WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

TOXIC SUBSTANCES HYDROLOGY PROGRAM: SURFACE-WATER CONTAMINATION

BACKGROUND

The introduction of synthetic organic chemicals and trace metals into the Nation's rivers, lakes, and estuaries through human activities has had an adverse impact on the suitability of these waters as a source of drinking water and as a habitat for aquatic life. Incidents of surface water contamination that have received wide attention from Federal, State, and local agencies, as well as the general public, include kepone in the James River in Virginia, PCB's in the Hudson River in New York, various organic chemicals in Puget Sound in Washington, and the impacts of agricultural practices on surface waters throughout the Nation. In order to effectively manage contaminated areas and to prevent future contamination, information is needed about the factors that affect the fate and transport of toxic substances in surface waters.

FACTORS AFFECTING CONTAMINANT TRANSPORT AND FATE

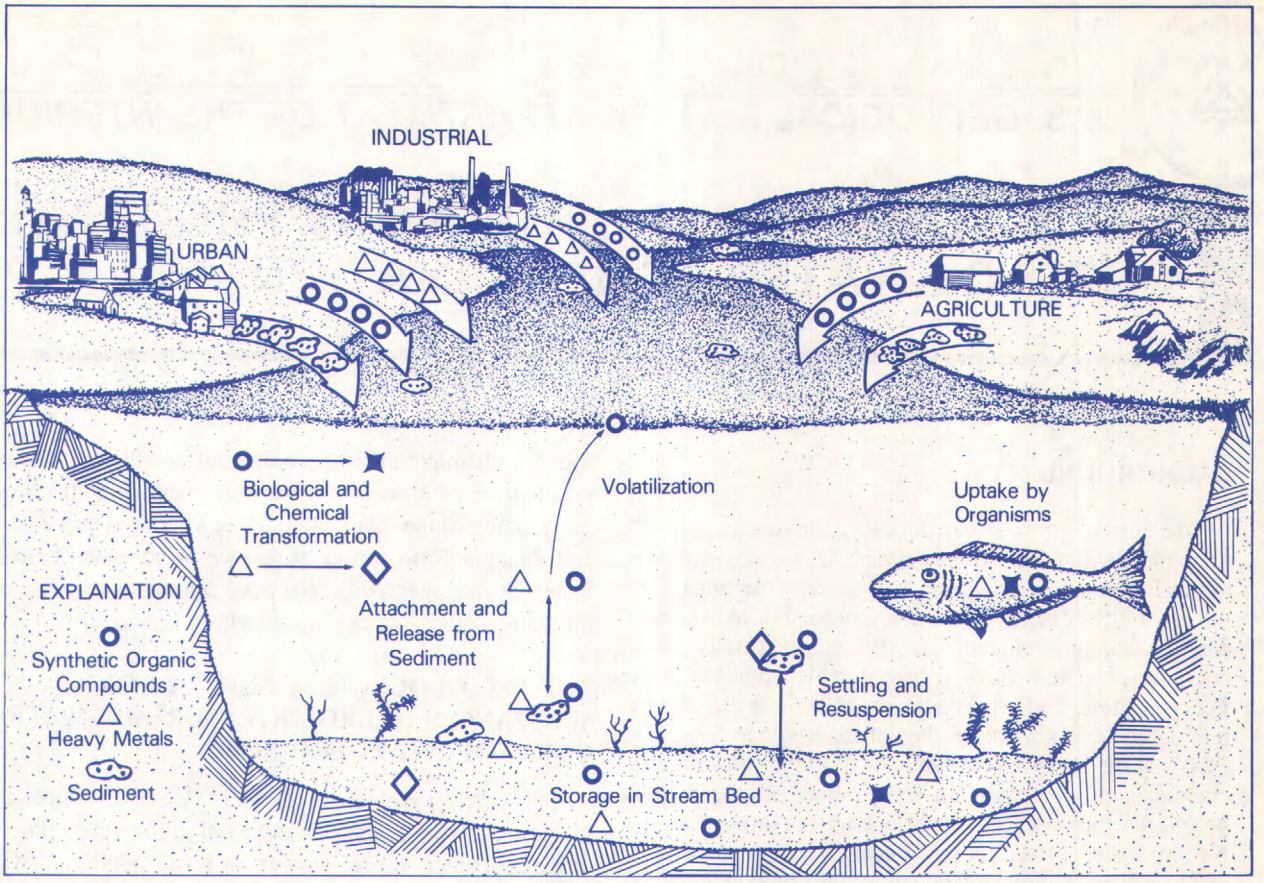
Toxic substances enter surface waters from sources such as industrial effluents, urban runoff, drainage from active and abandoned mines, and agricultural use of pesticides. Within a body of water, a variety of natural processes affect contaminant movement and fate. Some of these processes are illustrated in the figure. Chemical and biological transformations result in substances that have different chemical properties and that may be more or less toxic to aquatic life. Some hazardous substances attach to and are transported by suspended sediment. In areas such as reservoirs or estuaries where suspended sediment settles out of the water column, trace metals and synthetic organic chemicals associated with that sediment will be deposited. If undisturbed, sediment-bound contaminants are a long-term source of potentially toxic substances. These contaminants may be released over time back into the water where they are more available to aquatic organisms and may therefore be more of a threat. If disturbed by floods or by human activities such as dredging, the sediment-associated substances may be transported to previously uncontaminated areas. Depending on specific chemical and environmental conditions, one or all of these processes may be important. Scientific understanding of the many factors that affect the movement and chemical form of toxic substances is necessary to help resource managers take effective action to prevent or mitigate surface-water contamination.

