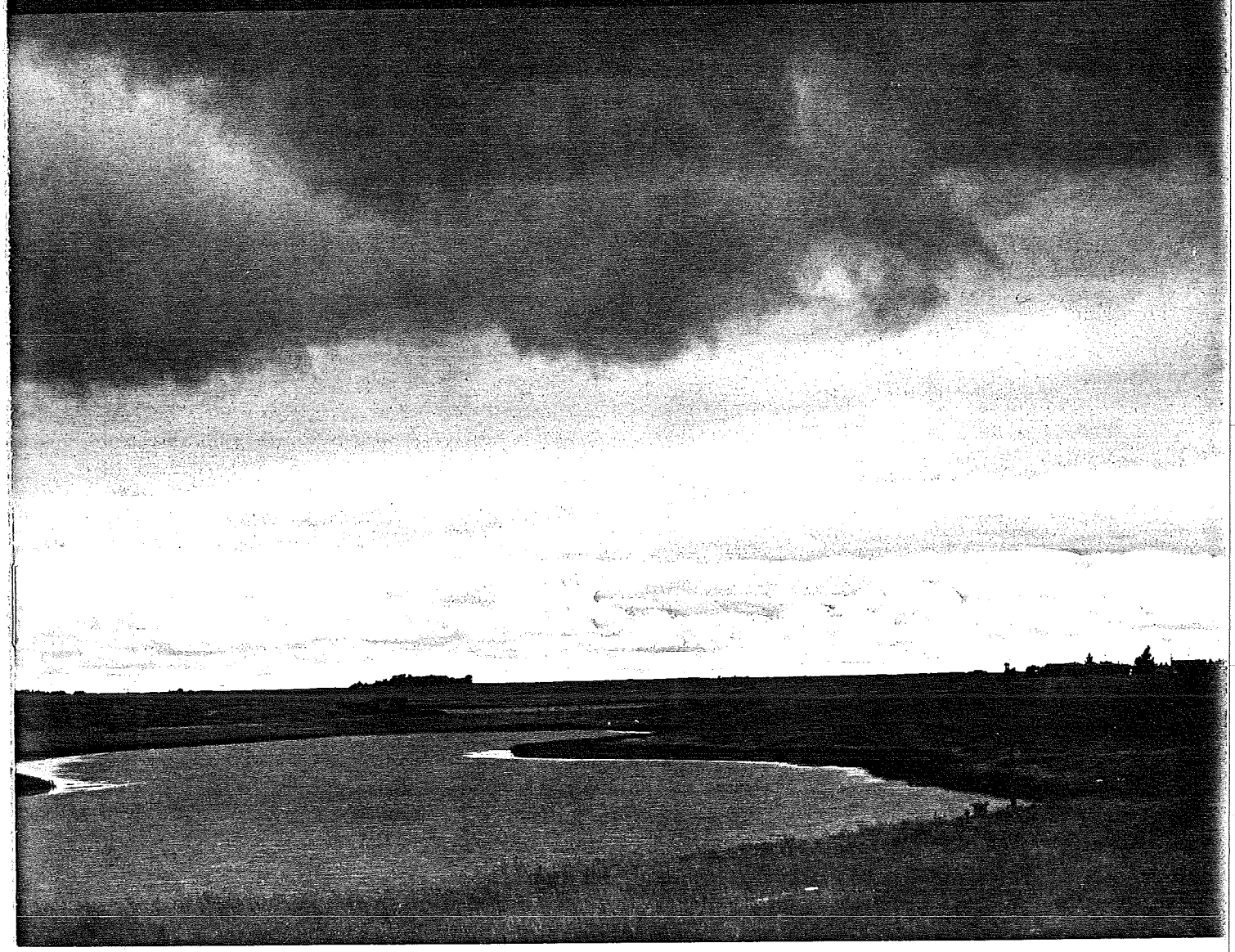
Environment Canada
Environnement Canada

STORM WARNING

Canada



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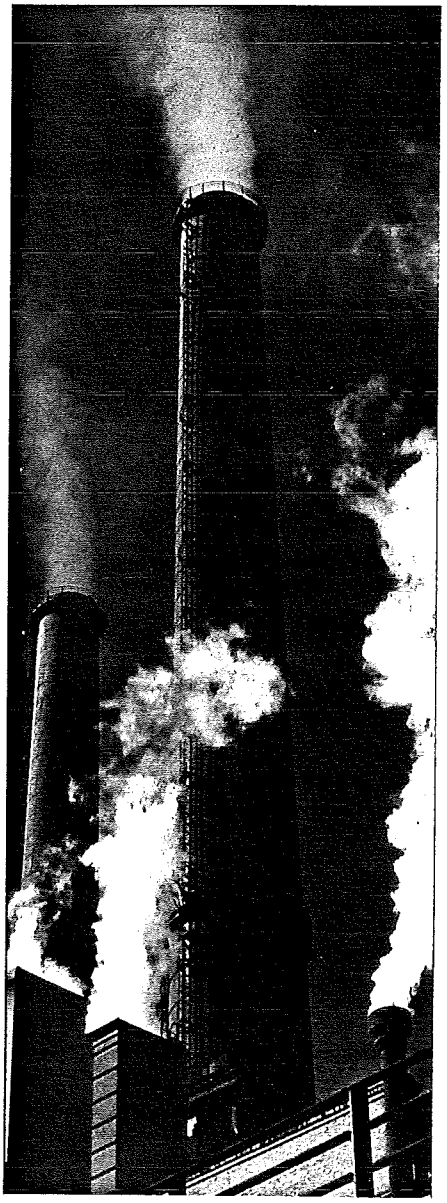
When people think of toxic chemicals, they often think of the safety of their water supply. However, evidence is mounting that the atmosphere itself is another important "pathway" or route for toxic substances. Once they are airborne, toxics can be inhaled as air pollution, or they can enter the food chain by settling on water, land, or directly on crops and food. More and more disturbing information about airborne toxic substances is coming to light:

- Dangerous chemicals such as dioxin, PCBs and DDT are commonly found in the bodies of Arctic seals and polar bears: animals which live far away from the common sources of chemical pollution.
- Lake Ontario is downstream from infamous sites of chemical pollution such as the Love Canal and the "S" Area dump site, but toxic substances are also found in the bodies of Ontarians who live far inland, and do not draw their drinking water from Lake Ontario.
