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1. Fuels are complex molecular mixtures of thousands of individual compounds comprising various hydrocarbons, small amounts of other compounds such as nitrogen and sulfur, and additives. Although, fuels can generally be described as mixtures of various ranges of hydrocarbons (i.e. gasoline can generally be described as a mixture of C4 to C12 hydrocarbons and diesel can generally be described as a mixture of C10 to C22 hydrocarbons) the actual chemical composition of various gasoline and diesel products can vary widely between brands and grades, and even within brands and grades, based on the source of the crude oil used in the refining process. In the study (Ecology 2018) that formed the basis for the petroleum hydrocarbon surface water protective values (cleanup standards) listed in Implementation Memorandum No. 23 (IM 23), laboratory standards (unleaded gasoline composite standard and Diesel Fuel #2 Composite Standard) sourced from RESTEK were used to "spike" surface water at various concentrations during the whole effluent toxicity (WET) testing experiment; both standards also contained additional chemicals methanol and methylene chloride, respectively. The composite standards contain fuels from three separate sources, and RESTEK acknowledges on their website that their gasoline and diesel composite standards exhibit lot-to-lot variability. This supports the point that fuels exhibit a high degree of variability with thousands of compounds and the composition of the laboratory fuel standards used in the study may not be chemically or toxicologically similar to fuels that have been or will be released into the environment. Therefore results of the study cannot reliably be extrapolated to understand the toxicity of fuels in the environment.

Additionally, fuels begin to undergo a weathering process immediately upon contact with the environment. Weathering occurs through volatilization, UV degradation, abiotic chemical reactions, and biologically mediated chemical reactions via microbes in soil, groundwater, sediment, and surface water. Importantly, the weathering process causes chemical changes in which hydrocarbons are converted to polar organic and other compounds. Expected polar organic compounds resulting from biodegradation of hydrocarbons fall into various families of compounds (e.g. alcohols, phenols, acids and esters, ketones, and aldehydes) but nearly all of these compounds have lower toxicity than the parent hydrocarbons. The weathering process is also unpredictable both in terms of speed and the resulting mixture of compounds that will be generated. These chemical changes add to the potential variability that may be encountered in a fuel after it is released to the environment.

Because of the high degree of variability in fuels, one study cannot reliably predict the aquatic toxicity of all gasoline and diesel products on the market and most certainly cannot predict the aquatic toxicity of products that have been released to the environment and have undergone weathering processes.