

Unrecognized Environmental Pollutants

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Abstract

The US water pollution control program focuses on the current 126 Priority Pollutants originally selected without peer review in the mid-1970s through a litigation settlement. That notwithstanding, they remain the focal point of water quality investigations. Limited attention is given to the many thousands of potential pollutants that are in municipal and industrial liquid and solid wastes. Periodically, unregulated chemicals that are in use are discovered to be widespread pollutants, posing a significant threat to public health and or the environment. One example is the pharmaceuticals and personal care products (PPCPs) used in homes and in agriculture, which are being found in domestic and agricultural waste waters and solid wastes. Another is perchlorate found in highway accident flares. That chemical is being found in surface and groundwaters in concentrations that are a threat to human health. Polybrominated diphenyl ethers (PBDEs) that are used as flame retardants on furniture and other materials are now being found in human breast milk and in some aquatic organisms. Those chemicals pose significant environmental concerns but are not regulated with respect to water quality impacts. Many of these unrecognized pollutant chemicals are not new chemicals but rather have been in the environment for decades. There is need to significantly change the approach used to evaluate the potential for the vast array of chemicals that are in commerce today to cause public health and environmental impacts.

Key Words:

Priority Pollutants, pollutants, Polybrominated diphenyl ethers (PBDEs), Pharmaceuticals and personal care products (PPCPs), perchlorate

Introduction

The US water pollution control program focuses on the control of a limited group of chemicals, the 126 current “Priority Pollutants.” The chemicals included on the list of “Priority Pollutants” were originally selected in the mid-1970s through a litigation settlement. The list did not receive appropriate peer review for its representation of the chemical contaminants of most pressing importance to public health and environmental quality. That notwithstanding, the Priority Pollutants remain the focal point of water quality investigation and management. Limited

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attention is given to the evaluation and regulation of the many thousands of other potential pollutants that are in municipal and industrial liquid and solid wastes, even in light of the myriad other chemicals currently in commercial and personal household use, and those that come into use annually.

Daughton (2004) highlighted the growing concern about unrecognized, unregulated pollutants, indicating that there are over 22 million organic and inorganic substances, with nearly 6 million commercially available. The current water quality regulatory approach addresses fewer than 200 of these chemicals. He also noted,

“Since the 1970s, the impact of chemical pollution has focused almost exclusively on conventional “priority pollutants,” especially on those collectively referred to as “persistent, bioaccumulative, toxic” (PBT) pollutants, “persistent organic pollutants” (POPs), or “bioaccumulative chemicals of concern (BCCs).”

The “dirty dozen” is a ubiquitous, notorious subset of these, comprising highly halogenated organics (e.g., DDT, PCBs).

The conventional priority pollutants, however, are only one piece of the larger risk puzzle.”

“Regulated pollutants compose but a very small piece of the universe of chemical stressors to which organisms can be exposed on a continual basis.”

Similarly, Dr. K. Hooper of the Hazardous Materials Laboratory, California EPA Department of Toxic Substances Control recently noted (Hooper, 2003),

“Over the past 25 years, tens of thousands of new chemicals (7 chemicals per day) are introduced into commerce after evaluation by USEPA. Few (100-200) of the 85,000 chemicals presently in commerce are regulated. We have reasons to believe that a much larger number than 200 adversely affect human health and the environment.”

Periodically, unregulated chemicals that are in use are discovered to be widespread pollutants, posing a significant threat to public health and or the environment. Examples of such findings and illustration of the need to address the broader issue of previously unrecognized pollutants are presented below.

Examples of Previously Unrecognized Pollutants

Pharmaceuticals and Personal Care Products (PPCPs). Increasing attention is being given to pharmaceuticals and personal care products (PPCPs) as environmental pollutants. At the California Bay Delta Authority (CBDA) Contaminant Stressors Workshop, Dr. Christian Daughton, Chief, Environmental Chemistry Branch, US EPA National Exposure Research Laboratory, addressed this issue in his presentation entitled, *“Ubiquitous Pollution from Health*

and Cosmetic Care: Significance, Concern, Solutions, Stewardship – Pollution from Personal Actions.” (Contact Daughton at daughton.christian@epa.gov)

Daughton (2004) pointed out that a wide variety of chemicals that are introduced into domestic wastewaters are being found in the environment. Various chemicals (pharmaceuticals) used by individuals and to treat pets, outdated medications disposed of into sewerage systems, and treated and untreated hospital wastes discharged to domestic sewerage systems end up in receiving waters for domestic wastewater treatment plant effluents. Further, transfer of sewage solids (“biosolids”) to land, industrial waste streams, landfill leachate, releases from aquaculture of medicated feeds, etc. also introduce these chemicals into the environment. Many of these chemicals are not new and have been present in wastewaters for some time. However, they are only now beginning to be recognized as potentially significant water pollutants and are largely unregulated as water pollutants.

