

Tracking arsenic in contaminated lakes



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Lake depth may affect health threats from arsenic

New research shows that contaminated shallow lakes have more arsenic in their water and food chain than contaminated deeper lakes, meaning bigger potential risk for humans and other organisms.

Drs. Rebecca Neumann and James Gawel study how arsenic is distributed in lakes contaminated by the former ASARCO smelter near Tacoma, Washington. To their surprise, they found that organisms in shallow lakes take up more arsenic than organisms in deeper lakes. In deep lakes, cold water sinks due to its greater density and does not mix with warmer surface waters. In shallow lakes, water is constantly mixed from bottom to top, meaning that arsenic moves up from contaminated sediments into oxygenated water. Because aquatic organisms live in oxygenated water, they get exposed to arsenic. Plants and algae take it up, mistaking it for the chemically similar phosphorus that they need to grow. When fish or other animals eat contaminated plants and algae, arsenic can move up the food chain, potentially to humans.



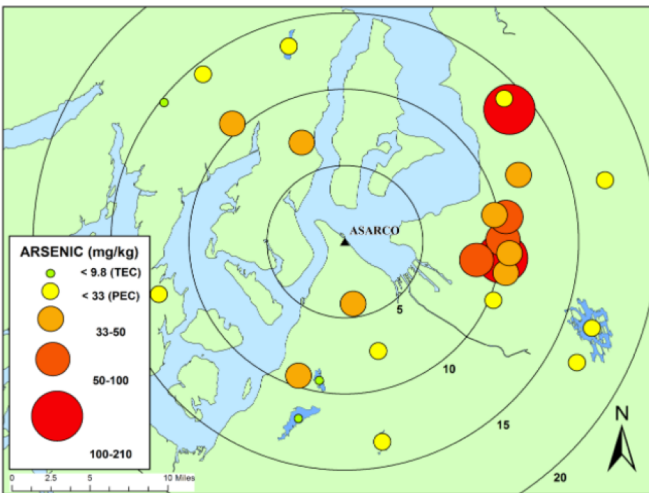
Graduate student Samantha Fung (left) and professor Alex Horner-Divine watch a diver from EPA collect an underwater sampling device.

Surprising levels of arsenic in periphyton

Periphyton is the fuzzy green algae that attaches to underwater surfaces in freshwater lakes, like rocks and plant leaves. Undergraduate research assistant Ken Burkhart decided to test periphyton for arsenic while he was testing some aquatic plants to which it was attached. Surprisingly, the levels that he found in periphyton were 10-100 times higher than the levels found in the plants. Now the group is studying how arsenic in periphyton might move up the food chain into the snails that graze on it and potentially into the people who harvest those snails to eat like escargot.

Arsenic and Local Lakes

Arsenic is a naturally occurring element that can combine with other molecules to form many different compounds. Some of the more cancer-causing forms are released from ore smelting, which actively occurred for almost 100 years at the American Smelting and Refining Company (ASARCO) smelter near Tacoma, Washington until it was permanently shut down in 1985. Now the area around the former smelter has been designated as the Commencement Bay/ Nearshore Tideflats Superfund Site due to the arsenic and other contaminants that ASARCO left behind in soils and lake sediments. South King County contains many lakes downwind of the former ASARCO smelter. The sediments of those lakes still contain arsenic almost 35 years after the smelter's closure. Arsenic in lake sediments will never go away unless by dredging. The human health and ecological implications of this contamination are unclear because little is known about whether and how arsenic enters and moves up the food chain. Work by Drs. Neumann, Gawel, and their trainees is aimed at filling that knowledge gap.



Study Sites

Work by Drs. Neumann and Gawel focuses on four contaminated lakes: the relatively shallow Steel Lake and Lake Killarney, and the deeper Angle Lake and North Lake. They found that plankton from shallow lakes contained ten times the arsenic that plankton from deeper lakes with similar levels of sediment contamination. The map to the left shows the sediment contamination of many lakes around the former ASARCO smelter. The highest levels of arsenic contamination are found in the lakes downwind from the smelter.

Arsenic concentrations in surface sediments in Puget Sound lakes (Gawel *et al.* 2014).

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