Climate Change and Clear Skies Initiative

On February 14, 2002, President Bush announced two new initiatives aimed at reducing toxic air emissions: the Clear Skies Initiative and the Global Climate Change Policy.

The goal of the Global Climate Change Policy is to cut greenhouse gas intensity (defined as the ratio of greenhouse gas emissions to economic output) by 18 percent over 10 years. This plan includes a 5-year, $4.6 billion commitment to tax credits for renewable energy sources and cogeneration.

Other key domestic components of the policy include (1) voluntary challenges to businesses to reduce greenhouse gas emissions; (2) transportation programs to promote development of fuel-efficient motor vehicles, research options for producing cleaner fuels, and programs to improve energy efficiency; and (3) a 10-year commitment to enhance natural storage of carbon by plant material by implementing and improving the conservation title of the Farm Bill.

The policy also has international components, including increased funding for "Debt-for-Nature" programs, funding of climate observation systems in developing countries, expanded technology transfer and capacity building in developing countries, and international research cooperative agreements (for example, with Japan, Italy, and Central America). For more information, see *http://www.whitehouse.gov/news/releases/2002/02/print/20020214-5.html*

LMMB Project Summary

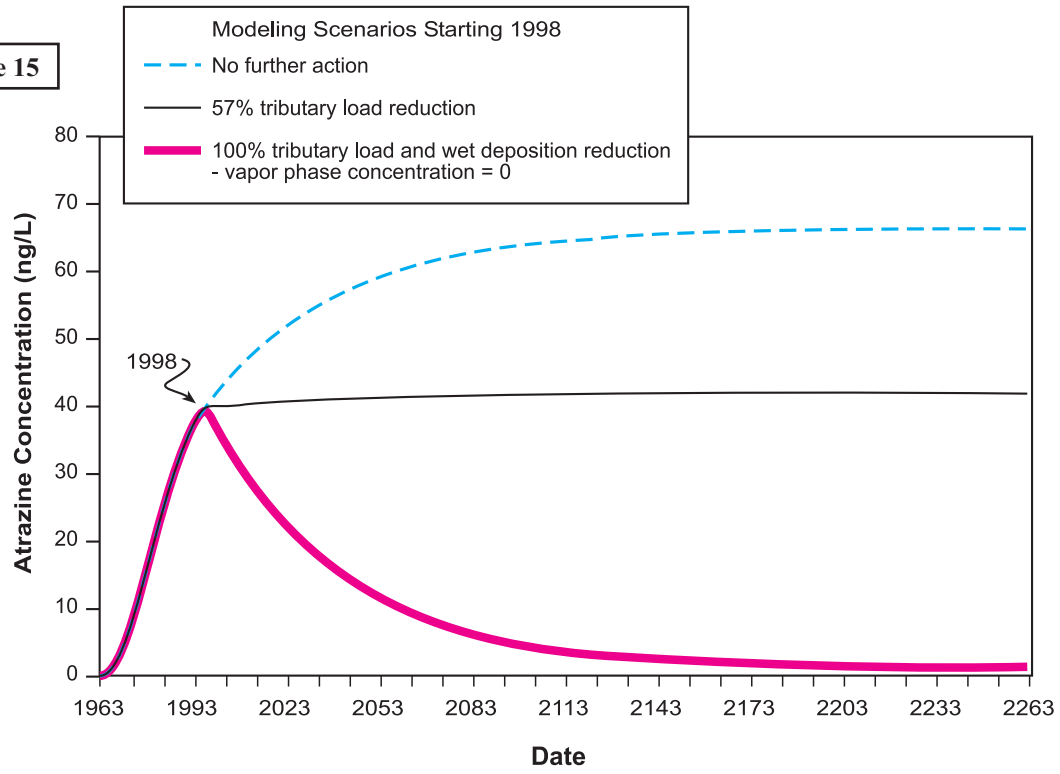
Preliminary model results are currently available for PCBs and atrazine only. Model results for mercury and trans-nonachlor will be released in the next 2 years. The PCB model results indicate that a 50 percent reduction in PCB loads to Lake Michigan will be needed to reduce lake trout fish tissue concentrations to below the fish consumption advisory level of 0.5 g/g by 2020. In order to maintain atrazine levels at 40 ng/L in the open waters of the lake, the atrazine model predicts that a 57 percent reduction in tributary loading levels will be needed.