- Chemical substances such as PCBs and DDT have been found in mothers' milk and are passed along to nursing babies. Toxic chemicals are found in the body tissue of individuals who eat little or no fish from the Great Lakes.



Recent evidence indicates that transport through the atmosphere is a very significant means by which waters in the Great Lakes receive chemicals. In fact, some scientists now believe that for two important chemicals, toxaphene and PCBs, the atmosphere is a major pathway into the Great Lakes, not solely industrial or municipal discharges. Atmospheric toxics naturally descend on land as well, and can find more direct routes to humans.

Current research also indicates that PCB levels in the relatively non-industrialized upper Great Lakes are now reaching levels similar to those of the heavily industrialized lower Great Lakes. This is the result of a fall-out of PCBs from the atmosphere.

There are two types of atmospheric transport of toxic substances, long and short range. With long range transport, sources of toxic contaminants can be

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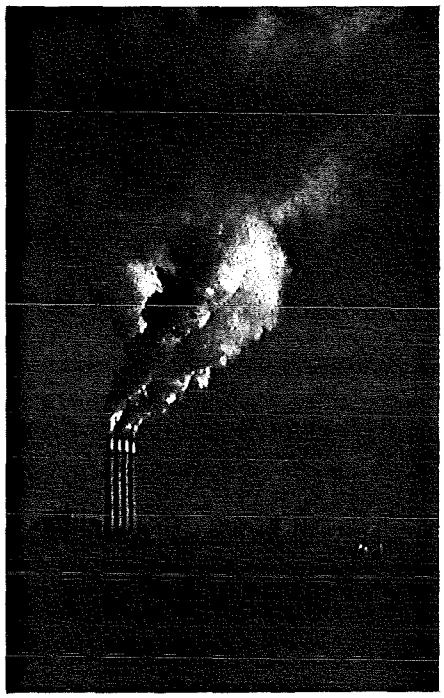

