6PPD and 6PPD-Q, Environmental Fate and Transport and Current regulatory Environment

Terrapex's presentation will build on the overview of N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine (6PPD) and its oxidation product, 6PPD-quinone (6PPD-q) proposed to be presented by SGS "6-PPD Quinone: Occurrence and Best Practices in Measurement".

These compounds, which have been determined to be severely toxic to Coho salmon and other species, are known to be entering waterways from runoff containing tire wear particles. Research is in the very early stages but is progressing rapidly. The presentation will focus on what will be of most interest to practitioners in site assessment and remediation and will present some of the challenges associated with these emerging contaminants.

The first segment of the presentation will review what is currently known about the physical and chemical properties of 6PPD and 6PPD-q and how these influence the environmental fate and transport of the compounds through water, soil, and air, as well as their potential for bioaccumulation and toxic effects. The second segment will review the current regulatory landscape surrounding 6PPD and 6PPD-q. We will look at actions that have been taken or are being considered in various jurisdictions, including Canada, the USA and Europe, to monitor and/or control the use and release of these compounds. Additionally, the presentation will discuss the concerns, responses and initiatives of rubber product manufacturers and industry associations.

Paul Cheung is an environmental risk assessor at Terrapex with over 10 years of environmental consulting experience. Specialising in risk assessment, vapour intrusion assessment, and risk management, Paul uses his technical skills to assist clients navigate the regulatory, municipal conveyance, and transactional due diligence processes. He has a keen interest in brownfield management and development strategy and regularly consults for a broad range of public, residential and commercial real estate, and industrial clients.

6-PPD QUINONE: OCCURRENCE AND BEST PRACTICES IN MEASUREMENT

N-(1,3-dimethylbutyl)-N'-phenyl-p-phenylenediamine (6PPD) is added to almost every automobile tire to prevent cracking from ozone. However, a newly discovered environmental reaction by-product 6-PPD-quinone (6-PPDQ) has been identified in 2020 as being responsible for urban runoff mortality syndrome (URMS) in Coho Salmon (Oncorhynchus kisutch). The LC-50 of 6-PPDQ is 41 ng/L to juvenile Coho making it one of the most toxic substances known to us. In addition to extreme toxicity in Coho, significant lethal effects (LC-50 1 µg/L or less) have been observed in geographically widespread species such as brook trout (Salvelinus fontinalis) and rainbow trout (Oncorhynchus mykiss). Toxicity shows 5 orders of magnitude species dependence. Worldwide monitoring results show almost ubiquitous presence. Other sources of 6-PPDQ could be the reuse of tires in playgrounds and artificial turf near sensitive streams, and adjacent to factories manufacturing or using 6-PPD.

In this study, we

1) Present recent advances in the measurement of 6-PPD and 6-PPDQ
2) Collate and discuss Canada and world-wide occurrence of 6-PPDQ
3) Shed light on tire and road wear particles (TRWP) and associated chemical constituents

This presentation will be followed by one from Terrapex on "6PPD and 6PPD-Q, Environmental Fate and Transport and Current Regulatory Environment".

We developed and validated an isotope-dilution UPLC-MS/MS method in aqueous samples capable of measuring 6-PPDQ at concentrations 400 times below the LC-50. This work also revealed significant challenges in the measurement of the parent 6-PPD due to its significant instability. Internal data on occurrence from coastal British Columbia and adjacent regions showed that 94% and 88% of the aqueous samples showed detected levels of 6PPD-quinone, and 6PPD respectively. The measured concentrations ranged from 0-740 ng/L for 6PPD-quinone and 0-5100 ng/L for 6PPD. On average, the concentration of 6PPD was 3.5x that of the 6PPD. The highest concentrations were detected in the wet season, and the lowest concentrations were detected in the dry season. Our method validation and initial occurrence data, and work of others in North America shows the widespread occurrence of 6PPDQ at levels toxic to multiple species. It also points to increased need for the monitoring of 6PPDQ, and the measurement of toxicity in other species given the wide variance in toxicity by species. In addition, there is emerging need to consider the regulation of 6-PPDQ in road runoff and to understand best practices for mitigation.

Ivana Vukovic is the Product Manager, Specialty Laboratories with SGS North America. With a Bachelor of Science and a variety of different roles in prominent international laboratories, she brings over 18 years of experience in the everchanging environmental industry. Ivana's specialty lies in providing scientific leadership and oversight on product and service designs,

development, and technical specifications with a powerful focus on pricing and performance. As a leader in the Specialty Laboratories division at SGS, Ivana's contributions center around impacting positive environmental change through PFAS identification and research. Her expertise encompasses a high focus on additional emerging contaminants on a global scale in different medias such as groundwater, soil, emissions and more. Her diverse knowledge connects clients and products to help move towards a sustainable and viable future.