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Agency

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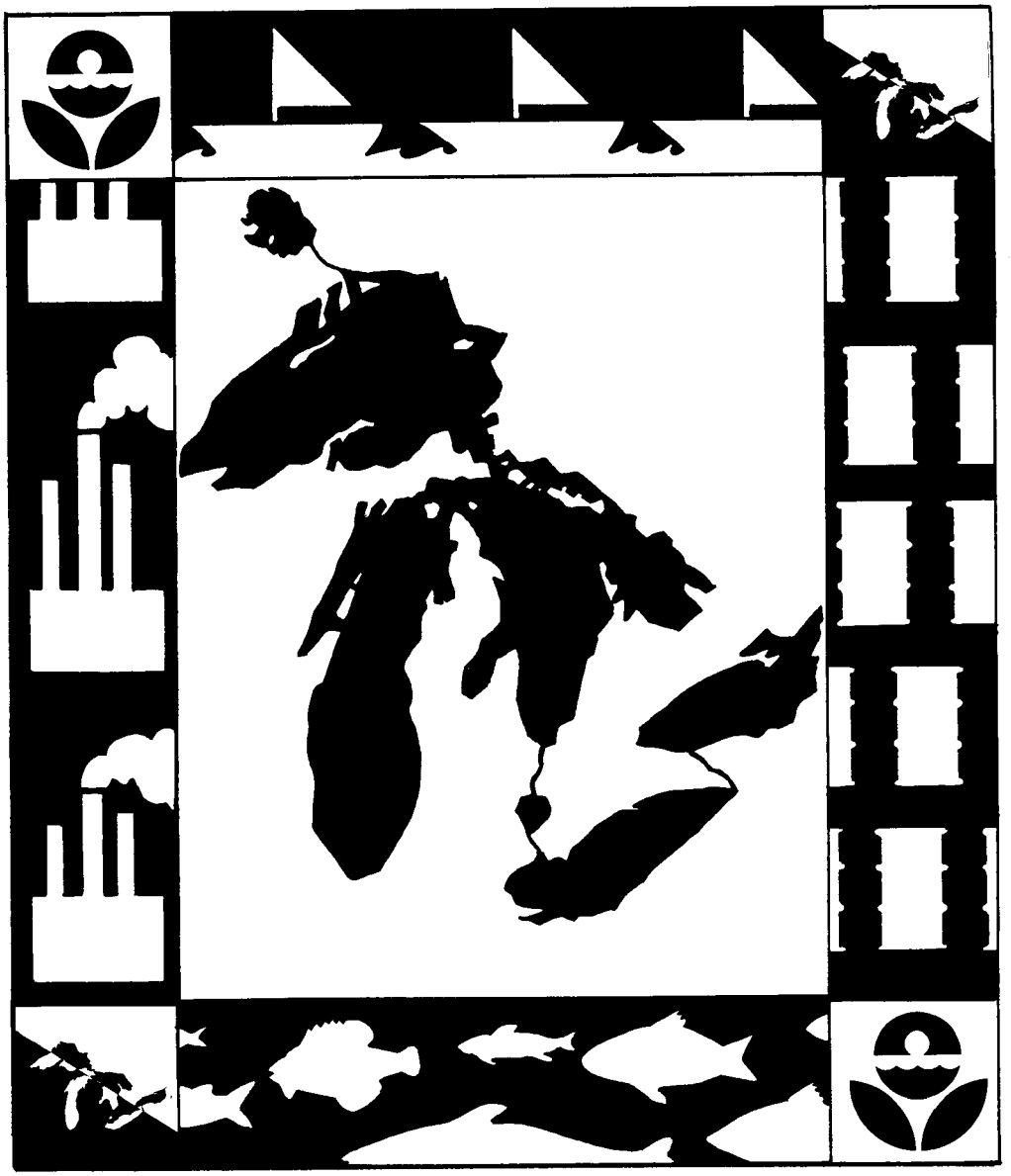
EPA

Toxic Substances in the Great Lakes



The Great Lakes: Why They Are Important...