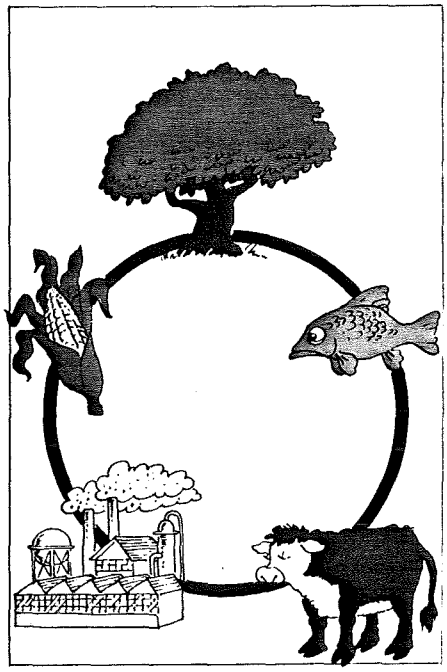

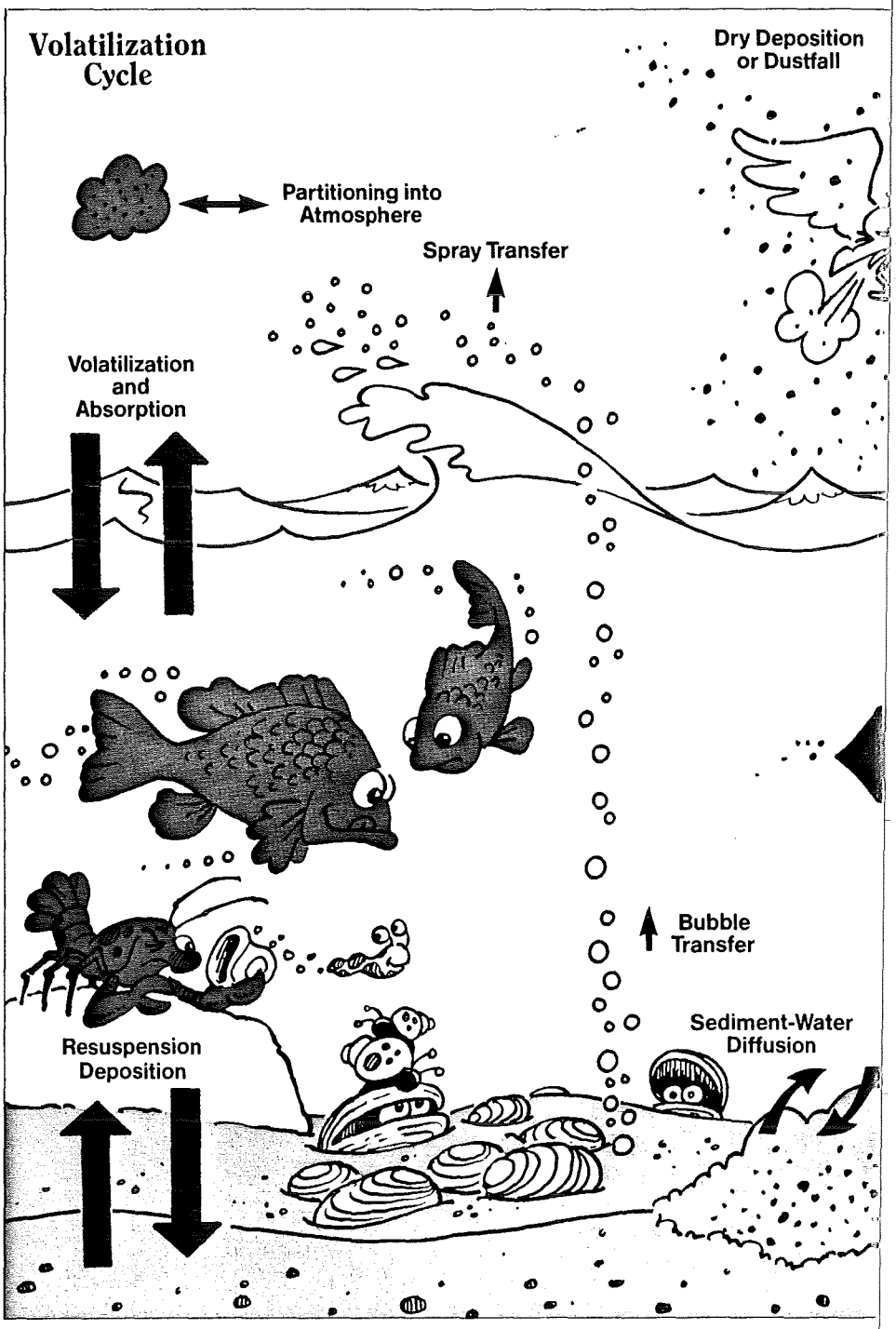

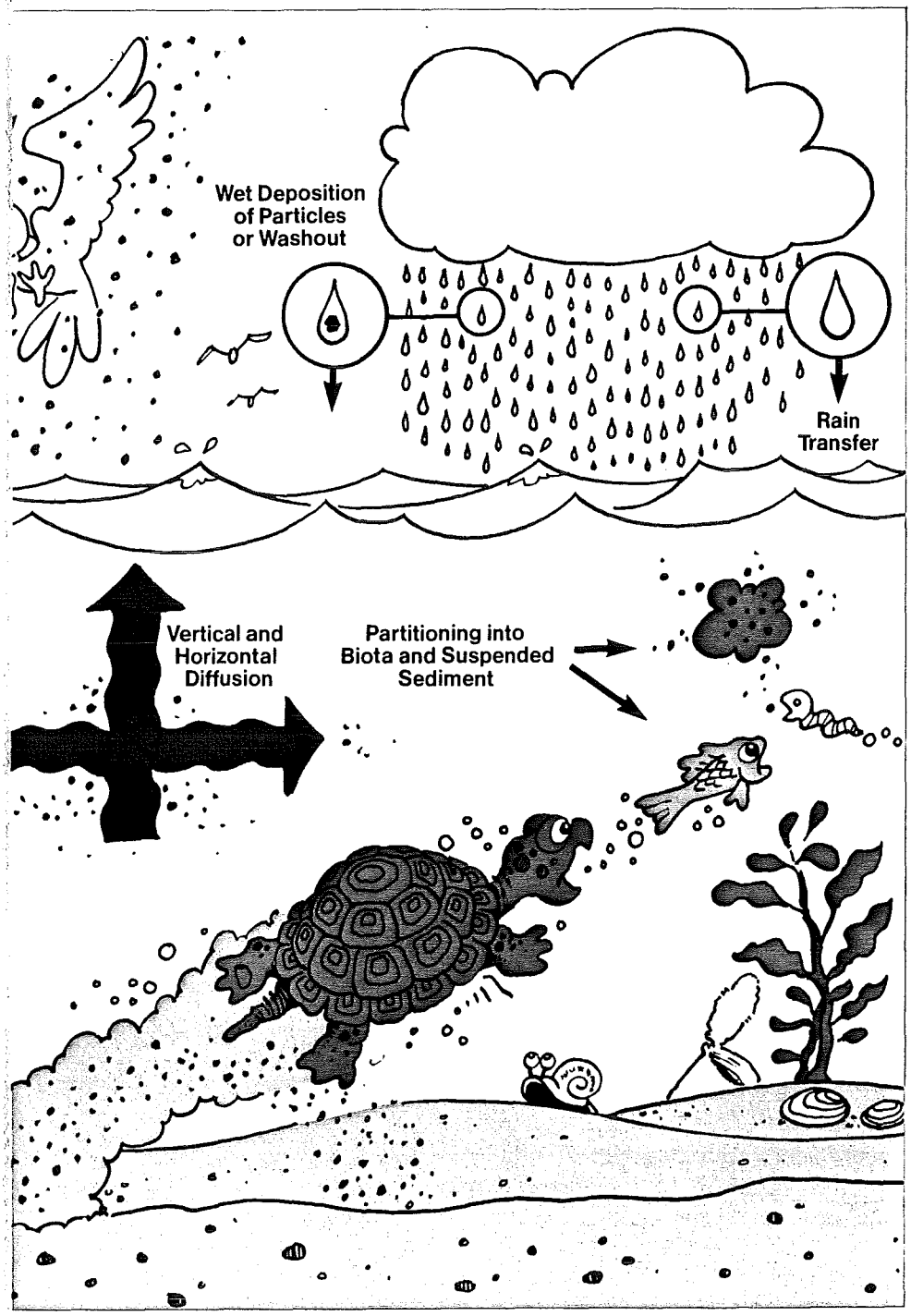

What goes up must come down – and does, often in our food and water. The amounts of toxic substances that are found in humans cannot be accounted for by drinking water alone. The only other possible pathways are through respiration and food. For most North Americans, food provides the major way in which toxics enter the human body. Both these pathways rely on the atmospheric transport of toxic chemicals.

