

# New York/New Jersey HARBOR ESTUARY PROGRAM

INCLUDING THE NEW YORK BIGHT RESTORATION PROGRAM



*Pollution in the Harbor Estuary and its effects on the entire estuarine ecosystem, is a primary concern of the NY/NJ Harbor Estuary Program. The Program is working with government agencies, elected officials, private enterprise and public interest groups to help protect and enhance the Harbor Estuary's natural resources and develop a plan for environmentally sound management of the Estuary.*

## *Pollution in the Harbor Estuary*

### *The Harbor Estuary*

For over 300 years, the Harbor Estuary has served as a port and economic center for the New York and New Jersey region, fostering the development of shipping, industry and commerce. These activities, combined with the stresses of one of the largest populations in the United States, have contributed to pollution of the region's waters with a wide variety of harmful substances. For example, the Estuary ranks among the top twenty estuaries in the nation for elevated concentrations of many toxic metals and organic chemicals.

The drainage **basin** of the Harbor Estuary encompasses about 16,300 square miles, including much of eastern New York, northern New Jersey and small parts of western Connecticut, Massachusetts and Vermont. The quality of the Harbor Estuary's waters is affected not only by activities occurring directly in the New York/New Jersey Harbor, but also by industrial, agricultural and land use practices throughout this larger regional area.

Since 1970, advances in sewage treatment and rigorous government regulation of discharges of toxic chemicals have resulted in improvements in the Estuary's water quality. Declining industrialization in the region and the enforcement of environmental regulations, such as the prohibition of lead in gasoline, have also had a positive effect.

But despite these improvements, pollution is still a major problem. We continue to have beaches closed due to bacterial contamination; the harvesting and consumption of fish and shellfish from our area is restricted because of both bacterial contamination and toxic pollutants; and polluted harbor waters can potentially harm wildlife and aquatic animals.

### *What are Toxics?*

A toxic substance is a chemical or mixture that causes injury to humans, plants and animals. Information about the amount of toxic substances in water is expressed as concentrations (substance weight divided by water volume or weight), but an elevated concentration alone does not tell us whether toxicity is present. For example, metals found in high concentrations in the environment are not toxic if they are not bioavailable, that is, if they are not in a location or form which enables them to enter an organism's tissues. In considering whether substances pose a threat to our harbor waters, scientists and regulators have to look at a variety of factors such as bioavailability, flushing and mixing rates of the bodies of water, and persistence of the pollutant in sediments. In the Harbor Estuary, toxic substances may reside in the water, sediments or in animal tissue.



## Clean Water Act

In 1972, the federal Clean Water Act was passed to protect the "chemical, physical and biological integrity of the nation's waters". Intended to regain or maintain waters that would be "fishable" and "swimmable," the Act required the Environmental Protection Agency (EPA) to set and revise water quality and human health criteria based on up-to-date scientific information. The EPA issues water quality criteria and states then adopt water quality standards for "acceptable levels" of pollutants.

The Clean Water Act established regulations so that industries and others must obtain permits requiring them to monitor and control the amount of toxics they discharge. It also provided considerable financial assistance that has allowed municipalities to construct upgraded sewage treatment plants, resulting in improved water quality.

# Pollutants in the Harbor Estuary

## Toxic Metals

Many metals are found in elevated concentrations in the Harbor Estuary--the Estuary has elevated concentrations of copper, lead, mercury, silver, arsenic, cadmium, nickel, zinc and other metals in water and bottom sediments. Copper and mercury are present at levels that exceed water quality criteria in some parts of the Harbor and both are a priority concern. Most toxic metals arrive in the Harbor Estuary from municipal treatment plants and from tributaries. Tributaries contribute some metals, such as copper, found naturally at high levels. Some metals from industry, municipal water pipes (a source of copper) and household products poured down drains (solvents, cleaners) may end up in the Estuary after passing through treatment plants.