The five Great Lakes are the largest reservoir of drinkable, navigable water in the world. Interconnected and internationally shared, they contain six quadrillion gallons of fresh water, which is 20 percent of the world's fresh surface water — and 95 percent of the United States'. More than 40 million people live in the Great Lakes Basin, the area that drains into these lakes and that includes parts of eight States (Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania, New York) and the Canadian Province of Ontario. That is nearly 20 percent of the U.S. population and 50 percent of Canada's.

More than 23.5 million people depend on the Great Lakes for their drinking water. Many more depend, however indirectly, on the lakes' role in producing manufactured goods, including an estimated 70 percent of U.S. and 60 percent of Canadian steel. The five glacial lakes are the reason U.S. steel production is centered in the Midwest: Iron ore from the shores of Lake Superior and limestone and coal from the other Great Lakes' shores are barged to either the south end of Lake Michigan or the eastern shore of Lake Erie. Mining, commercial fishing, paper mills, wineries, and fruit growing encouraged settlements along the Great Lakes, where one-quarter of U.S. industry now is located.

The Great Lakes also are the agricultural outlet for America's heartland. Grain has been a commercial cargo on the lakes since 1678, and navigation and commerce on the Great Lakes are worth noting. The Soo Locks, located between the sister cities of Sault Ste. Marie, Michigan and Ontario, handle more tonnage per year than do the Suez and the Panama canals combined.

In addition, the Great Lakes moderate climate, just as mountain ranges and oceans do. They provide a fourth coast for the U.S., with more than 4,000 miles of U.S. shoreline to be enjoyed for recreation as well as utilized by industry, including electricity-generating facilities. Sixty-four of the 1,000 power plants in the U.S. are situated in the Great Lakes coastal counties. Values of Great Lakes properties, sport fisheries, campgrounds, and

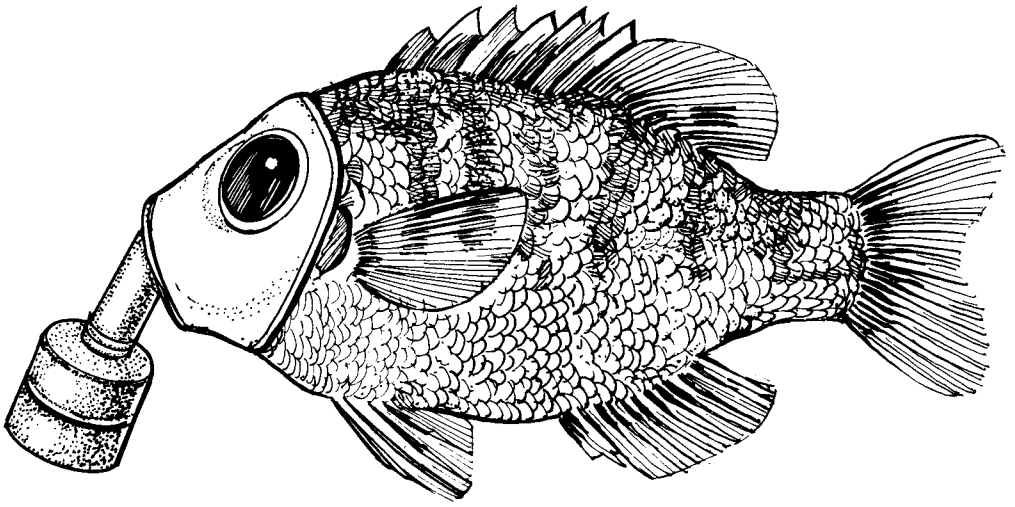
resorts are all appreciating rapidly. Boating, the most lucrative aspect of recreation on the Great Lakes, has grown at the rate of 10 percent a year. There are several reasons for this growth: People have begun to spend leisure time closer to home, and the Great Lakes' shores are beginning to open to the public, as private estates come onto the market and States pass beach-access statutes. The lakes themselves are getting cleaner. The States that that line the Great Lakes now operate vigorous programs to replenish fish stocks that had been significantly reduced by lamprey eels during the 1950s. For these reasons, then, the Great Lakes have shaped and influenced American growth and the lives of millions, sometimes without our even being aware of them.

