CIWEM Chartered Institution of Water and Environmental Management

Policy Position Statement

Pharmaceuticals and other trace organic micro-pollutants in drinking water

Purpose

This Policy Position Statement (PPS) presents CIWEM's current position regarding the occurrence of pharmaceuticals and other trace organic micro-pollutants in drinking water. The term "organic micro-pollutants" is intended to include any organic compounds that may be found at microgram per litre concentrations (parts per billion) or lower in water, such as pesticides, pharmaceutical residues, hormones, flame-retardants, plasticizers, perfluorinated compounds and others. It does not include disinfection by-products such as trihalomethanes.

The aim is to place the potential environmental and public health significance of these compounds into context and to also recognise the costs inherent in removing these compounds from water and the need for solutions that are sustainable in a broad sense.

CIWEM's Position on organic micro-pollutants in water:

There has been considerable media coverage reporting the presence of a range of organic micro-pollutants in natural waters, wastewater and even tap water. Some of the most high-profile media coverage has been given to pharmaceutical residues in natural waters for example, residues from contraceptive pills, antibiotics, or pain killers (analgesics).

Some of these organic compounds have always been "naturally" present to some degree in water (e.g. human or animal hormones), whereas other organic micro-pollutants would not normally be found in the natural environment but rather result from man-made products (e.g. pesticides, pharmaceutical residues, flame-retardants, perfluorinated compounds, plasticizers).

Alarm has been raised, even though the environmental and human health significance of many organic micro-pollutants is still unproven. However, the ever-increasing ability to detect and monitor compounds at micro levels leads to a growing awareness of potential impacts.

1. There is no convincing case, based on the currently available information, that organic micro-pollutants at the concentrations that are measured in drinking water which complies with current regulatory limits presently constitutes any acute, or even chronic, consequences to human health. The currently permitted concentrations of organic micro-pollutants in tap water should therefore be regarded as "safe" unless/until new information demonstrates that there is a significant risk.
2. The risk to humans in the UK so far as we can tell, is very low at present. Further effort is needed to manage the use of products so that the active compounds in them do not ultimately reach the environment, especially where alternatives exist. The revised Drinking Water Directive proposes taking a precautionary approach in setting new limits

for certain perfluorinated compounds and endocrine disrupting chemicals (EDCs). We are supportive of this approach.

3. There is currently a large amount of information from studies conducted around the world regarding the concentrations of a wide range of organic micro-pollutants in natural waters, wastewater and drinking water. Water utilities should assess the likely presence of any new chemicals that may be discharged into water that may be abstracted for drinking water and monitor accordingly. This monitoring should, wherever possible, include metabolites and degradation by-products of the micro-pollutants, which in some cases can have more significant consequences than the parent compound.

4. There is currently a relatively large amount of information from studies conducted around the world regarding the toxicological effects and epidemiological consequences of a range of organic micro-pollutants at the concentrations found in natural waters, wastewater, and drinking water. Further studies are needed to address compounding factors such as mixture effects and other routes of exposure besides ingestion (e.g. dermal exposure, inhalation, food sources) before appropriate conclusions regarding the true environmental and human health consequences of exposure to these organic micro-pollutants via water, on both short- and long-term bases, can be reached.

5. Further research is needed to develop new energy-efficient, cost-effective treatment technologies to optimise existing treatment practices to remove organic micro-pollutants from water and wastewater in a sustainable manner.

6. Other ways to minimise the concentrations of organic micro-pollutants, besides the implementation of new water and wastewater treatment processes, should also be investigated and implemented if appropriate. Examples may include improving the protection of drinking water source waters from organic pollution, or regulatory application of the "polluter pays" principle when particular consumer products are identified as being significant sources of organic pollution.

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Context

Much of the increased interest in these organic micro-pollutants in recent times results from advances in the analytical chemistry methods allowing, for the first time, quantification of the very low concentrations of these compounds in water. Therefore, it is not necessarily the case that all these organic micro-pollutants are newly occurring in water, but rather that it is only recently that the ability to reliably measure them at the very low concentrations at which they occur in water has developed.

Toxicology studies have shown that aquatic organisms (e.g. fish) in natural waters that receive wastewater effluents containing organic micro-pollutants can exhibit reproductive and other physiological effects that are directly attributable to organic micro-pollutants. It has not yet been conclusively proven that these organic micro-pollutants have either acute (immediate)

or chronic (long-term) health consequences for humans. This is partly due to the inherent complexity of conducting epidemiological studies where there are several confounding factors (e.g. the effect of exposure to a mixture of micro-pollutants, other routes of exposure) and which require very long study periods in order to produce conclusive results.

There are regulatory standards for some, but not all, organic micro-pollutants in water and wastewater. Some of these standards are specific values that are related to toxicological findings, often with safety factors applied, e.g. the current EU standard for benzene in drinking water is 1 microgram per litre. Limits also exist on certain groups of micro-pollutants, e.g. the current UK limit for pesticides in drinking water is 0.1 micrograms per litre.

Ozone, granular activated carbon and chlorine disinfection are effective water treatment processes for removing some organic micro-pollutants (e.g. pesticides, endocrine-disrupting compounds). Advanced processes, such as ultraviolet advanced oxidation and membrane filtration, have also been proven to be effective against many compounds, however these can be expensive to implement and operate, both in terms of cost and carbon footprint, and may therefore be difficult to justify for the sole purpose of removing micro-pollutants. There is a need to balance the high costs of treatment against the very small risks presented by the micro-pollutants in the water.

Under proposed revisions to the EU Drinking Water Directive, recommendations have been made to take a precautionary approach to managing two perfluorinated substances (PFOS and PFOA) and three representative endocrine disrupting chemicals. These take into account latest evidence from the World Health Organization and consideration of the appropriateness of applying the precautionary principle despite no evidence of risks to health from drinking water. This approach is justified on the basis of the persistent, bio-accumulative and toxic nature of PFOS and PFOA and the sensitivity of aquatic life to EDCs.

The modelling of contamination by micro-pollutants in source waters (particularly river systems) can be a useful tool for identifying pollution hot spots and determining where best to focus resources to remove micro pollutants from discharges. The Dutch have applied this to their main river / canal systems.

References and further reading

British Geological Survey. 2011. Emerging contaminants in groundwater

Drinking Water Inspectorate. 2010. Pharmaceuticals and drinking water

Lyons, G. 2014. Pharmaceuticals in the environment: A growing threat to our tap water and wildlife. A CHEM Trust report

UK Water Industry Research. 2014. Risk Based Prioritisation of Pharmaceuticals

European Commission: Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on the quality of water intended for human consumption (recast)

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Note: CIWEM Policy Position Statements (PPS) represents the Institution's views on issues at a particular point in time. It is accepted that situations change as research provides new evidence. It should be understood, therefore, that CIWEM PPS's are under constant review, that previously held views may alter and lead to revised PPS's. PPSs are produced as a consensus report and do not represent the view of individual members of CIWEM.