

SECTION C

Occurrence, Distribution, and Fate of Agricultural Chemicals in the Mississippi River Basin

The Mississippi River Basin drains about 41 percent of the United States and contains one of the most productive agricultural regions in the world. It produces the majority of all the corn, soybeans, sorghum, grain, cotton, livestock, and poultry grown in this country. Streamflow from the Mississippi Basin also provides most of the fresh water, nutrients, and sediment that enter the Gulf of Mexico. These inputs help make the Louisiana-Texas Gulf shelf one of the most productive fisheries in the world. The combined economic value of these two major industries has been estimated at more than \$100 billion (Malakoff, 1998). Maintaining a highly productive and profitable agricultural economy in the basin requires extensive use of pesticides and chemical fertilizers. It is estimated that more than 100,000 metric tons of pesticides and about 6.5 million metric tons of commercial nitrogen fertilizers are applied to cropland in the basin each year. Most of these chemicals serve their intended purposes, which are to control weed and insect pests, and to increase crop yields. However, a small fraction of some of these chemicals leaks into the environment and may contaminate surface and ground water resources, air, rainwater, and the marine environment. To investigate the occurrence, transport, and fate of agricultural chemicals in the water resources of the Mississippi River Basin, the Toxic Substances Hydrology Program has conducted a number of large-scale nonpoint source studies during the past 10 years. The Midcontinent Herbicide Project, the Mississippi Delta Cotton Pesticides Project, and the Gulf of Mexico Hypoxia Assessment are included in these studies. The overall goal of these studies is to help provide the scientific basis needed to develop agricultural management practices that protect the quality of the region's water resources.

The Midcontinent Herbicide Project began in 1989. Its objectives are to determine the occurrence, transport, and fate of herbicides and herbicide degradates in water resources in the Mississippi Basin. The primary focus of the project has been on herbicides used in the production of corn and soybeans in a 10-State area in the upper Midwest, and in the Mississippi River. During the past 10 years the project has conducted regional-scale studies of herbicides in streams, reservoirs, ground water, rainwater, and air throughout the study area. The project also has supported the development of new analytical methods, including immunoassays for the determination of herbicides, insecticides, and some of their degradates in water and air. The following papers present some of the recent findings from this project.

The Mississippi Delta Cotton Pesticides Project was developed in the mid-1990s to investigate the land use, chemical, and physical processes associated with pesticides used in the production of cotton. Much of the work on this project to date has been done in the Mississippi Delta in collaboration with the Mississippi Embayment Project of the National Water-Quality Assessment Program. However, the study area also includes cotton production areas in Texas, Arizona, and California. Specific objectives of this project are to:

- 1) Compile and map the current use of pesticides across the cotton belt,
- 2) Determine which pesticides and degradates enter surface and ground water of the cotton belt and develop models to predict their occurrence,
- 3) Use knowledge gained from the Midcontinent Herbicide Project to examine the most critical geochemical processes that affect the fate, transport, and toxicity of cotton pesticides in surface and ground water, and
- 4) Develop analytical methods to determine the occurrence of cotton pesticides and degradates in water resources.

Several of the following papers present the results of field investigations of cotton pesticides and results of analytical methods development.

The Gulf of Mexico Hypoxia Assessment was initiated in 1997 at the request of the White House Office of Science and Technology Policy. The purpose of this science assessment is to determine the causes and consequences of oxygen depletion in the Gulf of Mexico along the Louisiana-Texas shelf. As part of the assessment the USGS was asked to determine the sources and loads of nitrogen, phosphorus, and silica entering the Gulf, and to determine which human activities are most responsible for contributing these nutrients. The following papers present information on the flux of nitrogen in Mississippi River waters, and on sources of nitrogen, including atmospheric deposition, in the basin.

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