Pyrethroid in Creek Sediments Toxic to Organisms

Summarized from University of California, Berkeley, News Service, May 6, 2004

A family of pesticides used increasingly in place of more heavily restricted organophosphate pesticides has accumulated in many creek sediments to levels that are toxic to freshwater bottom dwellers, according to a new study. The pesticides, called pyrethroids, have been considered safe for fish and other organisms that live in the water column, but no one has studied their effect on sediment-dwelling organisms, such as midge larvae or shrimp-like amphipods, said University of California, Berkeley, biologist Donald P. Weston. These two organisms are used by the U.S. Environmental Protection Agency as indicators of fresh water sediment health.

Weston and colleague Michael J. Lydy of Southern Illinois University collected sediment samples from 42 rivers, creeks, sloughs, and drainage ditches in California's Central Valley and exposed amphipods and midge larvae to the sediments for 10 days. Twenty-eight percent of the sediment samples (20 of 71) killed amphipods at an elevated rate, and in 68 percent of these sediments, the pyrethroids were at levels high enough to account for the deaths. Thus, while other pesticides may well have contributed to amphipod deaths in some sediment samples, pyrethroids alone explain the toxicity in the vast majority of the sediment samples, Weston said.

Pyrethroids are a class of compounds represented by permethrin, first marketed in 1973, and various other chemicals usually ending in the suffix -*thrin*. Permethrin is found in many home and garden pesticides. Permethrin and its kin also find broad use in agriculture.

Though pyrethroids are used far less than organophosphates like diazinon and chlorpyrifos, their use in California has risen rapidly in recent years because of increased regulation of the spraying of organophosphates.

Weston noted that another chemical sometimes applied with pyrethroids may be making the situation worse. Piperonyl butoxide, or PBO, is a synergist that shuts down the enzymes that detoxify pyrethroids, making them last longer in an organism and increasing their killing potential. He and his colleagues now are trying to measure the level of pyrethroid that kills amphipods, which is around 3 parts per billion in sediments, and to determine whether levels of PBO should be considered in estimating the true toxicity of pyrethroid pesticides.

"I don't want to give the impression that pyrethroids are destroying the streams, since that has not yet been shown, but if we are serious about maintaining stream health, we have to consider the sediments and not limit our sampling just to the water above," said Weston. "While pyrethroids may be preferable to the organophosphates that preceded them, our work shows that the environmental effects of pyrethroids cannot be ignored and have had too little study for too long. We need to know more about pyrethroids, because if we don't, how can we regulate them?"

The study by Weston, Lydy, and postdoctoral researcher Jing You in the Department of Zoology at SIU was published in the May 15, 2004 edition of *Environmental Science & Technology*.

Visit pubs.acs.org/journals/esthag and www.berkeley.edu/news/media/releases/2004/05/06_pyrethroid.shtml.

Rainfall and Rio Grande Flow Link Studied

From the National Science Foundation

Rainfall in the mountains of New Mexico has a major influence on Rio Grande levels, and its effects can be seen as much as 50 years after the rain has fallen, according to hydrologists funded by the National Science Foundation. Christopher Duffy of Pennsylvania State University has shown that precipitation over the mountains, at least in the basin and range area of New Mexico, plays an important role in

Continued next page

recharging the water table and the Rio Grande River, although the river is far from the mountains.

Duffy used a computer model to investigate groundwater in central New Mexico. The terrain is variously classified as mountainous area, sloping bajada, and riparian or river area. Duffy incorporated the effects of environmental variables such as rainfall, snowpack, evapotranspiration, and altitude, as well as the porosity and permeability of the subsurface.

"The time between rainfall on the mountains and ultimate recharging of the riverine water table is about 50 years," says Duffy. "The seven-year, 1950s drought in the area is what is now affecting the Rio Grande and the water table.

"Developers of New Mexico's mountains and bajada regions need to consider a longer time horizon than a decade when planning to alter the natural environment. It may require a forward view of tens of decades to ensure sustainability. Even if no obvious year-round streams run from the mountains, they are still very important for the recharge of the water table and river."

