Modeling the Influence of Irrigated Agriculture on Selenium Levels in the Uncompahgre River in Western Colorado

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Abstract  In 1983, wildlife deaths and deformities caused by selenium in irrigation drainage flows were discovered in the Kesterson National Wildlife Refuge, California. Since that time, a link between local geology, irrigation return flows and toxic levels of selenium in water has been identified. Elevated levels of selenium have been recognized as a significant environmental problem in many rivers and streams of the western United States, including the Upper Colorado River Basin. A large black shale deposit known as the Mancos Shale is found throughout the Uncompahgre River Basin and contains trace levels of selenium. When Mancos Shale soils are irrigated, leaching of selenium occurs and return flows carry various chemical forms of selenium to rivers. To protect aquatic life, the Colorado Water Quality Control Commission has adopted a stringent standard for selenium. In many locations in the Uncompahgre River and downstream in the Gunnison River, this criteria is often exceeded. Meeting this standard will require improved irrigation management and other water management alternatives.

Modeling tools are being developed for the evaluation of agricultural management practices and refinement of current monitoring efforts for on-going evaluation of management alternatives. Hydrologic information is provided by the existing State-mod water allocation model, used by the State of Colorado to simulate water deliveries, return flows, and river flows under the existing water rights structure and future supply/demand scenarios. Spatial agricultural data and water quality sampling data provide additional information for the creation of a constituent mass loading model simulating leaching and transport of selenium and dissolved solids through the irrigation delivery system.

This model will be used to predict potential changes in water quality as a result of changes in irrigation water management. Information from the model will assist an economic analysis of potential Best Management Practices for the reduction of selenium levels to meet downstream water quality criteria.