

Can We Apply a Site-Specific Ecological Risk Assessment Framework for Microplastics?

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Background/Objectives. The microplastic state of science is quickly evolving, with new microplastic toxicity literature for ecological receptors being published every month. As microplastic toxicity is elucidated it may lead to the development of regulations, at which point the potential ecological risks posed by microplastics will need to be evaluated in a manner like other regulated chemicals. Although laboratory studies have shown that exposure to microplastics can cause toxic effects in some organisms, these effects still need to be applied to site-specific exposure scenarios to assess risk to ecological receptors. Although multiple papers in the past year have proposed microplastic risk assessment frameworks to capture their diverse properties and assess multiple exposure sources for receptors, many data gaps still exist that prevent site-specific ecological risk assessments from being completed. Fundamental data gaps, such as sampling and analysis, quality control, and data reporting, also still exist that contribute to uncertainty in assessing microplastics. The objective of this presentation is to evaluate if a framework can be developed following the EPA's 8-step ecological risk assessment framework for CERCLA sites.

Approach/Activities. This presentation will cover how an ecological risk assessment for microplastics can be applied to individual sites by walking through the EPA CERCLA risk assessment framework process. This includes problem formulation (such as selecting appropriate endpoints used in risk decision making); exposure and effects assessments (such as developing direct toxicity values, uptake factors, and wildlife toxicity reference values); and risk characterization (calculating hazard quotients).

Results/Lessons Learned. A wide variety of data needs should be addressed before we can develop a site-specific ecological risk framework. For example, there is a lack of standardized analytical approaches for quantifying and reporting the concentrations of microplastics in different media – this is a fundamental challenge that must be addressed before conclusions can be reached regarding other aspects of microplastics in sediment. The potential for microplastics to bioaccumulate and biomagnify in aquatic and terrestrial food webs is also a potential concern, but our understanding is currently limited by a lack of sound tissue analytical measurements, as well as an understanding of the range of microplastics concentrations adverse to plants and wildlife. As microplastics are ubiquitous in the environment, background levels need to be established. Overall, these data gaps need to be resolved so that site-specific ecological risk assessments can be performed and decisions regarding investigations and potential remediation and can be made for individual sites.