Executive Summary

Over recent years, the presence of Endocrine Disrupting Chemicals (EDCs) in various sewage discharges and fresh- and estuarine-waters has been extensively reported in the peer-reviewed literature. However, to date, evidence suggestive of a risk to human health from exposure to EDCs via drinking water has not been convincing. Despite this, much media and public interest continues to focus on the quality of drinking water supplies in England and Wales. It is therefore of high importance for the Drinking Water Inspectorate (DWI) to maintain an up-to-date knowledge base to assess the potential for consumers to be exposed to EDCs via this route.

The aims of this study are to comprehensively assess and summarise existing literature (both published papers and unpublished reports) on the presence in drinking waters of any substances that have, or may have, endocrine disrupting potential of relevance to human health. For substances with the potential to cause endocrine disruption in mammals, estimates of the concentrations in water bodies used for drinking water abstraction were modelled and estimates made of the resultant levels in drinking water based on the use of either conventional or advanced water treatment processes, both types commonly employed in the UK. Hazard profiles were developed to inform on the extent of risk posed by consumption of drinking water containing such substances at a ‘worst-case’ concentration ≥100 ng/L to characterise the nature of any risk to human health. The significance of our findings for water policy in England and Wales were also considered.

The initial literature review identified 509 articles suggesting 325 potential EDCs could be present in water bodies of potential relevance. Through application of a customised prioritisation scheme, this candidate list was reduced to 159 potential EDCs that were then subject to a multistage modelling process to estimate their environmental fate and behaviour and extent of potential removal by water treatment processes prevalent in the UK. Thirty-five of these chemicals were predicted to have highest (worst case) concentrations (i.e. following conventional treatment processes) ≥100ng/L; these modelled levels were used to estimate potential intakes (as mg/kg bw/d) via drinking water for three population subgroups: adults (>18 years), toddlers (1-2 years) and infants (0–1 year), based on standard default assumptions. The extent of the risk posed by such a worst case intake was then determined by establishing the margin of safety (MOS) between this intake and either an established authoritative health-base criteria value (e.g. tolerable daily intake) or using a study-specific exposure limit derived from the available hazard data; in either case, the value was based on what was considered to be the most sensitive endpoint irrespective to its relevance to the endocrine system. For endocrine-active pharmaceuticals considered to be of potential concern, a study-specific exposure limit was determined on the basis of the minimum therapeutic dose, using clinical judgement.

Comparison of predicted worst-case drinking water intakes against the hazard profile for the 35 chemicals subject to detailed modelling showed a very high MOS (>100) for 21 chemicals, even using worst case assumptions, and these were not considered to warrant further study. A further 8 chemicals had MOS of 10–100 and hence were considered of doubtful importance and, hence not to warrant further consideration. For 6 chemicals (p-benzylphenol, dibutylphthalate, 4-nitrophenol, digoxin, fluticasone and salbutamol), MOS were ≤10, and hence were considered to warrant a more detailed consideration to establish the likely ‘real world’ situation, as opposed to the estimates derived here from the use of highly conservative ‘worst case’ assumptions throughout the modelling process.

Furthermore, a précis of current scientific understanding with regard to the risks posed by complex mixtures of EDCs was prepared and an indicative estimate made of the potential risk that might arise from a mixture containing those substances identified here that possess oestrogenic activity, each at their predicted worst-case level. Importantly, it was found that even such an extreme worst case combined intake, when expressed in terms of an equivalent oestradiol intake, did not raise a significant health concern.
The potential mammalian-relevant endocrine disruptive potential of several metals and inorganic metal compounds was also considered; limited concerns were identified for cadmium, chromium, cobalt and copper. However, as the exposure models used here are unsuited to inorganic substances, our initial assessment was limited to a comparison of the available data on endocrine-relevant toxicity to established UK drinking water limits.

It is suggested that the database of evidence generated through this project should be periodically reviewed, as the publically available information on a number of substances identified here is expected to increase as a result of assessment processes required by REACH and, possibly, as a result of operation of the Biocides Directive. In addition, as the various regulatory measures that have been introduced on a European basis begin to take effect, it is anticipated that, for a number of chemicals identified, further reductions in usage and, hence, in exposure levels will occur over time. Furthermore, the operation of the Water Framework Directive (WFD) can be anticipated to result in additional information being generated on levels of substances present in water and is likely to result in improvements in the general standards of catchment management and water and wastewater treatment, thus acting to reduce still further any potential exposure.