WATER QUALITY AND SEDIMENTATION

Water quality is important to all life on the Mississippi River. Without good water quality, aquatic organisms like fish, mussels and invertebrates would not be able to survive and plants could not grow and provide food and cover for a variety of species.

Many attributes are included when one talks about water quality. Dissolved oxygen, temperature, pH and turbidity are some of the easier parameters to measure. Other elements measured may be considered pollutants (lead, mercury, nitrogen) even though they naturally occur in the environment, however, human activities along the Mississippi River and in its watershed have greatly altered the balance of many nutrients and water quality characteristics. Humans have also introduced a host of synthetic chemicals that will affect the environment for many years to come.

BACKGROUND

The Mississippi is the third longest river in the world, bordering 10 states along its course through the United States. A watershed of this size faces unique water quality issues. Unfortunately, the Mississippi does have some pollution problems, with several stretches of the river not meeting the basic national goal of fishable, swimmable waters established by the Clean Water Act. Human health is threatened in many areas by

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contaminated fish, polluted swimming beaches and toxic pollution. Inadequate water quality criteria, inconsistent standards and insufficient monitoring are partially to blame for the Mississippi's problems. Comprehensive and consistent water quality standards are especially critical to the river since so many communities downstream rely upon the efforts of upstream states to protect, maintain and enhance water quality.

Water quality problems occur throughout the length of the Mississippi, though the type and seriousness vary. The most severe water quality problems tend to occur adjacent to and downstream from major metropolitan areas because of point-source pollution. This type of contamination is a product of industry, power plants and wastewater treatment plants, as well as polluted runoff from city streets, parking lots and construction sites.

The lower Mississippi River (from Cairo, Illinois to the Gulf of Mexico) is particularly prone to point-source pollution since Arkansas and Louisiana house some of the country's most polluting industries. Point discharges are also significant on the Upper Mississippi, but they are more localized. Non-point runoff from urban areas and agricultural land is probably a greater contributor to the pollution problem of the Upper Mississippi River.

What is the present condition of the Mississippi River?

In many respects, the Upper Mississippi River is cleaner today than it was 30 years ago. Increased awareness of how pollution can negatively impact humans and the environment prompted passage of laws to protect our natural resources, however, the ecology of the Mississippi River and its tributaries is still rapidly being altered. Navigation, dredging, construction, wetland development, agricultural practices, urbanization, industrial waste discharges and increased recreational use continue to take their toll.

Why should we monitor the water quality of the Mississippi?

The Mississippi River with its backwaters, wetlands and floodplain forests provides valuable habitat for many fish and wildlife species. Over 20% of the North American ducks feed and rest on the Upper Mississippi River during migration. The Upper Mississippi National Fish and Wildlife Refuge acts as home to approximately 300 resident and migratory bird species, including bald eagles and tundra swans. Other wildlife inhabiting the bottomlands and bluffs along the river and its tributaries include 50 species of mammals, 45 species of reptiles and amphibians, 154 species of fish, and 50 species of mussels. All of these creatures are dependent on good quality of water for survival.

The water quality of the Mississippi affects more than just wildlife however. Approximately 18 million people rely on the river and its tributaries in the central United States for drinking water. The river generates over 1.2 billion dollars in annual expenditures from recreational activities. The Mississippi River also serves as a

transportation channel for bulk commodities, and as a wastewater disposal site. Unless action is taken, the slow but progressive loss of backwaters will continue, water quality will not improve, dredging costs will remain high, and we will potentially face the loss of a beautiful and irreplaceable natural resource.

POLLUTION AND CONTAMINATION OF THE MISSISSIPPI RIVER

In its many journeys, water may be contaminated by numerous substances and conditions. For the most part, these substances and conditions alter water in such ways that it becomes a hazard to wildlife, wildlife habitat and humans. Some effects are direct, others are indirect. Pollutants, like PCBs and heavy metals, "bond" to silt and clay particles in the water and can be transported by the River's current.

Polychlorinated Biphenyls (PCBs) are man-made chemicals that are colorless and odorless. Up until the late 1970's PCBs were widely used industrial chemicals because of the nature of their chemical and thermal stability. PCBs were used in fluorescent light fixtures, carbonless paper, adhesives, plastics, paints, varnishes and sealants, as well as for coolant insulation fluids in electrical equipment. The United States produced 1.5 billion pounds of PCBs between 1930 and 1975. Unfortunately PCBs were later found to be dangerous chemicals. Their stable tendencies prevent their breakdown into less toxic chemicals and consequently PCBs are quite persistent in the environment. As a matter of fact, PCBs are currently the river contaminants of greatest concern for Minnesota, Wisconsin, and Iowa.