## Organic Chemicals

Organic compounds, called hydrocarbons, are present as petroleum-based fuels, oils, grease and a myriad of other industrial and consumer products, and many of them are highly toxic.

Although more research is needed on the sources of organic chemicals in the Estuary, there are a variety of ways they can end up in our harbor's waters. Even though the production and use of PCBs, dioxin and certain other organic chemicals has been banned or severely curtailed, these chemicals are present in the Estuary's sediments and water, resulting from industrial discharges in the past (over a 20-year period, a General Electric capacitor plant in Fort Edward, New York dumped 300,000 pounds of PCBs into the Hudson River). Oil, grease and gasoline that drip from cars or are improperly discarded can deposit organic toxics in the Harbor. Pesticides introduce organic compounds into the harbor when they wash off agricultural land, lawns and roadsides during storms. Organic compounds in household products like paint thinners and glues find their way into the Estuary through household drains, toilets or outdoor spills. Many organic compounds accumulate in the Harbor Estuary's sediments while some more volatile compounds may evaporate into the air.

SOURCES FOR POLLUTANTS OF CONCERN IN THE NEW YORK/NEW JERSEY HARBOR ESTUARY								
POLLUTANT	% CONTRIBUTION BY SOURCE							
	Municipal	Industrial	Combined Sewer Overflow	Stormwater	Tributary	Leachate	Atmospheric Deposition	Total
Biochemical Oxygen Demand	58	1	19	5	16	1	0	100
Fecal Coliform	0	0	89	9	2	0	0	100
<b>METALS:</b>								
Copper	57	1	8	7	22	0	5	100
Mercury	39	0	7	3	51	0	0	100
Lead	28	0	14	6	38	0	14	100
Cadmium	5	0	2	1	92	0	0	100
Nickel	50	1	6	7	30	0	6	100
Zinc	36	0	6	7	46	0	3	100
<b>NUTRIENTS:</b>								
Total Nitrogen	63	0	2	2	29	2	2	100
Total Phosphorus	75	0	4	4	17	0	0	100
PCB's (polychlorinated biphenyls)	22	0	10	15	50	0	3	100

Source: HydroQual, Inc. (1991) NV/NJ Harbor Estuary Program: Assessment of Pollutant Loading to NV/NJ Harbor



### **Pathogens**

Disease-causing organisms, including bacteria and viruses, are called pathogens. In the Estuary, combined sewer overflows (CSOs) are the main source of such contamination, as measured by coliform bacteria levels which are used to indicate harmful pathogens. Though usually funneled through sewage treatment plants, human waste is often discharged into the Estuary through CSOs without treatment during rainstorms. In addition, animal waste left on streets and roads washes into waterways when it rains. Because of suspected pathogen contamination, the Estuary's beaches are sometimes closed after heavy rains to protect swimmers from elevated bacteria levels.

### **Organic Matter and Nutrients**

**Organic matter**, such as leaves and feces, can pollute harbor waters as it decomposes, using up available oxygen dissolved in the water. As dissolved oxygen (DO) is consumed, fish and other aquatic creatures may die because of the low level of oxygen (hypoxia). **Nutrients** such as nitrogen contained in human waste can over-enrich the harbor waters, encourage the rapid growth of algae, and lead to algal blooms that can be destructive to estuarine life. Biochemical oxygen demand (BOD) is a measure of pollution: a high BOD means there is a large amount of organic matter in the water, and a lot of dissolved oxygen is consumed in its decomposition. Most organic matter and nutrients in the Harbor Estuary's waters come from sewage treatment plants.

## Sources of Pollutants in the Harbor Estuary

When a particular industrial plant or a municipal treatment plant discharges pollutants into the Harbor Estuary, this is considered point source pollution. If the **runoff** from agricultural fertilizer or landfill seepage contributes to water pollution, it is known as non-point source pollution since it cannot be traced to one, identifiable site.

