It's Time to Say "No" to Toxic Hitchhikers

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Scientists, industrialists, and governments are perpetually battling over the issue of climate change. As the parties come closer to agreement on the need to address the problem, cost-benefit analyses will drive political decisions on how and what should be done next. It is time that a new set of benefits that until now have received little attention should be included in the strategies for reversing the warming trend. Global climate change has clearly been identified as the result of atmospheric accumulation of greenhouse gases that include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), sulfur hexafluoride (SF_6), and a number of the ozone-depleting chlorofluorocarbons. The largest source of these gases that trap and hold heat in the earth's atmosphere is combustion. Combustion not only produces the above gases but also dangerous compounds that pose a threat to our children before they are born, and to their children and grandchildren. These compounds include some well-publicized, persistent, organochlorine chemicals, such as dioxins, also called TCDDs, furans, hexachlorobenzene (HCB), and polychlorinated biphenyls (PCBs), and trace metals, like mercury and cadmium. The amounts of these toxic hitchhikers might seem insignificant compared with the tons of greenhouse gases that are released. But their impact on human and wildlife health and the global economy is substantial. Unfortunately, their toxicity is so great that only the newest, most sensitive instrumentation can measure the extremely low concentrations at which they can injure living organisms. Their invisibility, similar to the nature of their toxicity, is so insidious that, when environmentalists and climatologists began to focus on the problem of global warming, their role was not yet understood.

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Dioxins, furans, HCB, and PCBs are associated with serious widespread human and wildlife health problems. Human prenatal exposure to PCBs, dioxins, and mercury has been significantly correlated with impaired intelligence, behavior, immune competency, reproductive success, and metabolism. Wildlife exposure to these same chemicals, especially in aquatic systems where the chemicals readily biomagnify in the food web, has led to severe reproductive problems in a number of species with regional extirpation of some populations. The economic benefits from lowering emissions of these compounds could be astronomical. Reductions would improve the quality of life and assure the integrity and perpetuation of all species, including humans.

The Great Lakes basin of the United States and Canada offers an example of the damage these toxic substances can cause. In the late 1890s and early 1900s, the chlor-alkai industry started to produce free chlorine (a chemical that has improved the general health of the world) at a number of locations on the shores of the Great Lakes. Industrialists had no idea that they were inadvertently producing dioxin and causing widespread contamination. By the 1930s and 1940s, top predator fishes, herring, and lake trout began to disappear from the Great Lakes resulting in the declines of several huge commercial fisheries. It took until the 1990s for scientists at the University of Wisconsin, Madison to discover that very low concentrations of dioxins in lake trout eggs injure embryos so that they are unable to reach maturity. About the same time, Environmental Protection Agency scientists, doing core drills in Lakes Michigan and Ontario, discovered that dioxin concentrations in

the lakes were high enough in the 1930s and 1940s to prevent these top predator fish in the lake from reproducing. This raises questions about whether the loss of some of the major ocean fisheries in the world might not have been, in part, the result of the global dispersal of dioxins, furans, PCBs, and similar organochlorine chemicals. Black-footed albatrosses that feed only on the surface of the North Pacific Ocean and nest on Midway Island are already carrying elevated levels of furans, dioxins, and PCBs near or above concentrations at which aquatic birds are being affected in the more highly contaminated areas of the Great Lakes.

It has taken the regulatory community years to reach the conclusion that dioxin is a human carcinogen. Reducing cancer associated with exposure from stack emissions is a hidden benefit. But, cancer is only one of the many impacts these chemicals have on animals and humans. The greenhouse gases' cocontaminants are also endocrine disruptors, chemicals that look like or interfere with the hormones that control the development of an individual from conception to birth. Their effects are insidious, undermining an individual's ability to reach his or her fullest potential. Biologists have learned how devastating impacts like this can be on a population from their experience working in the field with wildlife. They warn that endocrine disruptors can lead to the loss of wildlife populations without society knowing what is happening (Bantle *et al.* 1995). They also agree that endocrine disruptors can change the character of human societies (Colborn *et al.* 1998). These chemicals can interfere with the developing brain and nervous system and humankind, again, could miss what is happening. As a matter of fact, cancer is essentially a rare event compared with the impact of these chemicals on populations of wildlife and humans. Cancer has never led to the extirpation of a wildlife population, but prenatal damage as a result of exposure to PCBs, dioxins, and furans has caused populations of fish and birds to decline dramatically or disappear (Colborn *et al.* 1990).

Among humans, for those individuals who survive through birth, insidious health effects, such as susceptibility to disease, autoimmune problems, learning problems, early or delayed puberty, abnormal urogenital development, reduced sperm count, and fertility problems may not be terminal or lethal, but certainly impair quality of life (Colborn *et al.* 1998). And their social costs can be substantial.

For example, prenatal exposure to background or ambient levels of PCBs can interfere with the development of the brain reflected in reduced Intelligence Quotient (IQ) scores and disturbing behavioral changes. Researchers found a 6.2 IQ deficit in children whose mothers were carrying PCBs and their cocontaminants during their pregnancies at or slightly above the norm found in the U.S. population. These children have difficulty reading and processing information, and can be as much as two years behind in school by the time they reach the sixth grade (Jacobson & Jacobson 1996). Their odds of becoming healthy, tax paying adults are reduced as their lifetime earning ability is jeopardized. The economic costs for a five-point IQ loss have been estimated to be $30 billion per year in Canada and from $275 billion to $397 billion per year in the United States. It is possible that up to 50% of these costs could be the result of environmental exposure (Muir & Zegarac 2001).

PCBs and HCB were not considered harmful when they were first produced on a large scale. And, dioxins, furans, and mercury, as by-products of combustion, were never intentionally produced or released. The impact of these chemicals on behavior and function is not easily identifiable at the individual level. It has taken expensive, long-term, epidemiological studies, some as long as a generation (20 years or more), to determine the damage from exposure to these greenhouse gas hitchhikers in humans. It is clear what society has to gain by removing them from the environment. And as analytical chemical protocols improve, more hitchhikers may be discovered spewing into the air along with the greenhouse gases that have been overlooked thus far. From an ecosystem health viewpoint, not only are these hitchhikers affecting the integrity of animal species in the womb, they are also threatening marine and freshwater fish food resources in a protein-starved world. There could be a lot more to gain than meets the eye. It is time to tally up the benefits and take action.

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