And Why They Are Threatened

Unfortunately, the Great Lakes have also been among the most abused bodies of water in our country. Intensive industrial, agricultural, and municipal uses have left a trail of pollution that by the 1960s had attracted worldwide attenton to the Great Lakes. Oil and debris, mats of algae, dying fish, and closed beaches — all were present to an alarming degree in many of the lakes and shoreline areas.

Of the pollution problems that faced and continue to face these lakes, toxic substances are the most critical. Toxic substances first came to the attention of the general public in 1962, with the publication of Rachel Carson's *Silent Spring*. The book discussed environmental consequences of widespread use of the pesticide DDT, including potential damage to human health.

Since *Silent Spring*, a wide variety of toxic substances has been discovered in the waters of the Great Lakes and in the fish, birds, and mammals that live in or near these lakes. Certain species of birds that feed on Great Lakes fish are showing ill effects from toxicants the fish are known to accumulate. Humans who eat Great Lakes fish are showing higher levels of PCBs in the blood than are found in the blood of people who do not eat those fish. Because the fish have been contaminated,



commercial fishing has been curtailed in the Great Lakes. Advisories and occasional health warnings restricting human consumption of certain species of Great Lakes sport fish have been announced by most of the eight States that border the lakes — and spend money to stock those fish. Drinking-water supplies in parts of the drainage basin have become contaminated by toxic substances, and accidental spills of these substances on land have forced temporary evacuations of residents in the Great Lakes area.

Toxic substances, often colorless and odorless, are chemical or metal-containing substances that may present an unreasonable risk of injury to health or to the environment. They are part of our daily lives and of routine manufacturing processes; sometimes their toxic properties are not known or their presence in the environment discovered until after many years of heavy use.

Of the toxic substances that have been and continue to be threats to the Great Lakes environment, the following are of particular concern.

NAME	USE	PROBABLE SOURCE
Ammonia	By-product of municipal sewage wastewater.	Municipal wastewater discharge.
Asbestos in taconite tailings	By-product of iron ore mining.	By-product of iron ore mining. Secured on-land disposal ordered by court by April, 1980.
Chlorinated organics	Wide variety of industrial uses.	Industrial discharges, agricultural runoff, chlorination of wastewaters.
DDT, chlordane, dieldrin, aldrin	Pesticides used widely in Great Lakes region to control insects, rodents. DDT banned in 1971; others now restricted.	Residues from previous widespread use; runoff from agricultural and forested areas, leaching from improper waste disposal sites.
HCB (hexachlorobenzene) HCBD (hexachlorobutadiene)	Pesticides, wood preservatives, fungicides; by-products of chloralkali industry; used in production of synthetic rubber.	Industrial discharges, agricultural runoff, disposal of waste products.
Heavy metals (mercury, lead, arsenic, cadmium, copper, chromium, iron, selenium, zinc)	Wide variety of industrial uses, from anti-knock agent in gasoline to paints, pipes, pesticides, glass, and electroplating.	Industrial discharges, medical profession wastes via municipal discharges, agricultural runoff, disposal of waste products; mine tailings.
Mirex	Insecticide used to control fire ants; flame retardant; plasticizer.	Was produced, processed in Great Lakes region until ban in 1975; spills.
PAHs (polyaromatic hydrocarbons)	Variety of industrial uses.	Industrial oil and grease discharges; by-product of all types of combustion.
PBBs (polybrominated biphenyls)	Fire retardant.	Industrial discharges.
PCBs (polychlorinated biphenyls)	Insulation for electrical capacitors, transformers; plasticizer; wide industrial usage. Total ban except by special EPA permit in July, 1979.	Industrial discharges, municipal sewage treatment plant discharges, harbor sediments, low-temperature incineration of wastes.
Phenols	Usually found in conjunction with other, more complex organic compounds.	By-product of petroleum, paper products manufacture; industrial wastewater discharges, refineries, spills.