Prolonged exposure to even small concentrations of PCBs can lead to health problems such as liver damage, cancer, and growth and developmental problems. In 1977, Monsanto Chemical Company, the sole producer of PCBs in the United States, stopped the manufacture of the chemical. The Toxic Substances Control Act banned the manufacture of PCBs in open systems in 1979.

Monitoring has shown the presence of PCBs throughout the country, including areas isolated from PCB manufacturers. It is estimated that over seven billion pounds of PCBs have escaped into the environment via discharges to the air, land and water. The chemicals periodically escape during spills or when old equipment is discarded. When PCBs leach out of the landfills they end up in our rivers, lakes and air (through evaporation). Once these chemicals enter the aquatic environment, they are incorporated into the food chain, becoming progressively more and more concentrated in the upper levels of the food web. This process is called biomagnification.

Mercury is a heavy metal that is routinely tested for in fish because it also accumulates in the muscle tissue of animals and can become biomagnified by the same process presented above. Several actions by humans are reducing the impact of mercury contamination. These actions include better handling practices in manufacturing industries and the recycling of batteries.

SEDIMENTATION

The filling in (sedimentation) of the Mississippi River and it's backwaters with silt and sand particles is one of the River's most serious problems. The accumulation of silt in backwaters fills in important habitat for fish and wildlife, and covers up spawning grounds. Sand that accumulates in the main channel of the Mississippi River, contributes to the high cost of dredging required to maintain the 9-foot navigation channel.

This filling in process, or sedimentation, varies for different parts of the river, but it can be substantial. For instance, in 1940, the land area of the delta where the Grant River joins the Mississippi River near Potosi, Wisconsin was 116 acres. By 1987 the delta had expanded to almost 500 acres in size.

Sedimentation is one of the most visible, and yet one of the most difficult problems to address on the river. Sources are widespread and as varied as the rural and urban land drained by the river and it's tributaries. Lack of individual accountability for these sedimentation sources complicates the issue.

Most sources of sediment are associated with soil erosion from croplands, streambanks, pastures, and construction of highways, homes and commercial sites - essentially anywhere soil and sand are washed away by rainfall or floods. The amount of soil washed away can be sizable. For every unprotected acre under construction, about a dump truck and a half of soil washes into a nearby lake or stream. This amount increases depending on the slope. This is not to say high erosion rates are an unavoidable part of farming or construction. Many farmers use a variety of practices to reduce erosion from their fields: strip cropping, buffer strips along streams, rotational grazing and contouring. However, a "few bad apples" can offset some of these gains. For example, it is estimated that 10 per cent of the farmers may be responsible for as much as 90 percent of the erosion problems associated with farming. Erosion control during construction activities can be reduced or avoided by using silt curtains to "trap" sediment, storm water retention ponds, and proper grading.

Other sources of sediment may not be readily apparent. For example, the sand and dirt on the roads that wash into the storm sewers (particularly in spring) are also a contributing source, as are grass clippings that are dumped into the streets. Even organic material helps to fill in the river. Storm sewers are a direct source of sediments (and contaminants) in the river because they exit directly into a convenient water body like a creek, or river that eventually drains into the Mississippi River. A method to reduce the impact of storm sewers is to use retention ponds to slow the runoff in urban and areas and give sediment a place to settle out before being released to streams and rivers.

Streambank erosion can be a significant source of sediment for some stretches of the Mississippi River because of the large amounts of eroded topsoil deposited on the valleys during the early 1900's. In 1935 enough sediment had eroded into the Kickapoo

valley floor that if it was all stacked on Lambeau Field you would have a dirt monument 12.4 miles high. If stream banks are not protected by vegetation or are heavily grazed, soil is susceptible to being moved downstream, particularly during floods. Movement of sediment can be substantially slowed as demonstrated by the changes that have taken place along the Kickapoo River. In 1958, state biologists said that for all intents and purposes Coulee trout stream fishing would disappear in the future (due to the conditions of the streams and rivers). Today we are working to reestablish native trout in the Kickapoo River because the condition of the stream has been so greatly improved.