Federal Conservation Programs

Innovative programs such as USDA's Environment Quality Incentive Program (EQIP) provide a "systems approach" for addressing agricultural nonpoint source pollution to Lake Michigan. This approach allows for sustainable production of food and fiber products while maintaining environmental quality and a strong natural resource base. In addition, EPA has several standing programs (for example, Section 319 nonpoint source pollution control) to address soil erosion and sedimentation within the basin.

Lakewide Atrazine Concentration Forecasts (Lake Michigan 41 Segment Model)

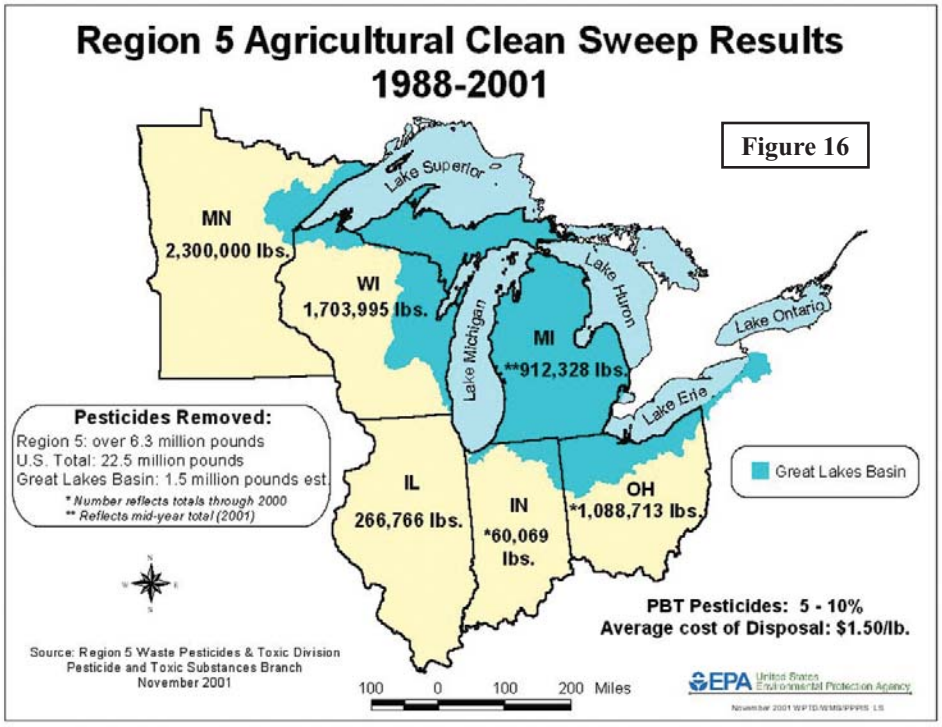
Figure 15



Other Pathways of Pollutant Load to Lake Michigan

While the LMMB study focused on four pollutants to develop a better understanding of pollutant fate and transport within the Lake Michigan ecosystem, many other pollutants are entering the ecosystem through a variety of pathways. The following discussion addresses recent investigations of four of these pathways:

- Atmospheric deposition,
- Nonpoint source runoff, including combined sewer overflows (CSO)
- Sediment
- Groundwater



Atmospheric Deposition

The role of air pollution as an important contributor to water pollution has long been recognized and has been the subject of growing scientific study and concern in recent years. Over the past three decades, scientists have collected a large and convincing body of evidence showing that toxic chemicals released into the air can travel great distances before they are deposited on land or water. Most notably, PCBs and some persistent pollutants (including several pesticides that have not been used in significant amounts in the United States since the 1970s) have been widely distributed in the environment and are now part of the global atmospheric background. Section 112 of the Clean Air Act required congressional reports of the effect of air deposition on the "Great Waters" of the United States, including the Great Lakes.

Loadings of pesticides whose use has been canceled or restricted in the United States to Lake Michigan are primarily from atmospheric sources that may be impossible to regulate or control. Although there are no current commercial sources of banned pesticides in the United States, loadings continue from use of remaining consumer stocks, evaporation from soils, resuspension of contaminated sediments, and atmospheric transport from other countries that continue to apply these substances. Further pesticide reductions can only be achieved through cleanup of contaminated sites, collection and disposal of existing stockpiles ("clean sweeps"), and use reduction in other countries.