FOUND IN	CHARACTERISTICS/HEALTH EFFECTS
St. Marys River	Removes dissolved oxygen. Kills fish.
Lake Superior	Airborne effects may include asbestosis, lung cancer; water-borne effects not known, but cancer is implied.
Lakes Michigan, Huron, Erie	Bioaccumulation in fish, wildlife, humans. Suspected cause of cancer in humans when found in drinking water.
All five Great Lakes	Bioaccumulation in fish, wildlife, humans. Persistent in the environment. Long-range effects can include reproductive disorders in wildlife; suspected cause of cancer in humans.
Lake Erie, Lake Michigan	Bioaccumulation in fish, wildlife, humans. May produce skin rash, headache, nausea. Suspected cause of cancer.
All five Great Lakes	Excessive levels of heavy metals bioaccumulate in fish and wildlife. Human consumption of such contaminated food may cause a variety of health problems. Mercury can cause brain damage, birth defects. Lead: anemia, fatigue, irreversible brain damage, especially in children. Cadmium: kidney damage, metabolic disturbances. Arsenic: damage to liver, kidney, digestive system, bone marrow; suspected cause of cancer in humans. Copper, chromium, iron, selenium, and zinc are toxic to fish.
Buffalo, Niagara Rivers; Lake Ontario	Bioaccumulation in fish, wildlife, humans. Persistent in the environment. Suspected cause of cancer in humans.
All five Great Lakes	Persistent in the environment. Induce cancer and cause chromosome damage in fish, wildlife, and humans.
Lake Huron	Bioaccumulation in fish, wildlife, humans. Cause of birth defects and possibly cancer in laboratory animals.
All five Great Lakes	Bioaccumulation in fish, wildlife, humans. Persistent in the environment. Test monkeys developed reproductive failures, skin and gastrointestinal disorders.
All five Great Lakes	Cause taste and odor problems in drinking water. Toxic to fish.

How Do Toxic Substances Affect the Great Lakes?

Toxic substances have been and continue to be linked to a number of problems in the environment and in humans. Primarily because of the harm or potential harm certain toxic substances can cause in humans, these substances are closely monitored and increasingly well-regulated. There are, however, other effects they have upon the Great Lakes. By changing the balance within even isolated portions of the Great Lakes ecosystem, toxic chemicals begin to bring about change in the entire ecosystem (the interdependent air, land, water, and living things). Persistent chemicals do not rapidly break down and disappear but instead accumulate in the tissues of living organisms. This is called *bioaccumulation*. Scientists are trying to discover what adverse effects it may have on humans.

The economic impact of toxic substances cannot be ignored. While some may say that cleaning up the environment is too expensive, the costs of *not* cleaning the environment — especially of its toxic substances — can be staggering. Love Canal, halfway between Lakes Erie and Ontario in the town of Niagara Falls, New York, is the most tragic example. EPA estimates that if the chemical wastes dumped into that ditch until the 1950s had instead been put into a secure, environmentally sound landfill, the cost might have been $2 million. By late 1979, Love Canal had cost New York State more than $25 million to clean up. Claims against the responsible chemical company may exceed $2 *billion*. And the costs in human suffering that includes birth defects and miscarriages is beyond dollar values.

Clearly the costs of cleaning up environmental accidents reach into the millions of dollars and beyond. To pump the groundwater of Montague, Michigan until it is free of toxicant contamination, for instance, is expected to cost the responsible chemical company between $15 and $20 million. That cleanup program is required to be complete within three years, but maintenance will continue indefinitely. Each case involving toxic substance contamination that is taken to court may involve damages in the millions of dollars, plus legal fees, time, and suffering.

