OTHER CHLORINATED POPS OF CONCERN

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Persistent organic pollutants (POPs) are bioaccumulative and toxic organic compounds of natural or anthropogenic origin that resist degradation in the environment. They are characterized by low water solubility and high lipid solubility resulting in bioaccumulation in fatty tissues of living organisms. POPs may be transported in the environment by movements of fresh and oceanic waters and also are transported long distances in the atmosphere, resulting in widespread distribution around the earth, including in regions where they never have been produced or used.

Twelve POPs have been identified by the United Nations Economic Commission for Europe for international regulation. These include eight pesticides, two industrial chemicals and two byproducts of industrial activities: hexachlorobenzene (HCB), mirex, chlordane, DDT, Toxaphene, endrin, aldrin, dieldrin, heptachlor, PCBs, PCDDs and PCDFs. Since 1970, the use of these compounds has been increasingly restricted and their production is banned in many, but not all, nations. However, due to their persistence, POPs tend to recycle within various environmental media even after their use has been restricted. The United Nations Environment program (UNEP) is currently coordinating negotiations to develop a global agreement for a global phase-out of twelve POPs (Rodan et al., 1999). The scientific basis for POPs screening criteria that have been used in regional and international programs focus on the properties such as persistence, bioaccumulation, toxicity and long-range transport. While the proposed POPs treaty is a positive step, it should be noted that there are several other halogenated compounds that are persistent, bioaccumulative, toxic and have the potential for long-range transport.

While UNEP is considering the phase-out of twelve chlorinated POPs, there are other chlorinated compounds such as polychlorinated- naphthalenes (PCNs), diphenyl ethers (PCDEs), diphenyl toluenes (PCDPTs), dibenzothiophenes (PCDTs), quaterphenyls (PCQs), paraffins (PCFs), terphenyls (PCTs), and benzenes such as pentachlorobenzene have been reported to occur in the environment. In addition, quaterphenyl ethers (PCQEs), biphenylenes (PCBEs), polychlorinated phenoxy anisoles (PCPAs), biphenyl anisoles (PCBAs), xanthenes (PCXEs), xanthones (PCXOs), anthracenes (PCAns), fluorenes (PCFIs), dihydroanthracenes (PCDHAs), biphenyl methanes (PCBMs) and phenylxylylethanes (PCPXEs) have the potential for environmental occurrence. While some of these compounds have been produced for specific applications, others are industrial byproducts or incineration products. Most of these compounds are structurally similar to PCBs, PCDDs and PCDFs, and may have similar toxicological properties. Some of these compounds, for instance, PCNs, have been observed at toxicologically significant concentrations in the Great Lakes region (Kannan et al., 2000). In addition to the compounds mentioned above, there are alkylated and hydroxylated forms of these same classes. These include polychlorinated alkylbiphenyls (PCABs), alkylnapthalenes (PCANs), alkylphenanthrenes (PCAPs) and alkyldibenzothiophenes (PCADThs). Alkylated analogs of PCDDs and PCDFs are

found in sludges and sediments near paper mills that use chlorine in the bleaching process. Due to the multitude of chlorinated organics that can be present in environmental matrices, the total mass of organically bound chlorine can be measured as "EOCl" by extracting them with organic solvents followed by neutron activation analysis. Such an analysis has revealed that known organochlorines such as PCBs, DDTs, PCDFs and PCDDs account for only a portion of the total organochlorines present in sediment or biota (Kannan et al., 1999). This indicates that there are a variety of unknown or unidentified organochlorines, which have the potential to bioaccumulate and persist in the environment.

Neither the environmental fate nor the toxicological properties of other chlorinated compounds have been studied in as much detail as those of the structurally similar PCDDs, PCDFs or PCBs. A few evidences are available for some of the compounds listed above that indicate that these compounds can be persistent, bioaccumulative and toxic. A few of these compounds are rarely monitored in environmental samples due to the lack of authentic standards and analytical methods.

In addition to the chlorinated compounds, brominated and fluorinated compounds have been reported to be distributed in the environment. Polybrominated compounds such as PBBs and PBDEs are used in flame retardants such as Bromkal. The Bromkal mixture induces EROD activity *in vitro*, but the potency for induction is much less than that of the PCDDs, PCDFs or PCBs. Some of the brominated compounds have been shown to disrupt the endocrine function. Brominated and chloro/bromo-substituted analogues of PCDD and PCDF have been found in the environment and are known to induce ethoxyresorufin-o-deethylase (EROD) activity *in vivo* and *in vitro*.

Recently, fluorinated compounds, particularly perfluorooctane sulfonate and related fluorochemicals used as surfactants in various applications have been shown to be widespread in the global environment. There compounds have been shown to be persistent and bioaccumulative (Giesy and Kannan, 2001). A few studies indicate the perfluorinated compounds can disrupt lipid metabolism and affect cell to cell communication.

Several organoiodine compounds are available in commerce, but their environmental occurrence and fate are not studied in detail. For instance, 3-iodo-2-propynylbutylcarbamate (IPBC), 1-bromo-3-ethoxycarbonploxy-1,2-diiodo-1-propene (BECDIP), and 4-chlorophenyl-3-iodopropargylformal (CPIP) are used as household antimicrobial/antifungal agents and wood preservatives. Although they belong to the class of organohalogens, the carbon-iodine bond energy is less than that of carbon-chlorine bond.

Obviously, there are several other halogenated compounds, which have the potential for persistence, bioaccumulation and toxicity. A detailed investigation on the global distribution and fate of additional POP candidates is needed to develop an agreement for a global phase-out. The session "other chlorinated organics of concern" is organized to address distribution and toxicity some of the newly emerging chlorinated organics of concern.

References

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