### **MUNICIPAL TREATMENT PLANTS**

The vast majority of municipal treatment plants that discharge into the Estuary now utilize **secondary treatment** (or biological treatment) to remove organic matter in sewage. The construction and upgrading of these facilities has contributed to marked improvements in water quality. But waste coming from industrial sites, **small businesses** and homes can contain toxic contaminants; treatment can reduce the concentrations of some of these contaminants, but others continue to be discharged into the Estuary from the treatment plants.

### **INDUSTRIAL DISCHARGES**

Over 400 industrial waste sources have their own discharge pipes which carry **effluent** into the New York/New Jersey Harbor; they are required by state law to monitor and control the amount of toxics they discharge. The majority of industries in our area discharge their waste into municipal sewer systems that channel the waste into sewage treatment plants; they are required to pre-treat their waste before discharge.

### **COMBINED SEWER OVER-FLOWS\***

Most of the larger, older cities on the Harbor Estuary, such as Newark and New York City, are responsible for the majority of the area's wastewater and use sewage systems for both sewage and stormwater runoff to be carried to treatment plants. During heavy rains, overflow may be discharged untreated into the Estuary, along with debris, pesticides and automotive fluids washed from the streets.

### **STORMWATER**

Areas not served by combined sewers have separate storm sewers to collect and carry rain and snow runoff to a point where it can soak back into the groundwater or flow into the Harbor Estuary. Here too, with heavy rain or snow, runoff and debris can be discharged directly into the Estuary.

### **TRIBUTARIES**

Rivers and streams such as the upper Hudson, the Passaic and the Raritan Rivers, contribute huge flows of freshwater into the Harbor Estuary, particularly in the spring. As the freshwater moves downstream, it carries along contaminants from both point and non-point sources, and the contamination is then discharged into the Estuary.

### **LEACHATE/LANDFILLS**

Toxic materials, such as the lead in paints or cadmium in batteries, can end up in solid waste landfills in our area and leach into the ground below the waste. Such liquid waste, or **leachate**, can seep from the ground into the Harbor Estuary's waters. Overall, only a small percentage of the Estuary's toxics comes from leachate.

### **OTHER SOURCES**

Pollution in the Harbor Estuary can also come from atmospheric deposition, when particles of toxic material fall into the waterway or through accidents and spills, such as the multiple oil spills that occurred in the Arthur Kill and Kill Van Kull in 1990.

\*for further information, see the Harbor Estuary Program's publication, **Combined Sewer Overflows in the New York/New Jersey Harbor Estuary**.



# Impacts of Pollution

## Effects on Health of Species

The waters of the New York/New Jersey Harbor Estuary have historically supported rich, diverse populations of fish and shellfish and have sustained active commercial and recreational fisheries. Declines that have occurred in the abundance of fish, shellfish and fish-eating birds in the harbor are due to a variety of factors--overfishing, pollution and habitat loss. Research has suggested that the abundance of shad, hard clams and oysters has declined as a result of water pollution, although overharvesting plays an important role as well. Some species, such as bottom-dwelling flatfishes, have had fin rot, possibly associated with chemical pollution. Hudson River tomcod have had tumors and a toxic organic chemical is the suspected pollutant. Osprey populations suffered a decline and research suggested a link between reduced egg-shell thickness and PCB, DDE and mercury concentrations in osprey eggs. Since the use of pesticides has been curtailed, the osprey populations have begun to rebound.

Low dissolved oxygen levels (hypoxia) can also affect species in areas of the Harbor Estuary, particularly non-mobile species which cannot escape to more oxygenated waters.

## Human Health Concerns

In the 1920s, the oyster industry in the Harbor Estuary was closed because of bacterial contamination from human sewage. The pollution of shellfish-growing waters, with the fear of outbreaks of diseases such as hepatitis and gastroenteritis, has more recently caused the closing of many parts of the Harbor Estuary to the harvesting of clam (although hard clams can be gathered and sold if they are cleaned before being sold to the public).