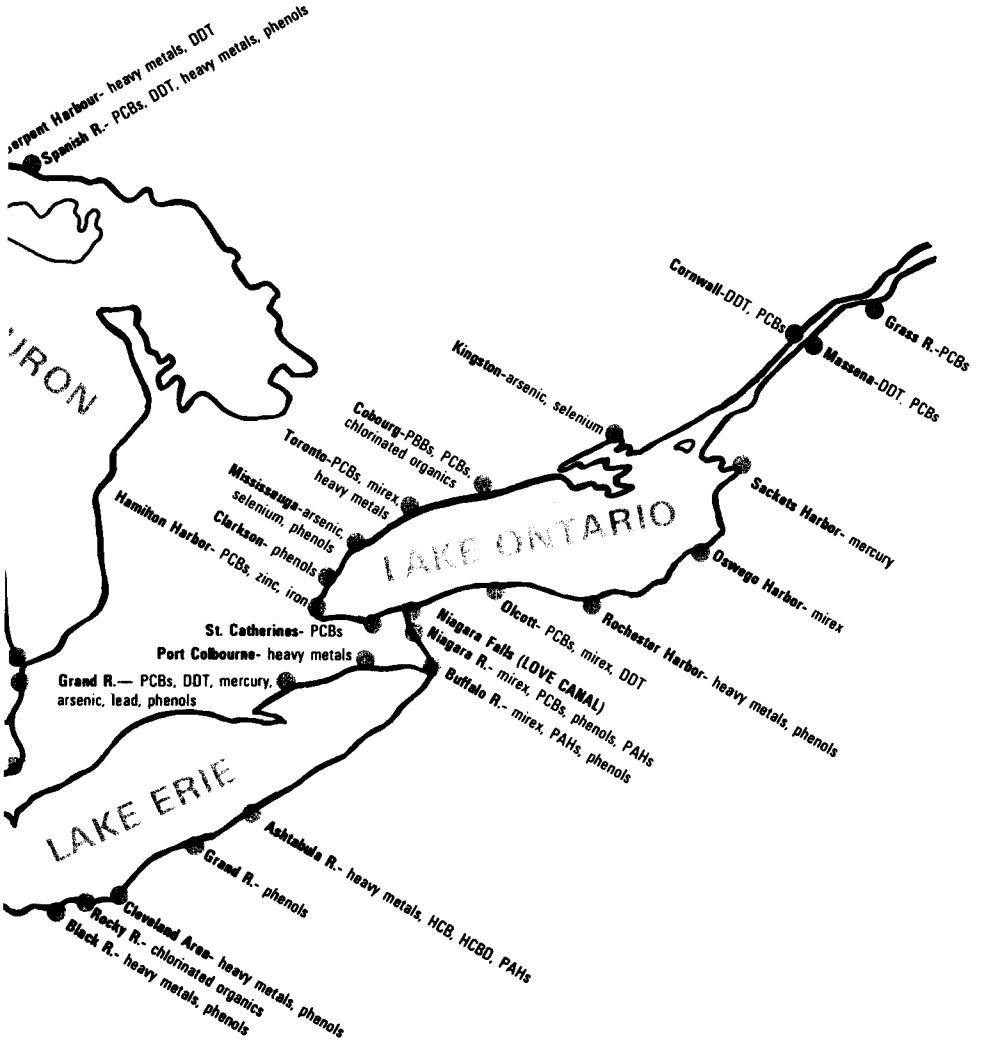
Drinking water from the Great Lakes, sometimes an overlooked bounty of this fresh water, must be specially treated when toxicant contamination threatens a community. Special carbon treatment is standard in such situations. Fear of cancer from the asbestiform fibers that were dumped for years into Lake Superior above Duluth was responsible for the creation of new, multi-million-dollar filtration facilities in north shore communities that had previously required minimal or no treatment of drinking water.

Because the Great Lakes are used for navigation, both commercial and recreational, their 119 harbors must be open to ship traffic. Dredging channels in these harbors used to be relatively simple. Silts and sediments were scooped out and dumped back into the open lakes, where they resettled and the process began again. Now, however, because of detected pollution including toxic substance contamination, dredging in many harbors involves removing polluted silt and sediment to specially constructed and confined disposal sites. The cost is three-and-a-half times that for simple dredge-and-dump operations in the open lake. New disposal sites have been built for 19 of the 56 harbors that are known to be polluted. The costs approach $200 million, and construction of additional disposal sites must follow for the remaining harbors. Indiana Harbor is so heavily contaminated that no major dredging is planned without further study.