Airborne toxics enter the food chain in several ways: as fallout onto food as it is grown; as fallout onto food as it is shipped and stored; from misapplied pesticides and fertilizers.

Most Ontario food, including meat and dairy products, is grown in areas quite close to sources of atmospheric pollutants. Thus, even organic food is vulnerable to airborne fallout, and even the most careful person can be exposed to toxic substances through the food chain. Canada is at present fighting automotive sources of air pollution through stricter emission standards and by phasing out lead in gasoline.

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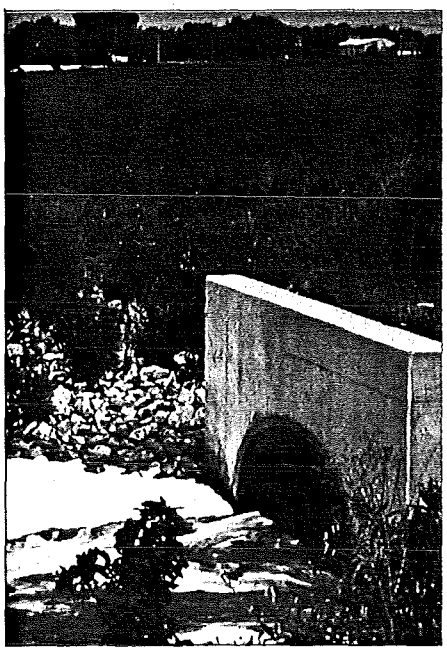
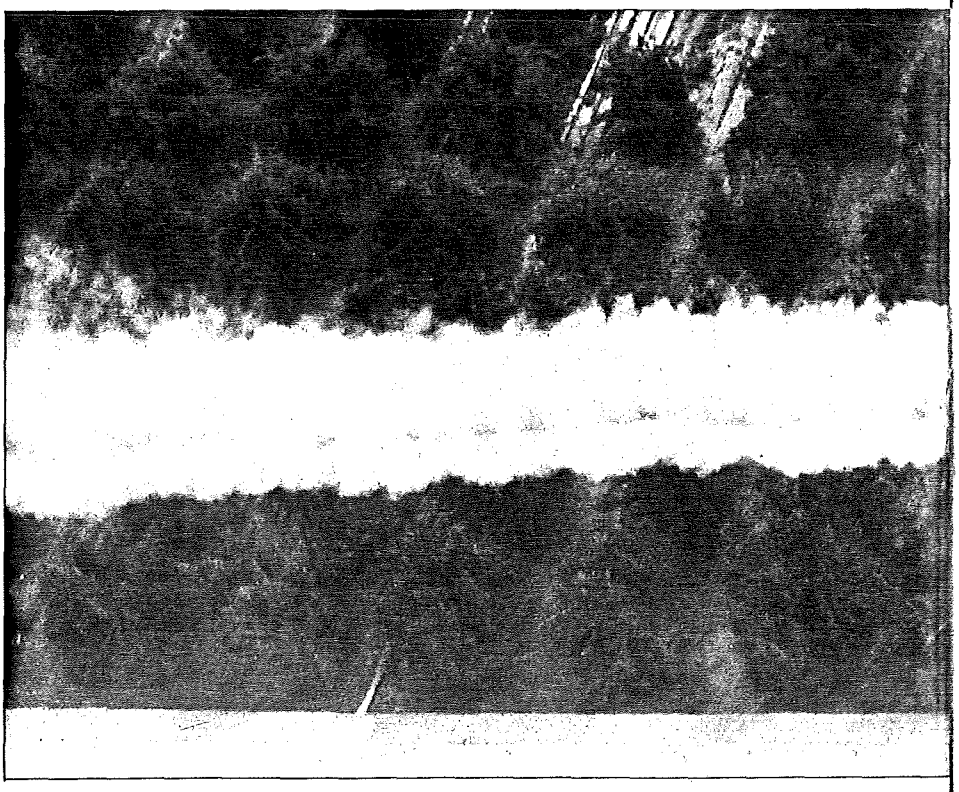


hundreds, even thousands, of kilometres away from the place where the substances eventually land. The presence of the pesticide toxaphene in Great Lakes waters provides a classic example of long range transport. Toxaphene has been restricted in Canada since 1971, yet it is the major chemical polluting Lake Superior, as a result of long range transport through the atmosphere from the American south, where it is used to control pests which prey on cotton crops. The long range transport of pollutants is a world wide problem – no area on the globe is safe, and even the high Arctic and Antarctic receive chemical fallout.

