Tire toxicity faces fresh scrutiny after salmon die-offs

May 1 2024, by Jim Robbins, KFF Health News

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For decades, concerns about automobile pollution have focused on what comes out of the tailpipe. Now, researchers and regulators say, we need to pay more attention to toxic emissions from tires as vehicles roll down the road.

At the top of the list of worries is a chemical called 6PPD, which is added to rubber tires to help them last longer. When tires wear on pavement, 6PPD is released. It reacts with ozone to become a different chemical, 6PPD-q, which can be extremely toxic—so much so that it has been linked to repeated fish kills in Washington state.

The trouble with tires doesn't stop there. Tires are made primarily of natural rubber and synthetic rubber, but they contain hundreds of other ingredients, often including steel and heavy metals such as copper, lead, cadmium, and zinc.

As car tires wear, the rubber disappears in particles, both bits that can be seen with the naked eye and microparticles. Testing by a British company, Emissions Analytics, found that a car's tires emit 1 trillion ultrafine particles per kilometer driven—from 5 to 9 pounds of rubber per internal combustion car per year.

And what's in those particles is a mystery, because tire ingredients are proprietary.

"You've got a chemical cocktail in these tires that no one really understands and is kept highly confidential by the tire manufacturers," said Nick Molden, CEO of Emissions Analytics. "We struggle to think of another consumer product that is so prevalent in the world and used by virtually everyone, where there is so little known of what is in them."

Regulators have only begun to address the toxic tire problem, though there has been some action on 6PPD.

The chemical was identified by a team of researchers, led by scientists at Washington State University and the University of Washington, who were trying to determine why coho salmon returning to Seattle-area creeks to spawn were dying in large numbers.

Working for the Washington Stormwater Center, the scientists tested some 2,000 substances to determine which one was causing the die-offs, and in 2020 they announced they'd found the culprit: 6PPD.

The Yurok Tribe in Northern California, along with two other West Coast Native American tribes, have petitioned the Environmental Protection Agency to prohibit the chemical. The EPA said it is considering new rules governing the chemical. "We could not sit idle while 6PPD kills the fish that sustain us," said Joseph L. James, chairman of the Yurok Tribe, in a statement. "This lethal toxin has no place in any salmon-bearing watershed."

California has begun taking steps to regulate the chemical, last year classifying tires containing it as a "priority product," which requires manufacturers to search for and test substitutes.

"6PPD plays a crucial role in the safety of tires on California's roads and, currently, there are no widely available safer alternatives," said Karl Palmer, a deputy director at the state's Department of Toxic Substances Control.

"For this reason, our framework is ideally suited for identifying alternatives to 6PPD that ensure the continued safety of tires on California's roads while protecting California's fish populations and the communities that rely on them."

The U.S. Tire Manufacturers Association says it has mobilized a consortium of 16 tire manufacturers to carry out an analysis of alternatives. Anne Forristall Luke, USTMA president and CEO, said it "will yield the most effective and exhaustive review possible of whether a safer alternative to 6PPD in tires currently exists."

Molden, however, said there is a catch. "If they don't investigate, they

aren't allowed to sell in the state of California," he said. "If they investigate and don't find an alternative, they can go on selling. They don't have to find a substitute. And today there is no alternative to 6PPD."

California is also studying a request by the California Stormwater Quality Association to classify tires containing zinc, a heavy metal, as a priority product, requiring manufacturers to search for an alternative. Zinc is used in the vulcanization process to increase the strength of the rubber.

When it comes to tire particles, though, there hasn't been any action, even as the problem worsens with the proliferation of electric cars. Because of their quicker acceleration and greater torque, electric vehicles wear out tires faster and emit an estimated 20% more tire particles than the average gas-powered car.

A recent study in Southern California found tire and brake emissions in Anaheim accounted for 30% of $PM_{2.5}$, a small-particulate air pollutant, while exhaust emissions accounted for 19%. Tests by Emissions Analytics have found that tires produce up to 2,000 times as much particle pollution by mass as tailpipes.

These particles end up in water and air and are often ingested. Ultrafine particles, even smaller than $PM_{2.5}$, are also emitted by tires and can be inhaled and travel directly to the brain. New research suggests tire microparticles should be classified as a pollutant of "high concern."

In a report issued last year, researchers at Imperial College London said the particles could affect the heart, lungs, and reproductive organs and cause cancer.

People who live or work along roadways, often low-income, are exposed

to more of the toxic substances.

Tires are also a major source of microplastics. More than three-quarters of microplastics entering the ocean come from the synthetic rubber in tires, according to a report from the Pew Charitable Trusts and the British company Systemiq.

And there are still a great many unknowns in tire emissions, which can be especially complex to analyze because heat and pressure can transform tire ingredients into other compounds.

One outstanding research question is whether 6PPD-q affects people, and what health problems, if any, it could cause. A study published in *Environmental Science & Technology Letters* found high levels of the chemical in urine samples from a region of South China, with levels highest in pregnant women.

The discovery of 6PPD-q, Molden said, has sparked fresh interest in the health and environmental impacts of tires, and he expects an abundance of new research in the coming years. "The jigsaw pieces are coming together," he said. "But it's a thousand-piece jigsaw, not a 200-piece jigsaw."