What remains of the commercial fishing industry, which had thrived in the Great Lakes until sea lampreys destroyed many species of fish, has been further damaged by toxic substances. In the 1960s mercury, primarily from Sarnia, Ontario industries, contaminated Lake St. Clair and put an end to fishing there and later on Lake Erie. A million-dollar, 4½-million pound carp fishery in Green Bay was devastated in 1975 by the discovery that PCBs in the fish exceeded the allowable limits of 5 parts per million (ppm) established by the Food and Drug Administration. If those limits are lowered to 2 ppm, an estimated $21 million worth of whitefish and chubs commercially caught by Wisconsin


Nipigon Bay- mercury, lead, copper, chromium
Jackfish Bay- mercury, zinc, phenols
Marathon- mercury
Thunder Bay- PAHs, mercury, phenols
Silver Bay- asbestiform fibers
LAKE SUPERIOR
Upper Portage Entry- copper, zinc mine tailings
St. Marys R.- phenols,
Menominee/Marinette- arsenic
Green Bay-PCBs, mercury
Fox R.- PCBs, PAHs
Sheboygan R.- PCBs
Milwaukee- PCBs, heavy metals, PAHs
Great Lakes Naval Training Center— heavy metals
Waukegan Harbor- PCBs
Indiana Harbor- PCBs, mercury, lead, zinc, arsenic; phenols, PAHs
Montague- chlorinated organics
Muskegon/Big Black Creek- DDT, PCBs
Alpena- aldrin
Pine/Tittabawassee/ Saginaw Rivers- PBBs, dioxin, PCBs
Saginaw Bay- PCBs, DDT
Sarnia- PA
chlorinated org
St. Clair R.- heavy metals,
chlorinated org
Lake St. Clair- mercury
Thames R.- PCBs, DDT
Detroit R.- PAHs, phenols, iron
Wyandotte-chlorinated organics
Monroe- PCBs, heavy metals

TOXIC SUBSTANCES IN THE GREAT LAKES



fishermen would be in jeopardy, as would be $14 to $15 million worth of Michigan-caught whitefish. PCBs are not the only problem. Dieldrin, a banned pesticide, continues to contaminate fish.

Sport fishing also suffers from toxic substances. In Wisconsin's portion of Lake Michigan alone, sport fishers spend an estimated $7.50 per outing, excluding tackle, boats, and other equipment. This adds up to to an estimated $14 million yearly income to the State, which spends an estimated $800,000 to stock, survey, and manage the game fish it adds to Lake Michigan. The return, then, tops 14-to-1. And, if each of the eight Great Lakes States receives comparable returns for its investments, these investments are substantial. Michigan has estimated the total value of its sport fishery to be in excess of $300 million per year. Other estimates place the value of the Great Lakes sport fishery at between $300 million and $1 billion.

In New York, before contamination by the pesticide mirex was detected, local purchases related to fishing along a salmon-stocked tributary to Lake Ontario jumped nearly 700 percent between 1973 and 1975, when stocking programs were initiated. Purchases dropped just as abruptly when the mirex contamination resulted in a total ban on fishing in the Niagara River and Lake Ontario.

Where Do Toxic Substances Occur in the Great Lakes Area?

The map on the preceding pages pinpoints some areas known to have toxic substances present. Sources of information are U.S. EPA's Toxic Substances and Great Lakes National Program Offices, State environmental specialists, and the U.S.-Canadian International Joint Commission What the map cannot illustrate are toxic substances yet to be discovered.

We know that old and abandoned chemical disposal sites within the Great Lakes Basin can at any time become major toxic substances problems that contaminate land, groundwater, and surface waters in a given area for years to come. Exactly where these sites are located or where they contaminate the environment and the Great Lakes is

nearly impossible to predict. Developers in Riverside, Michigan learned that land they had bought was contaminated by leaking drums of chemicals. An old landfill outside Monroe, Michigan is suspected of leaking PCBs and heavy metals near a creek that drains directly into Lake Erie. PCBs, already known to be heavily polluting sediments of Waukegan Harbor north of Chicago and a drainage ditch on an industry's property, have recently been discovered to be steadily seeping toward Lake Michigan, as well. The examples continue, all around the Great Lakes.

How Do Toxic Substances Enter the Great Lakes?