Short range transport, however, is the major menace to the Great Lakes basin ecosystem. The Great Lakes are located adjacent to, or downwind from, highly industrialized areas such as Toronto, Hamilton, Detroit, Chicago and Cleveland. Pollution from local atmospheric emissions contributes to the total loading of toxic substances in the Great Lakes basin.

There are several sources of atmospheric pollutants. Incineration is commonly used to destroy municipal wastes, but if the burning process is not properly carried out toxic chemicals can

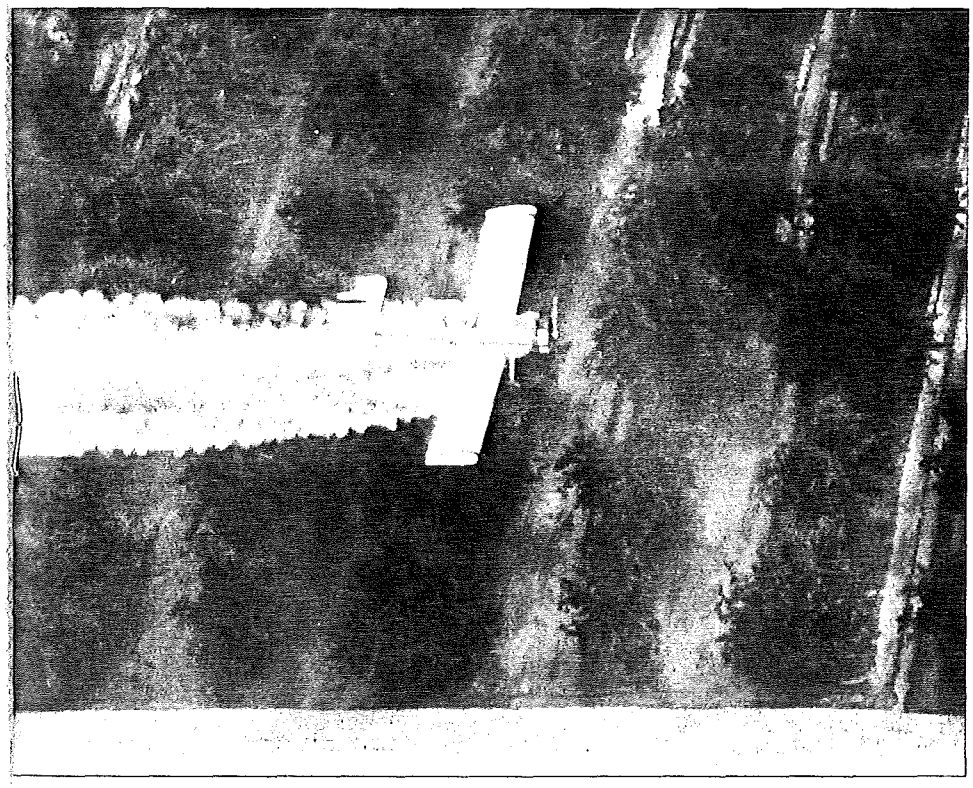


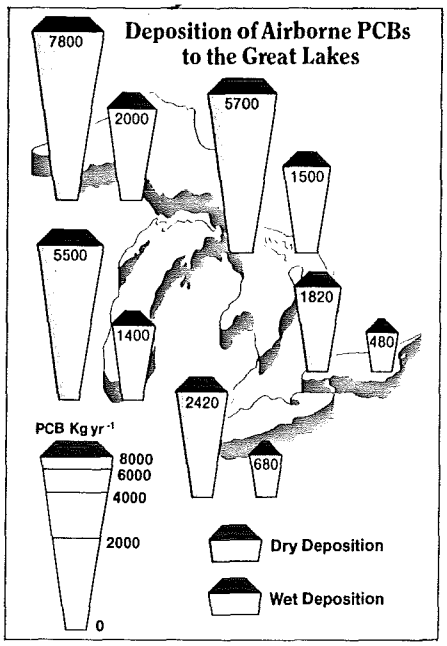
literally go up the chimney, to descend elsewhere. Incineration must be complete, and must be done at temperatures that are high enough for all toxic materials to be destroyed. Toxic substances can also evaporate from improperly sited, constructed or maintained landfill or waste disposal sites. "Volatilization" is a process whereby toxic substances evaporate off the surface of bodies of water such as the Great Lakes, and circulate through the air before descending. The evaporation and drift of agricultural chemicals is yet another source.