In addition to bacterial contamination, there is also concern over the public's consumption of fish contaminated by toxic chemicals. Since 1976, New York State has restricted the sale of striped bass from the Hudson River and Upper New York Bay, because of PCB contamination. Because of contamination from other chemicals such as dioxin, both New York State and New Jersey have issued fishing advisories for some fish and shellfish species, applying to all parts of the Harbor Estuary.

Bacterial contamination in the Estuary's waters has caused numerous beach closings in recent years, because of public health concerns.

## GLOSSARY

**drainage basin:** the entire land area drained by a waterway and its tributaries.

**effluent:** liquid waste discharged into the environment from a source such as an industry or sewage treatment plant; it can be treated or untreated.

**leachate:** the liquid that filters through landfills, picking up pollutants, which can subsequently contaminate groundwater or surface water.

**nutrients:** elements or compounds essential to the growth and development of living things -- like nitrogen and phosphorous.

**organic matter:** carbon-containing molecules that make up or are derived from the tissue of organisms.

**runoff:** the water from rain or snow that flows over the land and eventually reaches a stream or other body of water.

**secondary treatment:** biochemical treatment of wastewater after settling, using bacteria to consume the organic wastes. Disinfection with chlorine is the final stage of secondary treatment.

FISH TISSUE EXCEEDANCES					
TYPE OF FISH	POLLUTANT				
	PCB	Dioxin	Mercury	Chlordane	Dieldrin
Striped Bass	*	*	*	*	*
White Perch	*		*		
American Eel	*	*	*	*	
Bluefish	*		*		
Herring			*		
Blue Crab	*	*	*		
Lobster					*
Catfish		*	*		

Each asterisk represents the presence of a particular pollutant in a concentration above criteria set by regulatory agencies as safe for human consumption.

[Source: Katherine S. Squibb (1991), NY/NJ Harbor Estuary Program: Toxics Characterization Report]



## CURRENT ISSUES

### FLOATABLES

Floatables are buoyant, waterborne waste materials and debris, such as wood, plastic items, disposable diapers, polystyrene cups and fishing gear. The Harbor Estuary is littered with massive amounts of floatable debris whose sources include CSOs, stormwater runoff and illegal waste disposal. Urban street litter, litter from beach users and recreational boaters, household floatable waste flushed down toilets and illegally dumped medical and other waste, all contribute to the floatables problem. Public concern in recent years has focused on hazardous medical wastes washing up on area beaches. Since passage of the Medical Waste Tracking Act in 1988, a tracking system monitors the source of infectious wastes and certifies proper disposal. Floatable debris also can pose a serious health risk to marine animals.

### POLLUTANTS IN SEDIMENTS

Estuarine sediments, the matter that settles down to the bottom of the Estuary, act as both depositories and sources of toxic chemicals. Most organics and heavy metals that are discharged into estuarine waters are either already bound to particulate material or rapidly associate with suspended particles as they enter the water. The largest pool of contaminants in an estuary resides in its sediment. In the Harbor Estuary, sediment concentrations are affected by new inputs of pollutants, and the continual redistribution of sediments due to tidal currents.

### Contaminants in Sediments

The Harbor Estuary Program is developing a biomonitoring strategy to accurately assess which parts of the Harbor have heavily contaminated sediments and how to reduce that contamination. For example, PCBs, once point source pollutants, are now persistent in Hudson River and other tributary sediments and there is much controversy over how to remove and dispose of them. A similar debate is being waged over dioxin-contaminated sediments in the Passaic River and Newark Bay, near a Superfund site, and over cadmium-contaminated sediments at a Superfund site at Foundry Cove, along the Hudson River, upstream north of the Harbor Estuary.

### Sewage and Organic Matter

A variety of federal, state and local initiatives have been undertaken to reduce the harmful effects of CSOs. New York State's CSO control strategy requires municipalities to develop planning schedules for abatement. New York City's current *Combined Sewer Overflow Abatement Program* is aimed at developing engineering solutions and constructing abatement facilities. New Jersey's *1989 Stormwater Management and CSO Abatement Bond Act* provides funds to local governments for construction of CSO and stormwater abatement facilities.