Historically, industries discharged large quantities of toxic wastes directly into the Great Lakes and their tributaries. This practice is now restricted by Federal laws, among them the Water Pollution Control Act Amendments of 1972 and the Clean Water Act Amendments of 1977, as well as the Toxic Substances Control Act of 1976. Most *industrial discharges* have been greatly reduced or eliminated. Still, a number of toxic substances no longer being discharged in large amounts continue to pose problems for the Great Lakes environment. Mercury and PCBs, particularly, have been deposited over the years in the sediments of Great Lakes tributaries and in harbors. These are continously circulated through the aquatic food chain, from plankton to fish and back to sediments. Toxic substances move further up the food chain to humans when people eat contaminated fish or fish-eating birds.

Toxic substances also enter the Great Lakes Basin through *wastewater discharges from municipal sewage treatment plants.* Many small chemical and manufacturing companies, as well chemical users such as doctors, hospitals, and dentists, generate toxic wastes and typically dispose of them into the sewer system of the local municipality. Frequently the treatment plant cannot adequately treat or render harmless the toxic chemicals of the industrial waste, which may be discharged in wastewater or accumulated in sludge.

The paths of toxic substances to the Great Lakes and their tributaries are often indirect. *Stormwater runoff from urban areas* accounts for a disproportionately large share of the heavy metals that enter the Great Lakes, particularly lead from gasoline. Urban stormwater runoff flows over land and through storm sewers and eventually empties into the Great Lakes, bringing with it oil, lead, and cadmium.

Stormwater runoff from agricultural lands is another important vehicle for toxic substances entering the Great Lakes. The watershed, or basin, contains substantial farmland devoted to cash crops and dairying. Rains wash away fertilizers, fungicides, and pesticides used extensively on crops, orchards, and vineyards as well as the waste products of livestock that have ingested chemicals. These substances find their way into the streams and rivers that flow into the Great Lakes.

Chemical waste disposal sites are another indirect source of the Great Lakes' toxic substances. In the past many chemical wastes from various manufacturing industries were dumped into open lagoons or placed in barrels and shipped to poorly located or designed dumps. Years later, it was discovered that some of these wastes were toxic. Unfortunately, such discoveries are often made when it is found that the wastes are leaching into wells, rivers, and lakes, thereby threatening the health of the environment and the human population.

Hazardous waste disposal practices also present a serious problem to the entire Great Lakes community. Due to the rising costs of adequately treating and disposing of chemical wastes, as well as public resistance to properly designed disposal sites, some manufacturing companies are indiscriminately disposing of their wastes. In 1979 EPA estimated that some 57 million metric tons of such wastes are produced each year, and that of this only a small percent is being managed acceptably, by controlled incineration, neutralization, secure landfills, or recovery and reuse. Toxic industrial wastes that were dumped on

farmland in some areas in the early 1970s produced highly toxic runoff that continues to pollute the environment.

Toxic substances can enter the Great Lakes through *airborne emissions and subsequent fallout with rain and snow*. A major source of lead in the Great Lakes is from the exhaust of automobiles that burn leaded gasoline. Much of the present input of PCBs comes as a result of low-temperature incineration of solid wastes that contain PCBs. Obviously, airborne pollution is nearly impossible to chart and can contaminate sections of the Great Lakes one would expect to be relatively free of contaminants. This is precisely the case in Lake Superior, where PCBs from distant sources have been found.

Finally, toxic substances can enter the waters of the Great Lakes system through *accidental spills* that occur at manufacturing plants or during transportation of chemicals or toxic wastes. Numerous derailments of tank cars carrying toxic materials have occurred in the Great Lakes Basin within recent years. These accidents have required evacuation of several small communities and have contaminated local drinking water supplies.

Who is Doing Something about Toxic Substances in the Great Lakes?

EPA is responsible for implementing three of the Federal laws related directly to toxic substances: the Toxic Substances Control Act, the Resource Conservation and Recovery Act, and the Insecticide, Fungicide, and Rodenticide Act. EPA also is responsible for implementing the Federal Clean Water and Clean Air Acts — and for carrying out provisions of the 1978 Great Lakes Water Quality Agreement between the U.S. and Canada. This binational agreement, which builds on a 1909 treaty, specifically identifies toxic substances as a new point of increased emphasis. In cooperation with the States and other Federal agencies, EPA's Great Lakes National Program Office is developing a definitive program for monitoring Great Lakes fish for toxic substances.

