



Anthropogenic Impacts on Water Resources

Developing the basic science of innovative detection, predictive modeling, toxicology and remediation

Recent events in West Virginia have demonstrated the disruptive impacts that environmental contamination can have on society and the regional economy. The chemical release into the waters of the Elk River also demonstrated how little may be known about chemicals that are used in routine industrial applications. In order to understand and manage the risks of environmental contamination, it is imperative to be able to i) detect contaminants, ii) model their fate and transport, iii) predict their toxicity, and iv) understand how they can be removed from the environment.

These significant scientific challenges are being studied at Marshall University.

Detection

Our challenge is to detect biologically relevant contamination in surface waters in cases where the full suite of potential contaminants may not be known. For known or anticipated contaminants, Marshall researchers are working on nano-scale technologies for the direct capture and real-time reporting of chemicals in solution. In order to survey environmental samples for unknown contaminants, we are working on molecular and cell-based methods based on biological stress responses. A biological response indicates the presence of a contaminant or stressor. The type, duration, and magnitude of the responses are being studied to pioneer indirect detection methods that provide information about the cause of the stress.

Model Fate & Transport

In order to manage chemical releases and minimize their societal and economic impacts, we must be able to predict persistence in the environment, and how chemicals will move and change with time. These predictions require complex modeling of both the reactivity of the contaminating chemicals and the physical/chemical characteristics of the environment. This work requires the collaboration of mathematical modelers from the College of Science along with computer scientists from the College of Information Technology & Engineering.

Toxicity

When we do not have robust data on the acute and chronic toxicity of chemicals, we must rely on statistical estimations of risk to make important resource management decisions. It is clear from the MCHM release into the Elk River that the public wants those decisions to be based on sound science, not estimations. There is much work to be done to study the short-term and long-term toxicity of industrial chemicals that may be present in very low concentrations, particularly in understanding any subclinical biological impacts.

Remediation

When industrial chemicals are released into the environment, it is important that we know, or be able to predict, how they will move through the environment and what impacts they will have on aquatic life and human health. When a chemical is released that is known to be both toxic and persistent, we also need to understand the biological and/or mechanical processes that can be used to remove it from the environment. Researchers in both the College of Information Technology & Engineering and the College of Science are studying the remediation of common industrial chemicals under environmental conditions in order to aid in the cleanup process, and restore the environment to full public trust.

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