According to Daughton (2004),

“PPCPs [Pharmaceuticals and Personal Care Products] are a diverse group of chemicals comprising all human and veterinary drugs (available by prescription or over-the-counter; including the new genre of “biologics”), diagnostic agents (e.g., X-ray contrast media), “nutraceuticals” (bioactive food supplements such as huperzine A), and other consumer chemicals, such as fragrances (e.g., musks) and sun-screen agents (e.g., methylbenzylidene camphor); also included are “excipients” (so-called “inert” ingredients used in PPCP manufacturing and formulation).”

While the full range of impacts of PPCPs is just beginning to be investigated, PPCPs are being found to have adverse impacts on aquatic ecosystems. For example, Daughton (2004) discussed the relationship between PPCPs and endocrine disrupters, which are believed to be responsible for causing sex changes in fish. In addition, in a feature article in *Environmental Science and Technology* Eggen *et al.* (2004) reviewed a number of the issues pertinent to understanding the impacts of PPCPs and other chemicals that can cause endocrine disruption, DNA damage/mutagenesis, deficiencies in immune system and neurological effects in fish and other aquatic life. (Additional information on PPCPs is available at www.epa.gov/nerlesd1/chemistry/pharma/index.htm.)

Perchlorate. Perchlorate (ClO_4^-), used in highway safety flares and other applications, is another example of a chemical that is now being found in surface and groundwaters in sufficient concentrations to pose a threat to human health. Perchlorate is derived from several sources. Silva (2003) of the Santa Clara Valley, CA Water District, noted the potential for highway safety flares to be a significant source of perchlorate contamination to water, even when the flares are 100-percent burned. According to him, one fully burned flare can leach up to almost 2,000 μg of perchlorate, and

“A single unburned 20-minute flare can potentially contaminate up to 2.2 acre-feet [726,000 gallons] of drinking water to just above the California Department of Health Services’ current Action Level of 4 µg/L [for perchlorate].”

Silva also pointed out that more than 40 metric tons of flares were used/burned in 2002 alone in Santa Clara County. California’s Office of Environmental Health Hazard Assessment (OEHHA, 2004b) recently conducted an evaluation of the hazards of perchlorate in drinking water. The 4 µg/L action level for perchlorate in drinking water was based on the detection limit; it has been revised to 6 µg/L based on the recent OEHHA evaluation.

Polybrominated diphenyl ethers (PBDE). Another unrecognized, unregulated pollutant is the polybrominated diphenyl ethers (PBDEs) used as a flame retardant on furniture and other materials. Hooper (2003) recently discussed finding PBDE in human breast milk and in San Francisco Bay seals, and the fact that archived human breast milk shows that this contamination has been occurring for over 20 years. According to McDonald (2003) of the California Environmental Protection Agency, Office of Environmental Health Hazard Assessment,

“Approximately 75 million pounds of PBDEs are used each year in the U.S. as flame retardant additives for plastics in computers, televisions, appliances, building materials and vehicle parts; and foams for furniture. PBDEs migrate out of these products and into the environment, where they bioaccumulate. PBDEs are now ubiquitous in the environment and have been measured in indoor and outdoor air, house dust, food, streams and lakes, terrestrial and aquatic biota, and human tissues. Concentrations of PBDE measured in fish, marine mammals and people from the San Francisco Bay region are among the highest in the world, and these levels appear to be increasing with each passing year.”

PBDEs are similar to PCBs and are considered carcinogens. Some of the PBDEs are being banned in the US and in other countries.

Pesticides. Another example of unidentified pollutants was given by Kuivila (2000). She discussed the fact that there are approximately 150 pesticides used in California’s Central Valley that are a threat to cause water quality problems in the Delta and its tributaries. The current pesticide water quality regulation program considers only about half a dozen of those.

Conclusions and Recommendations

The presence of untold, unregulated pollutants in environmental systems, as illustrated above with the examples of PPCPs and others, is not unexpected based on the approach that is normally used to define constituents of concern in water pollution control programs. Based on the vast array of chemicals that are used in commerce, many of which are or could be introduced into aquatic systems from wastewater and stormwater runoff, it is likely that many other chemicals will be discovered in the future that are a threat to public health or aquatic ecosystems. There is a pressing need to significantly expand water quality monitoring programs to specifically search for new, previously unrecognized water pollutants. As demonstrated by the perchlorate and

PBDE situations, monitoring programs that focus on Priority Pollutants stand to be significantly deficient in properly defining constituents of concern with respect to impairing the beneficial uses of waters.

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