Between 1988 and 2001, EPA Region 5 estimates that agricultural clean sweeps have removed 1.9

The Great Lakes Air Deposition Strategy

In January 2002,EPA published its Great Lakes Air Deposition (GLAD) Strategy: Priorities for U.S. EPA's National Geographic Initiative Grants. The strategy is intended to assist EPA Region 5 and the Great Lakes states in allocating Great Lakes National Geographic Initiative funds over the next 5 years by identifying high-priority activities. There are four high priority areas: (1) air deposition and source characterization monitoring, (2) emission inventory development and emission inventory development and emission factor development, (3) atmospheric and multimedia modeling, and (4) assessments of effects on aquatic life and wildlife. Additional information on the GLAD Strategy and proposal requirements is available at *http://www.epa.gov/region5/air/glakes/glad.htm*

Conservation and Buffer Strips Along Waterways

Federal legislation has established several programs to provide financial incentives or actual payments to agricultural landowners who choose to take land out of production. Using prescribed land cover for 10 to 15 years is a means of reducing agricultural runoff and the resultant erosion, sedimentation, water quality degradation, and habitat destruction in streams and lakes. Among these programs are the Conservation Reserve Program (CRP), the Conservation Reserve Enhancement Program (CREP), and the Continuous CRP (CCRP), which are managed through the Department of Agriculture's Natural Resource Conservation Service (www.nrcs.usda.gov). The U.S. Fish and Wildlife Service operates a private land management program to provide cost-sharing incentives to individual landowners for habitat improvement projects. There are similar programs at the state and local levels offering grants, tax offsets, or conservation easements. These programs are accomplished through local, voluntary partnerships between individuals and government and make use of financial incentives, which limits the number of participants because of resource constraints.

While long-range atmospheric transport is an important pollutant source for Lake Michigan, recent studies also point to the influences of local sources, particularly from urban areas. For example, air sampling over Lake Michigan when the wind is blowing from the southwest shows contributions of PCBs, PAHs, and mercury from the Chicago area to the lake. The relative importance of each pollutant source to the overall loadings is variable depending on the season and local weather conditions.

million pounds of pesticides from the Great Lakes basin (Figure 16)Figure 16

Nonpoint Source Pollution

EPA identifies polluted runoff as the most important remaining source of water pollution and provides for a coordinated effort to reduce polluted runoff from a variety of sources. Previous technology-based controls, such as secondary treatment of sewage, effluent limitation guidelines for industrial sources, and management practices for some nonpoint sources, have dramatically reduced water pollution and laid the foundation for further progress. However, nonpoint source loads continue to turn rivers and streams into pollutant pathways to the lake. Total maximim daily load (TMDL) studies will be needed for these tributaries to identify the management measures needed to bring them back into compliance with water quality standards. Over the next several years, states will be developing many TMDLs for pollutants entering into water bodies from both point and nonpoint sources. TMDLs will help manage water quality on a watershed scale.

Major sources of nonpoint pollution include urban stormwater runoff, discharges from animal feeding operations, cropland runoff, and episodic combined sewer overflows.

Stormwater is water from rain or snow that runs off city streets, parking lots, construction sites, and residential yards. It can carry sediment, oil, grease toxicants, pesticides, pathogens, and other pollutants into nearby storm drains. Once this polluted runoff enters the storm sewer system, it is discharged, usually untreated, into local streams and waterways. It can contaminate drinking and recreational waters and remains a major source of beach closures.

In late 1999, EPA promulgated rules to reduce stormwater runoff from construction sites between 1 and 5 acres and municipal storm sewer systems in urbanized areas serving populations of less than 100,000 through the issuance of permits. These controls must be in place by 2003.

This new stormwater rule builds on the existing program to control stormwater runoff from municipalities with populations greater than 100,000 and 11 industrial categories, including construction disturbing over 5 acres. Under the expanded program, sediment discharges from approximately 97.5 percent of the acreage under development across the country will be controlled through permits.

The Lake Michigan basin has a high concentration of agricultural enterprises where animals are kept and raised in confined environments. Polluted runoff from animal feeding operations is a leading source of water pollution in some watersheds. Potential impacts include the absence or low levels of dissolved oxygen in surface water, harmful algae blooms, fish kills, and contamination of drinking water from nitrates and pathogens and beach closures.

For the vast majority of animal feeding operations (AFO), voluntary efforts will be the principal

approach to assist owners and operators in developing and implementing site-specific management plans. Impacts from higher risk, confined animal feeding operations (CAFO), such as sites with the equivalent of 1,000 beef cows, are addressed through National Pollutant Discharge Elimination System (NPDES) permits under the authority of the Clean Water Act. About 5 percent of all animal feeding operations are expected to need permits.