Both the United States and Canada have toxic substance control programs at various governmental levels. A number of regional planning commissions have begun to focus attention on the control of toxic substances and hazardous wastes. The U.S.-Canadian International Joint Commission, which oversees care and cleanup of the Great Lakes, and the Great Lakes Basin Commission, with U.S. State and Federal representation, consider toxic substances' control of primary importance. So too do the U.S.-Canadian Great Lakes Fishery Commission and the U.S. Fish and Wildlife Service.

Are There Any Successes To Show for the Efforts?

After DDT was banned in 1971, levels detected in Great Lakes fish began to drop dramatically. That downward trend continues. Mercury levels in Lake St. Clair and Lake Erie fish have dropped. Levels of PCBs are said to be diminishing slightly, as shown in the tissues of some fish taken from some sections of Lake Michigan. PCBs were banned except by special EPA permit in July, 1979, but their presence in fish and birds throughout the Great Lakes will be detectable for years to come. Drinking water filtration with activated carbon is serving as a temporary answer to the problem of phenols and other organic toxic substances. And it might be considered a success that more and more people are becoming aware of the toxic substances problem — and are trying to take action to resolve it as soon as possible.

What Else Needs To Be Done?

All of us must continue to be aware of the dilemma: We enjoy the benefits of a modern society based in large part on chemicals, from treated papers to television to films to heavy machinery. Yet, many of those things that make our society modern do not quickly degrade and become harmless to the environment and to us. Chemicals require special treatment, and this need is a new consideration to many people.

What can you do to combat toxic substances in the Great Lakes? Several things are possible.

- See if local sewage treatment works and local industries have and follow pretreatment regulations for their wastes. To find out if such programs are required locally, you can call the mayor's or village manager's office for the name of the proper authority or department. If regulations still need to be developed and you have time to volunteer, your efforts will almost certainly be welcome.
- Look at what else is being done in your area to regulate and control toxic substances. Does a local ordinance exist? Is your county or regional planning group addressing the issue? What is your State pollution-control agency doing about toxic substances, throughout the State and in the Great Lakes drainage areas? Use your telephone directory to learn which government agencies are around you. When you call them to see what they're doing, you might ask to have your name added to their mailing lists. When these groups invite public participation, as in public hearings, you will know early and have the opportunity to become as involved as your time permits.
- Learn about hazardous waste disposal in your area. Chemicals and other harmful wastes are a reality of modern life. Disposal of these materials can either compound the problem or begin to control it. Locating and dealing with existing hazardous waste disposal sites is a matter of urgent concern. In the Midwest, EPA Region V's "Seek and Find" program invites members of the public to report any suspected sites to EPA via toll-free telephone numbers. A number of States and regional commissions also are identifying hazardous waste disposal sites, as are various agencies of the Federal Government, including EPA.
- Be aware that proper disposal of hazardous, possibly toxic, wastes is a matter of controversy. Although nearly everyone agrees that these wastes need to be stored somewhere, many people do not want sites located near to them. As a result, few sites are

being selected for approval in the U.S. or Ontario, and toxic and other hazardous wastes continue to stockpile. Because of its importance as an industrial region, the Great Lakes area contains a large share of these wastes. Local and national environmental groups are becoming active in trying to resolve the problem. Your efforts are needed. Ask for EPA Region V's Hotline Directory of environmental groups and try to work with a group in your area. If you want to interest others, EPA Region V has available several excellent films about hazardous wastes, as well as printed materials about hazardous wastes and toxic substances. These are yours to review for the asking.

- On a smaller but equally important scale, examine your own uses of products that may contain toxic substances. Use unleaded fuel in your car and keep the engine properly tuned. Read labels of household products to see what they contain. Find natural or biological substitutes for as many as you can, especially for pesticides and the like. When you must use paint thinners and toxic cleaning agents, use them sparingly — and dispose of them properly.

To report an oil or hazardous materials spill in the Great Lakes — or anywhere in the United States — call the National Response Center in Washington, DC toll-free: 800-424-8802. Your report will be forwarded to the appropriate office for action.

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