Research Brief 361: Model Predicts PFAS Buildup in Wild Animals

You are listening to the Superfund Research Program's Research Brief podcast. This month's brief is titled, "Model Predicts PFAS Buildup in Wild Animals," and will highlight researchers work developing a model that estimates PFAS accumulation in food webs. This model reveals unique characteristics of diverse PFAS that affect accumulation in different species and may be useful for screening PFAS for potential ecological and human health risks.

Researchers funded by the NIEHS Superfund Research Program, or SRP, developed a new model that predicts how PFAS move and build up within food webs. The model lays the groundwork for screening the thousands of PFAS compounds that could potentially pose a risk for ecological or human health. PFAS are synthetic chemicals used in consumer products that are ubiquitous on the planet and in some cases harmful to humans and wildlife.

Dr. Elsie Sunderland of Harvard University and project lead for the University of Rhode Island SRP Center explained that current accumulation models don't accurately estimate PFAS levels because they were designed to assess other types of contaminants with different chemical properties, such as PCBs and pesticides. The modeling framework developed by her research team needed to be adapted to account for those unique properties.

Sunderland explained that PFAS are charged particles that tend to gravitate towards protein-rich areas of the body like the kidney, brain, liver, and plasma. PFAS also behave differently based on their type and charge. These unique properties were accounted for in the model in order to produce a more accurate estimate.

This model also considers features of different animals, such as their size, feeding rate, metabolism, and excretion, and the complex interactions between animals that make up different food webs.

The team tested their model's predictions in three different food webs against data from laboratory studies and samples collected from plants and animals in the wild to validate their approach.

Their modeling predictions of PFAS accumulation closely mirrored laboratory studies with rainbow trout and field data from the Lake Ontario ecosystem and the entire Canadian Arctic region.

Sunderland shared that these regions have been extensively studied and there is a vast amount of data on these ecosystems, food webs, and the levels of PFAS which is important for validating the model's predictions.

The new model predicted that PFOS and longer-chain PFAS compounds would tend to biomagnify in food chains — meaning that the concentrations of these compounds tend to increase from prey to predators. Other PFAS compounds, like GenX and Perfluorohexane sulfonate (also called PFHxS) were predicted to have low biomagnification potential in all three food webs. Similar to reported data in the field, the model predicted that land animals would accumulate more PFAS than aquatic ones.

While the authors attribute some of the differences to specific PFAS properties and animal characteristics, there are many questions left to answer.

According to Sunderland, with PFAS, there is much that the research community doesn't yet understand about how they behave in the body, how some of them are metabolized, or even how long it takes to eliminate them – and that the kind of model developed by this research team can be very helpful for generating future research questions.

Sunderland ended by underscoring that this simulation model can be applied to new field data sets to more accurately predict PFAS concentrations across species and ecosystems and provide better information to decision makers.

If you'd like to learn more about this research, visit the Superfund Research Program website at niehs.nih.gov/srp. From there, click on the Research Brief title under the banner, and refer to the additional information listed under the research brief. If you have any questions or comments about this month's podcast, send an email to srpinfo@niehs.nih.gov.

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