SUMMARY

A range of pharmaceuticals has been detected in soils, surface waters and groundwaters across the world. While the reported concentrations are generally low (i.e. sub μg/l in surface waters), the substances have been observed throughout the year across a variety of hydrological, climatic and land-use settings. As a result, questions have been raised over the potential for pharmaceuticals in surface waters to enter drinking water supplies and to affect consumers.

In a previous Drinking Water Inspectorate (DWI) funded study, results from a simple exposure model were used alongside information on therapeutic doses of pharmaceuticals to identify pharmaceuticals that are likely to be of most concern in UK drinking water sources. However, this previous study was entirely desk-based and did not involve any experimental measurements of pharmaceutical concentrations. The current study was therefore performed to generate actual measurements on the occurrence of pharmaceuticals in source and treated waters in England.

The study considered a range of pharmaceutical compounds and their metabolites that have either a) high predicted exposure concentrations; b) toxicological concerns; or c) a low predicted exposure to therapeutic dose ratio. An illicit drug and its major metabolite were also investigated. The study compounds (in total 17) covered a range of chemical classes and varied in terms of their physico-chemical properties. The study was done at four sites where concentrations in source water at the drinking water treatment abstraction point were predicted to be some of the greatest in England. The study therefore is likely to provide a ‘worst case’ assessment of potential human exposure to pharmaceuticals in drinking water in England and Wales.

Ten of the 17 study compounds were detected in untreated source waters at sub-µg/l concentrations. Six of these compounds (namely, benzoylecgonine (a metabolite of cocaine), caffeine, carbamazepine (an antiepileptic medicine), carbamazepine epoxide (a metabolite of carbamazepine), ibuprofen and naproxen (both non-steroidal anti-inflammatory drugs) were also detected in treated drinking water. With the exception of carbamazepine epoxide, concentrations in treated drinking water were generally significantly lower than in source water. Even though England is a densely populated country and in some regions there is limited dilution of wastewater effluents, these observations, made at sites that were predicted to have some of the highest concentrations of pharmaceuticals in England and Wales, are in line with results from similar studies performed in other countries.

Comparison of measured concentrations of the study compounds in drinking waters with information on therapeutic doses demonstrated that levels of these compounds in drinking water in England are many orders of magnitude lower than levels that are given to patients therapeutically. It would therefore appear that the low or non-detectable levels of pharmaceuticals and illicit drugs present in drinking waters in England and Wales do not pose an appreciable risk to human health.