

=====Electronic Edition=====

RACHEL'S HAZARDOUS WASTE NEWS #144

---August 29, 1989---

News and resources for environmental justice.

Environmental Research Foundation
P.O. Box 5036, Annapolis, MD 21403
Fax (410) 263-8944; Internet: erf@igc.apc.org

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=====[Previous Issue](#)=====Next Issue=====

THANKS TO MONSANTO...

This is a modern tale about how everything is connected to everything else in the environment. It begins in 1929 when the Monsanto Corporation started selling PCBs (polychlorinated biphenyls). PCBs are oily liquids that are very stable (they don't change their characteristics) even when they get hot, and they don't conduct electricity but they do conduct heat. Therefore, they make good insulators in electrical transformers and capacitors. They have also been used as hydraulic fluid, and in metal finishing. They are found in electrical systems and other components of automobiles (which is one reason junked cars and "car fluff" may be quite hazardous to your health). For a time, carbonless carbon paper was made with PCBs.

Then scientists in the 1970s studying damage to wildlife from DDT realized that there was something else causing the same problems as DDT, and soon they identified PCBs as the culprit. It turns out that PCBs interfere with birds' reproductive systems just the way DDT does--they cause egg shells to become thin, so the eggs get crushed when the mother sits on them, and they never hatch. Other evidence about hazards from PCBs came to light and in 1976 Congress banned PCB production--the only chemical Congress itself has ever banned.

Nevertheless, Monsanto had sold a lot of PCBs before Congress cut them off at the knees; as a result, there are 1.2 million tons (2.4 billion pounds) of PCBs loose somewhere in the world. Remember, they are very stable compounds (that was the reason for their commercial success), so they don't degrade or disappear easily.

Now a recent series of studies has begun to discuss the whereabouts of all the world's PCBs. Sixty-five percent of them are still in use in electrical equipment that will be getting old and ready for replacement during the '90s, or are in landfills. Twenty percent have already reached the oceans. Eleven percent are in terrestrial soils and sediments; 4% have been incinerated or otherwise degraded.

Eighty-five percent of the world's PCBs are held within developed countries, fifteen percent exist in developing countries.

PCBs have a broad range of unpleasant effects. They accumulate in fatty tissues of living things (birds, fish, people, etc.) and they readily pass through the walls of cells. Cells are the tiny bags of fluid of which every living thing is built. For example, a typical human is constructed of 50 trillion cells. Chemicals that can pass through the walls of cells can cause all sorts of mischief, and PCBs are no exception. PCBs can cause cancer and they can promote cancer (that is, other chemicals when combined with PCBs develop the ability to cause cancer). PCBs also cause birth defects in humans and animals. PCBs damage the human immune system (and probably the immune systems of other creatures as well). PCBs also cause hypertension (high blood pressure) and they cause strokes in humans. Women who ate fish from the Great lakes mildly polluted with PCBs (at or below legal limits) bore children with small heads and who suffer from significant learning and behavioral defects. (See [RHWN #61](#).)

PCBs enter the ocean by two routes--by deposition from the atmosphere (when it rains) and by drainage from rivers. Atmospheric deposition is by far the largest source; 98% of the PCBs entering the ocean arrive as air pollution, only 2% arrive via river water.

Because PCBs can become airborne when they are released into the environment, they have spread everywhere on earth. Recent studies in sparsely populated areas of Canada (northern Saskatchewan, Ontario, and New Brunswick) have revealed that rainfall now carries 17 parts per trillion (ppt) of PCBs. As a matter of law, the Ontario government allows only 1 ppt of PCBs to be discharged into the environment, but it has been difficult to get a court injunction against rainfall.

Between 1969 and 1984 the levels of PCBs in arctic polar bears quadrupled. At the current rate of increase, by the year 2005 (16 years from now) the average polar bear will have 50 parts per million (ppm) PCBs in their fatty tissue (adipose tissue) and then polar bears will meet the EPA (U.S. Environmental Protection Agency) criteria for being classified as a hazardous waste.

Some species of cetaceans (the whale family) already far exceed polar bears in PCB concentrations. Killers whales from the deep ocean have 410 ppm PCBs in their blubber, and blue-white dolphins off the coast of Europe have 833 ppm. Thus these creatures must definitely now be classified as hazardous wastes by EPA criteria.

The upper layer of water in the oceans plays an important role in this story. The upper 50 micrometers of water (called the microlayer) concentrates pollutants from atmospheric deposition (rain), terrestrial runoff (rivers) and sewage disposal. (The dot over the letter i in this newsletter measures 400 micrometers in diameter, so 50 micrometers is 1/8 of the diameter of the dot over an i.) In the microlayer, the uppermost surface of the ocean, pollutants are found at concentrations 10 to 100 times greater than the average concentration in ocean water. Plankton are the tiny creatures that form the bottom-most level of all ocean food chains. They carry out photosynthesis, using energy from sunlight to convert carbon dioxide and water into plants, which are then eaten by creatures that are eaten by other creatures, and so

forth. Plankton live in the microlayer because that's where there's most sunlight for photosynthesis. Therefore they absorb the concentrated pollutants. Then when they are eaten, they pass the pollutants to the next creature, which passes them on to the next creature and so on. Because PCBs are soluble in fat, they are retained in the bodies of fish and mammals and at each step in the food chain, the concentration of PCBs increases. Animals at the top of an oceanic food chain (like whales) will have a concentration of PCBs in their bodies 10 million times greater than the concentration in plankton at the bottom of the chain. (This is called biomagnification or bioconcentration, and it is the reason why dilution is no solution to pollution.)

The next-to-last chapter in our unfolding story is that marine mammals (seals, porpoises, whales, etc.) have a genetic predisposition to reproductive failure caused by PCBs. This is simply bad luck. PCBs happen to act like hormones in marine mammals, interfering with their ability to reproduce.

Joseph Cummins, Associate Professor of Genetics at University of Western Ontario, writing in the journal, *THE ECOLOGIST*, says that if even as little as 15% more of the world's stock of PCBs gets into the oceans, "the extinction of marine mammals would be inevitable." He says, "The consequence of failing to control PCB releases to the oceans will be the extinction of marine mammals and the chemical fouling of the ocean fisheries, rendering them unsuitable for use by humans." Dr. Cummins believes that the "developed" world can manage its PCB stocks sensibly. (We note that he does not offer a basis for this belief.) However, he is concerned that the developing world hasn't the financial resources to control the PCBs now in use in its domain. He therefore suggests that Monsanto should purchase back all its PCBs from wherever they are located in the developing world, to avoid PCB-induced calamity for all the world's oceans in the coming decades.

For its part, Monsanto makes no apology for its behavior. It continues to operate very profitably, introducing new chemicals into use at every opportunity. And that concludes our modern tale.

Get: Joseph Cummins, "Extinction: The PCB Threat to Marine Mammals," *THE ECOLOGIST* Vol. 18 (1988), pgs. 193-195. And while you're thinking about it, why not send a note of thanks to our friends at Monsanto who have done so much to make the modern world the kind of place it is today: 800 North Lindbergh Boulevard, St. Louis, MO 63141-7843. Or phone them at (314) 694-1000.

--Peter Montague, Ph.D.

Descriptor terms: oceans; pcbs; water pollution; air pollution; wildlife; fish; marine mammals; biomagnification; extinction; species loss; developing countries; monsanto; global environmental problems;

[Next Issue](#)