stormwater events could temporarily spike concentrations to levels of concern in the lower basin. We still have a lot to learn, especially about sub-lethal toxicity thresholds.

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- DRBC Staff: Elaine Panuccio, Jake Bransky, Avery Lentini, Amber Munchback, Sum Harris, Carl Bargery

DRBC 6-PPDq Website