### Non-Point Source Pollution

Enforcement of pre-treatment programs for industrial effluent and up-

grades in sewage treatment have contributed to reductions in bacterial contamination and organic solids in the Harbor Estuary. But non-point source pollution remains a major contributor of pollutants. The Floatables Action Plan of the Harbor Estuary Program aims at reducing the amount of debris in New York and New Jersey waters. Its principal recommendations include marine debris collection programs, improved street cleaning, CSO and stormwater abatement, enforcement of solid waste transfer regulations (so that garbage does not blow off barges), shoreline cleanup programs and vigorous public education.

Under the federal Clean Water Act, New York and New Jersey are responsible for developing non-point source pollution management plans for the Harbor Estuary.

### Research and Monitoring

There are large gaps in the data available on pollutants in the Estuary. More information is needed on how contaminants move around the Estuary, their bioavailability, and their effects on organisms and the entire ecosystem. We know more about concentrations and effects of PCBs in the Estuary because they have been the subject of long-term monitoring and research, and relatively less about chlordane and dioxins. As new management strategies for the Estuary are implemented, long-term monitoring will occupy a central role in determining the effectiveness of remedial approaches and in identifying emerging problems at an early stage.



## PEOPLE POLLUTION

## TOXICS AT HOME

### *New York/New Jersey Harbor Estuary Program*

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Individuals contribute to a great deal of the pollution that ends up in our Harbor Estuary through the use of lawn fertilizers and pesticides, the disposal of hazardous household products, auto fluids and plastics, and through sewage and other water uses. Individual citizens making some important changes in how they use products and dispose of them can have an enormous impact on the health of our Estuary's waters.

#### WHAT CAN YOU DO?

Try alternatives to lawn and garden pesticides, such as biological controls.

Don't dispose of oil-based paint, thinner and other solvents by pouring them down the drain (it's against the law in New Jersey and New York).

Don't pour used motor oil, brake and transmission fluid down a drain or onto the street; take it to your service station to be recycled.

Recycle as much as possible, especially plastics.

Conserve water to reduce flows to sewage treatment plants.

Don't litter on beaches or throw garbage from boats.

Don't dump anything on the street, in a drain or down the toilet that you wouldn't want to end up in the Estuary.

Get involved in or help organize your community's beach cleanup days, adopt-a-stream programs or street clean-ups.

Inform your elected representatives of your concerns and opinions about pollution in the Harbor Estuary.

Ordinary household products found in bathrooms, kitchens, garages and basements often contain hazardous substances that may be harmful to the consumer and damaging to the waters of the New York/New Jersey Harbor Estuary. Proper disposal and recycling of hazardous products is important in diminishing their harmful effects on our area's waters. We can also reduce our use of some of these products by finding less toxic substitutes.

#### TRY THESE ALTERNATIVES:

To prevent clogged drains, don't use chemical drain cleaners. Dispose of grease and food in the garbage can and not in the sink. If your drain does get clogged, purchase a long, flexible metal "snake" at a hardware store to unblock the drain. Or pour boiling water with baking soda and vinegar down the drain.

Many scouring cleansers and bleaches contain chlorine, a potential health hazard. Instead, use the naturally occurring mineral borax, a good all-purpose cleaner and deodorizer, or baking soda, which works well as a scouring cleanser or freshener.

Alkaline batteries contain mercury and zinc, which can leak into groundwater or soil if the batteries are thrown away. Choose recently available "low mercury" or "no mercury" general purpose batteries the next time you buy batteries. (Remember always to dispose of all batteries at hazardous waste collection days or recycling centers).

Use substitutes for oil-based paints and solvents containing toxic aromatic hydrocarbons (such as toluene). Water-based products perform as well as their oil-based counterparts, and are less toxic and easier to clean up. Sometimes a little "elbow grease" can make paint strippers or other commercial solvents unnecessary.