Video Transcript - How do scientists study contaminants in the environment?

Hello! This is Dr. Kim Anderson, and I am an environmental chemist at Oregon State University studying contaminants in the environment.

One group of chemicals that we study are the polycyclic aromatic hydrocarbons or PAHs. These are chemicals of concern because some PAHs are toxic or can cause cancer in humans and wildlife. PAHs are often found at Superfund sites and are also one of the principle contaminants of concern in oil spills, such as the recent oil spills in the Gulf of Mexico.

This video describes passive sampling devices or PSDs, a unique tool that we use to measure contaminants in the environment such as PAHs.

In the environment, only part of the total amount of chemical present is potentially available for uptake by organisms. This concept is known as the bioavailability of a chemical. It is the bioavailable fraction that determines potential negative impact on the health of people, plants and animals.

The BRIDGES project uses PSDs to study the link between bioavailability and health impacts. These are called passive because they do not need any power or maintenance once they are set up in the environment.

The PSD contains a strip or tubing that looks like a clear bike inner tube. But it acts like a high-tech sponge. It absorbs chemicals like a living creature such as a fish, birds, or a person.

Animals living in contaminated waters are exposed to the bioavailable fraction in the water. Contaminants enter fish and shellfish through their gills and exposed skin. A contaminant in sediment is not very bioavailable to a fish that does not interact with the bottom, but it much more bioavailable to shellfish living or feeding in the sediment.

Fish breathe by absorbing oxygen from water through their gills. If present, certain chemicals can also pass through the thin skin of the gills and into the fish and a small amount of chemical may also absorb through the fish's outer skin.

This cartoon shows the magnified surface of fish gills. Notice that some of the chemicals enter the cell membrane and go into the fish. Some are simply too large to enter the pores. Others that appear to bounce off the membrane are not able to enter because of specific chemical properties that do not allow these chemicals to pass through the membrane. Once the chemical moves through the membrane, it will enter the blood circulation of the organism and possibly build up in its tissue.

This cartoon shows the magnified surface of the PSD membrane. PSDs are able to estimate the bioavailable amount of contaminant in water because they take in contaminants just like fish or shellfish. Like the gill membrane, PSDs have pores that allow some contaminants to enter and block others based on physical size. Certain contaminants will be absorbed into the PSD depending on their chemical properties. Contaminants that build up in fish and shellfish are also absorbed into the PSD.

A big advantage of using PSDs is that they can remain in the environment for days, weeks or months, collecting contaminants over time just like a fish living in polluted water. This allows us to have a better idea of bioavailable exposures over longer periods of time instead of just collecting one sample of water on one day. It allows us to measure very low amounts in water since the PSDs can concentrate chemicals over these days, weeks or months.

To learn how you can be exposed to contaminants in the environment, be sure to watch the first video on routes of exposure.

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