The scientists of the Great Lakes Water Quality program have concluded that:

There is at present little or no understanding of the role and importance of atmospheric processes which contribute to the presence of priority substances in the Great Lakes ecosystem. As a result it is difficult to formulate, implement and evaluate ecologically sound strategies for the health and well-being of man and the environment in the Great Lakes basin.

There are measures which can be taken that will help to deal with the problem of airborne toxic substances.





TOXAPHENE

A chlorinated insecticide, has been used widely in the United States to control insects on cotton, fruit and vegetables. As much as 59% of the chemical may be lost to the atmosphere during spraying and 52% of the amount which reaches the ground has been known to vaporize within 58 days.

Toxaphene has been found in all three of the upper Great Lakes and has replaced PCBs as the major contaminant of Lake Superior. Levels of toxaphene in Lake Superior are now as high as those of waterways in the states where the chemical is sprayed. Since the use of toxaphene was restricted by the United States in 1982, toxaphene has not been evident in summer rain around the Great Lakes.

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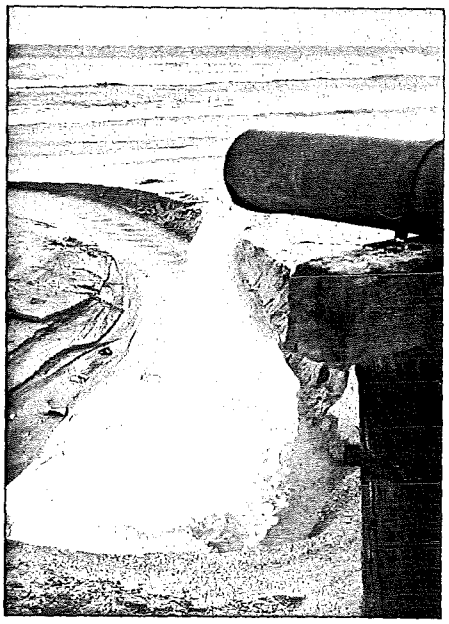


There are five classes of pollutants that have been given the highest priority within the Great Lakes basin: PCBs and organochlorine pesticides; polynuclear aromatic hydrocarbons (PAHs); the trace metals mercury, lead and cadmium; chlorinated dioxins; and dibenzofurans. Scientists agree on the dangers of these substances, have a fairly good idea of how they behave in the environment, and of what effects they can have on human and environmental health. In dealing with these substances, the uncertainties which plague the implementation of environmental controls can be minimized. If a strategy can be devised that will meet this challenge, the worst threat will be overcome. Programs must be developed to monitor these poisons, to trace them to their sources, and to stop them at that source.

As is so often true, with atmospheric toxic chemicals an "ounce" of prevention is worth a "pound" of cure. The best way to clean up airborne pollution is to stop it from entering the atmosphere in the first place. The solution is twofold: proper incineration and the elimination of discharges to both water and air.

