Abstracts

Thursday, May 1

Session J5: Pesticide Monitoring, Modeling, and Risk Assessment

8:00 – 9:30 am | Room 233

Integration of Surface and Groundwater Modeling and Monitoring Data in Pesticide Ecological Risk Assessments

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Abstract
Under the Federal Insecticide, Fungicide, and Rodenticide Act, the United States Environmental Protection Agency's (USEPA) Office of Pesticide Programs (OPP) is responsible for the regulation of pesticides. As part of the process for assessing risks to aquatic organisms exposed to pesticides , OPP's Environmental Fate and Effects Division (EFED) conducts aquatic exposure assessments that utilize a combination of modeling and monitoring data. Pesticide risk assessments rely principally on modeling for estimates of risk and use a tiered modeling approach for estimating both surface water and groundwater concentrations.

As needed, the tiered approach integrates increasing levels of refinement based on risk conclusions. Modeling begins at a national scale using assumptions about the predominant factors that influence pesticide concentrations in water (*e.g.*, runoff vulnerability). This initial estimation provides a conservative upper-bound estimate of potential pesticide concentrations. Pesticides that exceed screening levels of concern (LOC) for either human health or ecological effects are assessed at the next level of refinement, using Tier II models and an evaluation of available monitoring data. As the tiers increase, the level of sophistication increases as does the spatial and temporal relevance to the estimated exposures.

Since most monitoring data are not targeted to pesticide applications, monitoring data are typically used to characterize modeling estimates. When monitoring data are targeted both temporally and spatially to a specific pesticide use pattern, they can be used as a quantitative measure of exposure provided that the sampling frequency aligns with the duration of concern, and sufficient ancillary data are available to describe the study objectives. In cases where monitoring data are not specifically targeted to a pesticide's use pattern, the data can be used qualitatively to provide context to estimated values derived from aquatic exposure modeling. Monitoring data can also provide information that is lacking in modeling, such as the identification of vulnerable and/or non-vulnerable areas, depending on the spatial extent of the data.

Use of the Co-occurrence Pesticide Species Tool (CoPST) to Model Seasonal and Temporal Patterns of Pesticide Presence to Guide Water Quality Monitoring Timing and Location

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Abstract
A decline in pelagic species has been observed in the San Francisco Bay-Delta, triggering questions as to whether contaminants are contributing to the decline. To help address these questions, Waterborne Environmental, Inc. (Waterborne), in conjunction with University of California Davis, the U.S. Environmental Protection Agency Region 9, and the California Department Water Resources, developed the CoPST (Co-occurrence of Pesticide and Species Tool), which is a GIS/modeling framework that incorporates 40 high-risk pesticides and aquatic endangered species presence to identify areas and timing of greatest risk.

This presentation describes the first application of the tool. In this application, the co-occurrence of endangered species module was not utilized. The question was "when and where monitoring should be focused for specific pesticides, based on historical use application and available monitoring data." Although many monitoring efforts are ongoing in the California Central Valley and Bay-Delta, research has shown that the current temporal and spatial sampling of pesticides may be insufficient to capture the complete profile of water quality. Coordination was necessary with existing monitoring surveys and regulatory programs such as the Central Valley Regional Water Quality Control Board's Irrigated Lands Regulatory Program (ILRP), Surface Water Ambient Monitoring Program (SWAMP), and Delta Regional Monitoring Program (RMP).

The analyses output was a GIS layer using heat map style representation for predicted pesticide edge of field loading indexes, along with layers of actual monitoring results in a monthly time step. The results layer also incorporates a lookup feature by section (640 acres), allowing users to pass their cursor over the indexed sections, showing the individual pesticides that contributed to the modeled index, as well as the corresponding pesticides if present in the actual monitoring data.

Next steps include connecting the model output to current watershed improvement planning efforts, and determining best management practices placement and monitoring priorities.

Pesticide Surface Water Monitoring: Bias Factors to Estimate Peak Concentrations and PRZM-Hybrid to Complete Measured Chemographs

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Abstract
Daily sampling for water quality monitoring at multiple sites is operationally challenging. Consequently, most monitored datasets do not have daily samples. We use bias factors (BFs) to address the following question: If less frequent monitoring datasets are used to estimate exposure, what is the probability or uncertainty of missing potential peak concentrations and/or maximum rolling average concentrations? Bias factors estimate the error in predicting the true peak concentration and/or maximum rolling average concentration from non-daily samples or sampling frequencies. We will present BFs calculated from two datasets representing multiple site-year-chemical combinations for selected sampling frequencies and relate them to watershed characteristics (hydrology, size). Calculated BF results will be compared to measured data for selected site-year-chemical combinations. We will also demonstrate how PRZM-Hybrid output can be used along with calculated BFs and less than daily monitoring data to estimate daily chemographs. This work demonstrates how lower frequency monitoring data can be coupled with model output to estimate potential maximum shorter duration concentrations to address water monitoring management needs.

Pesticide Toxicity Index – A Tool for Assessing Complex Mixtures of Pesticides in Streams

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Abstract

Pesticide mixtures commonly occur in streams with agricultural or urban land in the watershed. The Pesticide Toxicity Index (PTI) is a tool to assess the potential aquatic toxicity of complex pesticide mixtures by combining measures of pesticide exposure and acute toxicity in an additive toxic-unit model. The PTI for pesticides in water is determined separately for fish, cladocerans, and benthic invertebrates on the basis of toxicity data from publicly available databases and documents, consisting of 10,837 bioassays representing 492 pesticides and degradates and 559 species. Two types of PTI values can be computed for use in different applications. The Median-PTI is calculated from median toxicity concentrations for individual pesticides, so is robust to outliers and is appropriate for comparing relative potential toxicity among samples, sites, or pesticides. The Sensitive-PTI uses the 5th percentile of available toxicity concentrations, so is a more sensitive screening-level indicator of potential aquatic toxicity. PTI predictions of toxicity in environmental samples were tested using data aggregated from published field studies that measured pesticide concentrations and toxicity to *Ceriodaphnia dubia* in ambient stream water. *C. dubia* survival was reduced to ≤50% of controls in 44% of samples with Median-PTI values of 0.1–1, and to 0% in 96% of samples with Median-PTI values >1. Empirical 50%-mortality thresholds that correctly predicted toxicity or nontoxicity in 90% of samples in an aggregated dataset were determined to be 0.3 for the Median-PTI and 1 for the Sensitive-PTI. These thresholds are not necessarily applicable to future studies because they are based on a limited number of pesticides and studies. An effort is underway to develop a PTI for hydrophobic pesticides in sediment based on toxicity to benthic invertebrates. The PTI is a relative indicator of potential toxicity that can be used to interpret water-quality data, relate pesticide exposure to biological condition in multi-stressor systems, and prioritize future assessments.