Pharmaceuticals in the Environment
P*h*RMA Briefing Paper
PIE Background

Recently improved analytical testing technology has made it possible to detect trace amounts of consumer chemicals including pharmaceuticals in surface waters. The concentrations of pharmaceuticals reported in US drinking waters are generally at trace levels of ng/l or part-per-trillion (ppt).[1] It is not a new situation that drinking water may contain trace levels of pharmaceuticals and other household chemicals, both organic and inorganic. Some pharmaceuticals have probably long been present in drinking water at very low concentrations. What is new is that we now have more sensitive analytical methods to detect these substances at very low levels.

Pharmaceuticals are found in the environment because trace amounts of medicines pass through the human body without being metabolized completely and make their way to surface waters through the municipal wastewater treatment system. Pharmaceuticals are probably present in the wastewater of virtually all households where patients who take medicines live. Therefore, it is not currently possible to prevent medicines from entering sewage. Wastewater treatment plants in the U.S. are designed to mimic the natural biodegradation processes that occur when organic compounds enter the environment. These systems are designed to reduce, but not eliminate, pollutants present in domestic wastewater. Therefore, practically all compounds used in households are expected to be present at trace levels in the discharges from wastewater treatment plants.

There are other possible minor sources for pharmaceuticals in the environment. Unused medicines can contribute to pharmaceuticals found in surface waters because they are sometimes flushed down toilets or poured down sinks. Recent Federal guidance on the topic recommends that medicines be disposed of in the trash or returned to pharmaceutical take back locations that allow the public to bring unused drugs to a central location for safe disposal. Pharmaceutical manufacturing facilities could also contribute to the compounds found in surface waters, but these facilities are designed to limit or eliminate this sort of discharge.

Many responsible scientists and technical experts have contributed to the on-going scientific discussions about pharmaceuticals in the environment. The studies conducted to date suggest that it is highly unlikely that the very small quantities of even potent pharmaceuticals detected in the environment would be harmful to human health. Safe exposure to hormones such as the estrogen that naturally occurs in milk and soy products is much higher than exposure to residues of any estrogen-like pharmaceutical in water. Trace levels of any antibiotics found in surface waters are far below the concentrations necessary to se-

[1] What is 1 ppt? One ppt is about one second in 32,000 years or one inch in 33 round-trips to the moon or 1 penny in $10 billion. On average, all pharmaceuticals detected in U.S. drinking water are below 10 ppt. Caffeine is detected at about 25 ppt. For caffeine, a person has to drink more than five million bottles (20 oz) of water to have the same amount of caffeine in one cup of coffee (~75mg). [Source: Pharmaceuticals in US Drinking Water *and Beyond, Rengao Song, Ph.D., Manager of Water Quality and Research, Louisville Water Company.]*

lect for antibiotic resistance in microbes. There appears to be no appreciable risk to human health from detected concentrations of pharmaceuticals in surface waters.

Exceptional circumstances have led to more focused efforts to evaluate the impact of pharmaceuticals in the environment on some aquatic and terrestrial species. Most scientific publications agree that there are no acute aquatic life effects expected due to pharmaceuticals in the environment. And most studies conducted to support product registrations are now showing that chronic effects in aquatic organisms are not expected for most compounds at predicted environmental concentrations. However, work continues on evaluating chronic effects for certain potent compounds, such as hormone mimics, because effects have been observed near environmentally relevant concentrations. And in an unusual situation in India, where old cattle were treated before they died with an anti-inflammatory drug, ingestion of drug residues by vultures feeding on carcasses has led to vulture deaths from renal failure. Scientific techniques to understand and predict the potential for long-term effects of pharmaceuticals residues in the environment in these kinds of exceptional circumstances are continuing to be developed.