Control of Combined Sewer Overflows

Combined sewer overflows (CSO) continue to be a major source of pollution in the Lake Michigan basin. Combined sanitary and storm sewers were commonly built throughout the Lake Michigan watershed as an economical means of managing urban wastewater. These systems are heavily concentrated in the northeast and Great Lakes regions. Under normal conditions, these combined systems are able to transport sanitary wastes and limited amounts of stormwater to a wastewater treatment plant for disposal. However, during heavy precipitation events, the combined sewer can become overloaded and discharge the untreated overflow containing sanitary and stormwater directly into surface waters. Because the overflows contain pathogens, toxic pollutants, solids, and debris, CSOs can create serious public health and environmental problems. CSOs are considered point sources under the Clean Water Act and are therefore subject to regulation.

Dredging Lake Michigan*
Photograph courtesy of USEPA

Sediment sampling aboard EPA research vessel, "Mud Puppy" in Indiana Harbor Canal
Photograph courtesy of EPA, ARCS program*

On January 29, 2002, EPA delivered a Report to Congress on Implementation and Enforcement of the Combined Sewer Overflow Control Policy. This report provides an overview of the progress made in controlling CSOs across the United States. It also provides state-by-state summaries of CSO control programs. Additional information on the report and state CSO programs as well as the state-by-state summaries can be found at http://cfpub.epa.gov/npdes

Sediments: Both a Contaminant and a Pathway

Land disturbed by natural or man-made processes produce sediments that impair tributary mouths and spawning areas. Better understanding of sediment movement in the lake is the goal of the Episodic Events: Great Lakes Experiment (EEGLE) at www.glerl.noaa.gov/eegle/.

Sedimentation in the tributary mouths and nearshore areas of Lake Michigan has been an ongoing problem. See Appendix B for a summary of sediment contamination and cleanups at the Lake

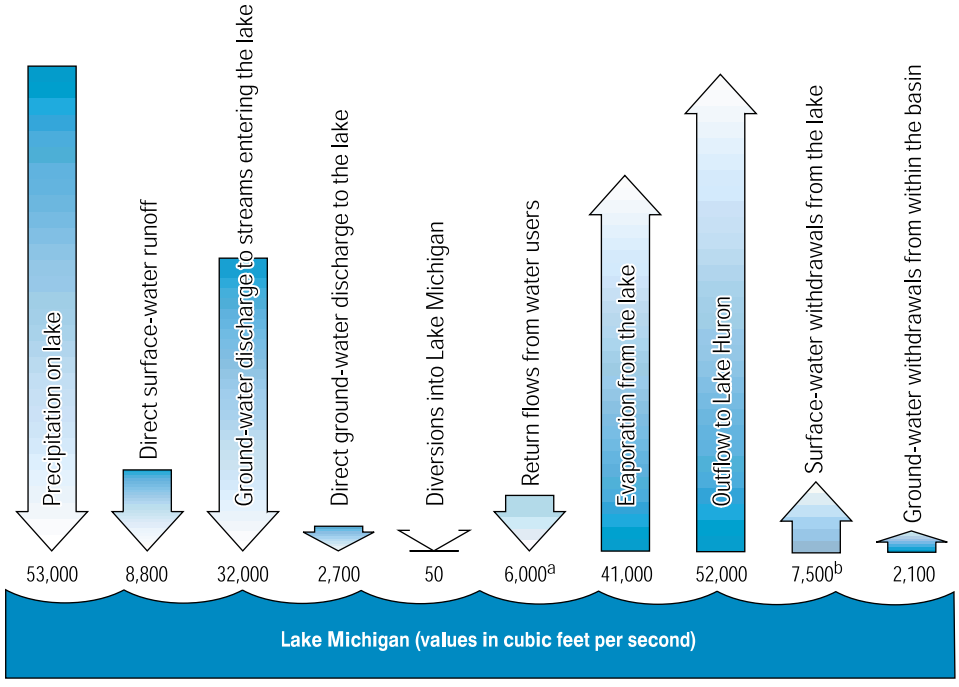
Michigan AOCs. Substances found in Lake Michigan sediment reflect the land uses in the upper portions of the watershed. Runoff from agricultural lands washes soil particles as silt that can smother aquatic habitat. The soil particles may also carry agricultural chemicals and nutrients into water bodies. Urban runoff also contributes sediments contaminated with pesticides, nutrients, oils, and other pollutants. Other substances deposited into the lake and its tributaries, such as PCBs, may bind preferentially with sediment particles. These substances accumulate or persist in the tributary mouths and nearshore areas because unlike smaller rivers that are constantly flushed with water, the lake is a sink. A drop of water entering Lake Michigan will take an average of 100 years to either evaporate or be washed into Lake Huron. The retention time for a particle of sediment is even longer.