It does not require exotic new

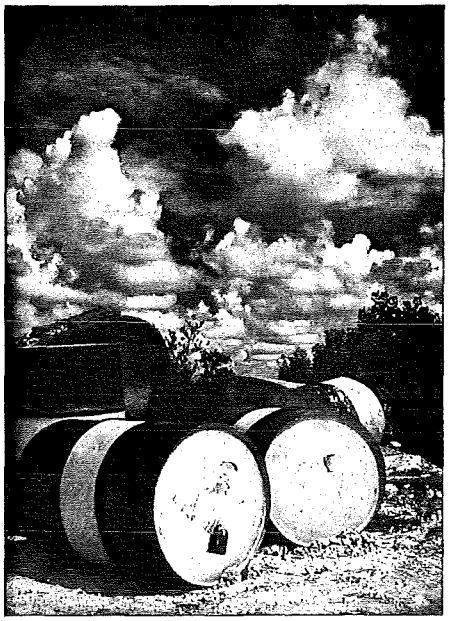
Chemical Residues in Ontario

	Human Adipose (mg/kg)			Human Milk - fat basis (mg/kg)
	Kingston	**Ottawa**	**Ontario**	**Ontario**
PCB	3.0	2.0	2.1	0.756
DDT	3.429	2.694	4.069	0.983
Mirex	0.027	0.011	0.02	-
Photomirex	0.009	0.006	-	-
HCB	0.106	0.078	0.013	0.0184
BHCH	0.136	0.065	-	-
TCDD	12.4×10^{-6}	8.6×10^{-6}	-	-
Heptachlore poxide	0.035	0.037	0.07	0.012
Dieldrin	0.036 n = 12	0.043 n = 10	0.10 n = 47	0.194 n = 125
	(Ryan et al 1983)		(Frank et al 1983 a, b)	

technology to safely dispose of priority toxic substances. They can be safely destroyed by high temperature incineration, using techniques that are already well known. The process must be carefully controlled to ensure that destruction is complete. Improper low temperature incineration can actually increase the presence of some toxics, and is a cause of some of our present problems.

In fact, improper disposal can sometimes be as bad as, or worse than, no disposal at all. When substances such as PCBs are stored in an improper landfill, or poorly burned, they can spread and contaminate an even larger area by leaching into the watershed, or by rising into the air and dispersing. Proper incineration techniques, however, should not harm humans or the environment, if carefully carried out. The risk to general society and the ecosystem is already high and will only be lowered by starting to dispose of persistent toxic chemicals through techniques such as incineration.

Although not very well known until recently, the menace of atmospheric toxic pollutants is rapidly emerging as a major, if not the



PCBs in North American Food

Vegetables	Total PCBs	Total PCBs in Soil	Reference
Beet	66 μg/kg (dry wt.)	16,400 μg/kg	Sawhney
Turnip	66 μg/kg (dry wt.)	16,400 μg/kg	and Hankin
Beans (Pods & Seeds)	181 μg/kg (dry wt.)	—	1984
Carrot (scrubbed not peeled)	68.7 mg/kg (fresh wt.)	386 mg/kg	Iwata et
Carrot (peeled)	1.34 mg/kg (fresh wt.)	386 mg/kg	al 1974
Cabbage	400 μg/kg (dry wt.)		Babish et al 1979
Leafy vegetables	0.14 mg/kg	17.1 mg/kg	Baker et al 1980
Meats			
Beef fat	9.5 μg/kg		Frank et al
Pork fat	3.0 μg/kg		1983
Mutton fat	8.37 μg/kg		Saschenbrecker
Fowl fat	3.0 μg/kg		1976
Coho Salmon (muscle)	5.77 mg/kg (wet. wt.)		Norstrom and Hallett 1978
Carp (edible fillet)	1.58 mg/kg		Zabik et al 1982
Dairy			
Whole Milk	0.899 μg/kg		Frank et al 1983

PCBs:

It has been assumed that with the advent of government regulations against them, the use of PCBs would decline. This has been the case. However, since the regulations were not retroactive, 92.2% of PCBs in Ontario are still in use, mostly in electrical equipment. The quantity of PCBs in storage prior to disposal is large – 433 497 litres. Since this figure can only increase as PCBs are phased out, prohibitions on PCBs increase the need for safe disposal.

If the following three things can be done, the threat of toxic substances in the Great Lakes basin will be conquered:

- **Clean up unsafe disposal sites such as Love Canal and the "S" Area dump.**
- **Eliminate discharges in the manufacture, use, shipment and disposal of persistent toxic substances.**
- **Construct efficient systems for the treatment and disposal, particularly through incineration, of toxic substances.**

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major environmental threat within the Great Lakes basin. Thus far, most attention has been focused on direct discharges into the Lakes. Now, we are learning that airborne pollutants also pose a distinct threat to human health, as they descend on land and water surface alike. Evidence now shows that toxic chemicals are present in the general population at levels that cannot be accounted for if water supplies are their only source. All the facts suggest that the atmospheric transport of toxic substances is one of the next major battles to be fought against pollution in the Great Lakes basin.

Canadians rely heavily on chemicals and the benefits they provide — in agriculture, in medicine and thousands of everyday products. But despite their heavy dependence on them, Canadians are increasingly wary of chemicals. The phenomenon of "chemophobia" is understandable, rooted as it is in such widely publicized incidents as the tragedies of Bhopal and Love Canal.