THE U.S. GEOLOGICAL SURVEY TOXIC SUBSTANCES HYDROLOGY—SURFACE-WATER CONTAMINATION PROGRAM

The U.S. Geological Survey (USGS), since its inception in 1879, has been involved in the development of earth-science information about water quality. USGS studies in hydrology, chemistry, and biology provide the scientific basis necessary to investigate the complex factors that affect contaminant transport and fate. In fiscal year 1984, the USGS began an interdisciplinary program, the Toxic Substances Hydrology—Surface-Water Contamination Program, to provide additional understanding of surface-water contamination. A complementary effort within the Toxic Substances Hydrology Program addresses ground-water contamination.

PURPOSE

The purpose of the Toxic Substances Hydrology—Surface-Water Contamination Program is to provide the earth-sciences information needed to improve waste-disposal practices and to mitigate or prevent further contamination of water resources by toxic substances. To do this, scientists in the program (1) develop and evaluate methods to assess the distribution of hazardous substances in surface water, sediment, and biota and (2) conduct applied and basic research on the physical, chemical, and biological processes that affect the movement and fate of toxic substances. This information is necessary to help appraise the occurrence and distribution of hazardous substances in the environment and to predict how their concentrations will change over time and over distance from a contaminant source.



ACTIVITIES

Because a number of complex factors affect contaminant transport, interdisciplinary research is necessary to obtain the fullest understanding of the movement and fate of toxic substances. The program brings together scientists representing a variety of disciplines, such as hydrology, geology, chemistry, geochemistry, microbiology, and aquatic biology, to study important types of contaminants in selected hydrologic environments. River systems under study have been affected by (1) mine wastes containing high concentrations of arsenic, (2) industrial effluent containing a variety of organic chemicals, (3) water from mine drains and mine tailings that contains high concentrations of metals, and (4) pesticides used in agriculture.

Major research is required to improve methods for sample collection, sample preparation, and analysis for toxic substances. Efforts are being directed toward better techniques to obtain representative samples of sediment and associated contaminants; improving methods for extracting both metals and organic chemicals from solids; and improving the ability to detect and quantify substances present at extremely low concentrations.

Resource managers in Federal agencies, State and local governments, and industry require scientific understanding in order to prevent or mitigate contamination. Scientifically based decisions about waste disposal, chemical use, effluent discharge, and land use can help prevent contamination. Remedial action at contaminated sites will be more effective if based on a sound understanding of natural processes. The information gained from the program expands the scientific basis for these management decisions.

For further information on technical reports, overview reports, and hydrologic data contact:

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