Remediating Lake Michigan's legacy of contaminated sediment continues to be a high priority, and some progress has been made toward remediating the most highly contaminated sites on the lake in the past two years. As discussed under subgoal 1 "Can we all eat any fish?," two examples are moving forward on the Fox River in Wisconsin and Grand Calumet River in Indiana. The removal of 700,000 cubic yards of contaminated sediment from the east branch of the Grand Calumet River is targeted to begin in 2002. The cleanup is a result of a $30 million settlement between the Federal government, the State of Indiana, and USX. The sediments targeted have been highly contaminated with PCBs, heavy metals, benzene, PAHs, and cyanide. Approximately 4.65 million cubic yards of contaminated sediment will eventually be removed from the Indiana Harbor Ship Canal.

Sediment dredging is also moving forward in other areas of Lake Michigan. The U.S. Army Corps of Engineers is moving forward with a Comprehensive Dredge Material Management Plan for Waukegan Harbor, Illinois. The plan calls for dredging 250,000 cubic yards of polluted material and disposing the material in a confined disposal facility.

Finally, progress is being made to reduce future siltation and sediment contamination problems. The Lake Michigan Forum has formed an Agriculture Pollution Prevention Task Force to address specific pollution prevention projects for sediments and pesticides in the Lake Michigan basin. In winter 1999, the Forum held a workshop on sediment issues

Figure 17



[a] Return flow is reduced by 3,200 ft^3/s that is diverted out of the basin at Chicago, Ill.

[b] Withdrawals for power plant cooling not included

Citation: USGS

in the basin based on input received from the task force. The Buffer Initiative is also an important step forward in controlling this pathway. (see p. 77)

Groundwater Pathways in Lake Michigan

Groundwater enters the Great Lakes as either direct or indirect discharge. Direct groundwater discharge is flow directly into a lake through the lake bottom. Indirect groundwater discharge is flow into a lake by way of a tributary stream.

Groundwater discharge is a significant determinant of the biologic viability of tributary streams and coastal wetlands. In undisturbed areas, groundwater discharge throughout the year provides a stable inflow of water with consistent dissolved oxygen concentration, temperature and water chemistry. Where land uses significantly reduce groundwater flow to a stream, reaches of the stream or wetlands may lose their biologic viability. Likewise, where land uses add contaminants to a stream or wetland, they also may become impaired.

Lake Michigan is the only Great Lake for which there is enough information to estimate direct groundwater discharge. Figure 17 represents the relative contribution of groundwater and surface water to Lake Michigan.

Until recently, the impact of groundwater on surface water quality has largely been ignored. Nonetheless, groundwater can have a significant effect on the quality of water in stream tributaries to the Great Lakes and on coastal wetlands by transporting natural and man-made pollutants to them. In agricultural and urban areas of the Great Lakes basin, contaminants on the land surface become dissolved in groundwater and eventually flows into streams, wetlands, and the Great Lakes. This widespread, diffuse flow of contaminants by way of groundwater is a type of nonpoint source contamination. Pesticides and nutrients, such as nitrate and phosphorus, are the principal nonpoint source form of pollution that reaches the Great Lakes by way of indirect groundwater discharge to tributary streams and coastal wetlands. The growing understanding of the importance of this pathway has led many States to begin setting ground water quality standards and regulating the substances that can be discharged to groundwater.

Next Steps

- A mercury source reduction and sediment remediation strategy will be finalized.
- Contaminated sediment sites will be reviewed and their status will be updated.
- EPA will compile a report on nutrient contributions from the agricultural sector and on point sources during wet weather.
- Fall 2003 State of Lake Michigan Conference will present updated mass balance results.
- By 2004 and 2005, develop coordinated monitoring to provide a 10-year trend for the lake
- By 2010, remediation of 50 percent of AOC sites
- By 2020, remediation of 70 percent of AOC sites
- By 2025, remediation of 100 percent of AOC sites

Luddington Lighthouse
Photograph by Carole Y. Sineheart, the Michigan Sea Grant Extension*