Streambank erosion that is accelerated by human actions can be addressed in a number of ways. One of the most environmentally friendly ways is to keep the banks of the stream vegetated by limiting the access of livestock to the stream, or maintaining a buffer strip between the stream and adjacent farm fields.

Sedimentation also has positive effects. Sediment is an important component for some habitat types on the Mississippi River. Shorebirds heavily utilize sand bars and mud flats created through sedimentation. Sedimentation has helped to literally bury some of the pollutants that once flowed downstream in high amounts from the Twin Cities Metropolitan area. The freshly eroded silt carried by the river has covered older deposits of sediment laden with PCBs, heavy metals and other toxins. This "burying" of contaminated sediments effectively improved the water quality of the river downstream from the lake. In addition, the sand deltas that extend out into the Mississippi River from tributaries produce some of the richest wildlife habitat on the river.

The sources of sediment in the river are many and the deposition of sand and silt in the river is an inevitable and natural process. Thus it is a process which we can reduce, not eliminate. Sustaining the fish and wildlife resources we enjoy will require responsible and active participation from many of us.

Specialized Terms

Bioaccumulation - the uptake and retention of substances by an organism from its surrounding environment and from its food. Chemicals increase in concentration as they move through the food chain. Organisms at the upper end of the food chain such as predator fish, or people or birds that eat these fish may end up with very high concentrations of some chemicals.

Biomagnification - the process whereby certain substances such as pesticides or heavy metals move up the food chain, work their way into rivers or lakes, and are eaten by aquatic organisms such as fish, which in turn are eaten by large birds, animals or humans. The substances become concentrated in tissues or internal organs as they move up the chain. (See: bioaccumulants.)

Clean Water Act - Federal law that set national policy for improving and protecting the quality of the nation's water. The law set the timetable for cleanup of the nation's waters so that they are fishable and swimmable. The law also required all pollutant dischargers to obtain a permit and meet the conditions of the permit. To accomplish this pollution cleanup, billions of dollars have been made available to help communities pay the cost of building sewage treatment facilities. Amendments to the Clean Water Act were made in 1977, 1981, and 1989.

Effluent - a complex waste material (e.g., liquid industrial discharge or sewage) which may be discharged into the environment.

Impoundment - A lake or reservoir which is usually human-engineered and has a stream flowing in as well as an outlet; often formed by dams. Because of nutrient and soil loss from upstream land use practices and the slowed current, impoundments usually have higher nutrient concentrations and faster rates of sedimentation than natural lakes.

Leachate - the contaminated liquid resulting from water seeping through a landfill or other materials. It contains water and dissolved and decomposing solids. Leachate may enter the groundwater and contaminate drinking water supplies.

Navigation pool - Span of river between 2 adjacent locks and dams; navigation pools are numbered consecutively from upstream to downstream. A pool is named after the lock and dam that creates it. For example, lock and dam 12 impounds water that creates pool 12.

Nonpoint source pollution - pollutants that enter the water from a variety of nonspecific sources; e.g., agricultural runoff, urban runoff, atmospheric deposition.

Point source pollution - pollutants that enter the water from a localized source; e.g., industrial discharge, wastewater treatment plant discharges, overflow from combined storm/sanitary sewer systems.

Polychlorinated Biphenyls (PCBs) - a group of over 200 compounds which have been manufactured since 1929 for uses such as electrical insulation, heating/cooling equipment, etc. Despite being banned in 1979 due to their environmental persistence, PCBs are still being detected in air, soil, and water. Some members of the PCB family have chemical structures and biochemical characteristics similar to dioxins and other neurotoxins such as dioxon. PCBs have been linked to health problems such as embryo mortality and deformities in wildlife, and are suspected of causing developmental problems in human infants.

Sediments - particles of soils, sand, silt, clay and minerals wash from land and paved areas into creeks and tributaries. In large unnatural quantities, these natural materials can be considered a pollutant. Construction projects often contribute large amounts of sediment. Certain lumbering practices affect sediments in runoff. Sediments may fill stream channels and harbors that later require dredging. Sediments suffocate fish and shellfish populations by covering fish nests and clogging the gills of bottom fish and shellfish.

Turbidity - water clarity; degree of muddiness or cloudiness due to stirred up sediments.