Visit www.nsf.gov./od/lpa/newsroom/pr.cfm?ni=97

New Findings Reinterpret Perchlorate Risks

The Urban Water Research Center at the University of California, Irvine recently released a report stating that perchlorate in drinking water may pose no additional risks to healthy people. The report was prepared by a five-member panel of experts, including Richard Bull, adjunct professor of pharmacology/toxicology and environmental science at Washington State University and former director of the U.S. EPA's Toxicology and Microbiology Division; Andrew Chang, professor of agricultural engineering and associate director of the UC Center for Water Resources at UC Riverside; Carl Cranor, professor of philosophy, UC Riverside; Ronald Shank, professor and chair of community and environmental toxicology, UCI College of Medicine; and Rhodes Trussell, adjunct professor of environmental health, science and policy at UCI and president of Trussell Technologies.

The panel was charged with reviewing relevant peer-reviewed literature on the health effects, risk assessment, and risk management on perchlorate, essentially the same information the California Department of Health Services (CDHS) is using to determine the state maximum contaminant level (MCL) for perchlorate in drinking water.

The panel concluded that perchlorate concentration in drinking water as high as 100 parts per billion is not harmful to healthy adults. However, they stated that a conservative value for the perchlorate MCL is warranted even though direct benefits could not yet be demonstrated, because of uncertainties of the effects of the compound on people with lower than normal iodide uptake (such as some pregnant women), uncertainties of how perchlorate might interact with certain other anions that also occur in drinking water, and uncertainties in how representative the study participants were in terms of body weight, environment, and lifestyle.

Finally, the panel recommended further research in several areas. Most importantly, more information is needed on perchlorate's health effects on populations other than healthy adults. In addition, improved detection methods are needed to measure perchlorate at lower concentrations, in reclaimed water, and in food and beverages. Research is also lacking on methods for reducing the problems of brine disposal where removal of perchlorate by ion exchange is used.

The 60-page report is available at www.urban-water.uci.edu/UCI-UWRC_Perchlorate_wCorrection061404.pdf

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Sandia to Research Desalination, Arsenic Removal

From Sandia National Laboratory

Sandia National Laboratories in Albuquerque recently received a $6 million allocation from the FY2004 federal Energy and Water Development Appropriations bill for research in desalination and arsenic cleanup.

Desalination

The desalination program will focus on research and development of technologies addressing the technical, economic, and environmental issues associated with the treatment and utilization of inland brackish groundwater. Some of the research will be done at the Tularosa Basin National Desalination Research Facility in Alamogordo, now in the early stages of construction. Sandia, the U.S. Bureau of Reclamation, the U.S. Office of Naval Research, and others will use the facility to study new desalination technologies and the use of renewable energy in the desalination process, and to focus management and reuse technologies.

The Tularosa Basin in south-central New Mexico was selected as the desalination facility location because it contains a range of brackish water — from almost fresh to twice as salty as seawater — all within a five-mile radius. A set of wells already has been drilled at different brackish levels in the basin. The desalination facility will consist of six indoor bays where testing can be done side-by-side. Testing will also be conducted outside in three additional test pads.

Arsenic removal

The $3 million for research of arsenic removal from water stems from EPA guidelines that go into effect in 2006, reducing the allowable amount of arsenic in drinking water from 50 parts per billion (ppb) to 10 ppb. Albuquerque is one of many communities affected by the new ruling. Arsenic concentrations in drinking water in the area are highly variable, but average 15 ppb.

The American Waterworks Association Research Foundation (AwwaRF) and WERC — a consortium that includes New Mexico State University, the University of New Mexico, New Mexico Tech, and Dine College — will share the funding with Sandia. Besides the $3 million for the arsenic project, Sandia will receive an additional $1.8 million from another congressional appropriation.

Development of new arsenic removal technologies is the responsibility of AwwaRF. Sandia's role will be to pilot promising new technologies as they get close to commercialization. WERC will handle transfer of the technologies to companies that will commercialize them and sell them to water utilities.

The pilot-scale testing program will evaluate a variety of innovative approaches to reduce the cost of arsenic treatment for small communities, and will specifically address the needs of Native American communities. One of the best treatment methods is the use of adsorbents, natural or man-made materials that have been designed for the purpose of removing arsenic and other contaminants. These materials are packed into containers through which untreated water is forced. The arsenic is adsorbed by the material, and the water comes out with no detectable arsenic. The material then can be disposed of in landfills or regenerated for further use. Systems can be large enough to treat sufficient drinking water for large communities or small enough to fit under a kitchen sink.

Visit www.sandia.gov/news-center.