

EXECUTIVE SUMMARY

The Drinking Water Regulations that incorporate the provisions of the European Union (EU) Drinking Water Directive into the law of England and Wales contain a list of substances for which there are numerical standards. However, there is also a requirement to consider other potential contaminants that might be present in drinking water. A number of authorities and jurisdictions outside the EU have produced guidelines or standards for substances that are not specifically listed in the EU Directive. There may, therefore, be legitimate questions from stakeholders on what is known about the presence of these substances in UK drinking waters. In addition, it is important to assess the information that is available should there be a suggestion that these additional substances be considered in revisions of the Directive.

Additional substances were identified in the World Health Organisation (WHO) Guidelines for Drinking Water Quality and in standards from the USA, Canada, Australia, New Zealand and Japan. Many of these were individual pesticides. These are fully covered by the pesticide parameters in the EU Directive, which refers to all pesticides and sets a precautionary maximum contaminant level. Searches of the peer reviewed and grey literature were performed for data on the concentrations of these substances in drinking water in all parts of the world, but particularly in the UK. Research on and monitoring of the chemicals of interest, commissioned or carried out by DWI, the Environment Agency or other UK authorities and agencies was also investigated for relevant data. Most of the larger water companies were approached to determine whether they had carried out investigations or monitoring for these substances. Not all companies were able to help but some provided a considerable amount of information. The data that were received usually reflected high risk sources.

Although there are no systematic data on the listed substances, the data that are available are helpful and indicate that the majority of substances, where they are present, occur at concentrations below the health-based guidelines from WHO. Occasional detections above the guideline values, but well below other health-based standards, appear to be associated with a very small number of naturally occurring inorganic substances in groundwaters.

In the third edition of its Guidelines, WHO introduced the concept of drinking water safety plans (DWSPs), which is an approach now generally accepted as best practice. This approach has been formally incorporated into the drinking water regulations for England and Wales and is based on hazard identification and risk assessment, followed by management procedures to mitigate those risks. The risks and mitigating procedures should also be prioritised to ensure that resources are directed where they will have the greatest impact. This approach provides a framework for managing risks from source to tap and helps to ensure that hazard identification occurs for substances that are potentially of concern for drinking water. This means that investigation of their presence in drinking water sources and in drinking water itself is targeted to where such substances are likely to be found and takes existing barriers into account. By doing this it is possible to demonstrate that the barriers are appropriate and functioning properly so that the need for extensive chemical analysis of specific substances is significantly

reduced. This approach is not only more efficient in directing resources where they will have most impact but it also means that water quality can be assured over a much wider range of *potential* contaminants than would otherwise be possible. Chemical monitoring of the final water merely informs us that there *is* a problem, while the DWSP approach is designed to ensure that controls are in place that will *prevent* a problem. Chemical monitoring is a final check on the presence and amount of chemicals; it does not control them.

Several of the listed substances are inorganic and most of these are present naturally as constituents of water, although there may also be anthropogenic sources that contribute to concentrations in water. Most of these have been assessed by the Environment Agency as part of their groundwater monitoring programme and are not of concern for drinking water. A DWI-commissioned in-depth study on uranium in drinking water identified a small number of samples, taken from private water supplies that exceeded the current WHO provisional guideline value, but not the USEPA standard. An early study, part of the Regional Heart Study, indicated that molybdenum concentrations may exceed the WHO guideline value in some areas. Since molybdenum is an essential element, it requires a different approach to risk assessment and DWI has therefore commissioned a study of molybdenum in drinking water in England and Wales.

A substantial number of the listed substances are volatile chlorinated organic molecules, most of which are used as solvents or result from the breakdown of solvents. Experience has shown that these do not occur at greater than trace concentrations in surface waters because they volatilise to atmosphere. However, if they are spilt or discharged to soil and are able to reach groundwater they may persist for a considerable time. Tri- and tetrachloroethene, and carbon tetrachloride, are incorporated into the regulations and, therefore, all waters are monitored for the presence of these substances. Because of chemical similarity it is possible that many other chlorinated organics would also be detected by the same analysis (if based on gas chromatographic separation with electron capture or full-scan mass spectrometric detection) and therefore action could be taken if detected concentrations were significant, i.e., close to health-based guideline values.

A small number of fuel related compounds are also included on the list. The odour threshold for all of these substances in water is very low and they are almost invariably unacceptable to consumers at considerably lower concentrations than the health-based values.

The additional non- or semi-volatile substances on the list include the cyanotoxin microcystin-LR, DEHP, DEHA, dioxins, EDTA and NTA. This is a diverse group of compounds but, within this group, dioxins have been shown not to occur in drinking water. This is because of their low water solubility and high potential to adsorb to particulate matter and sediment, which is readily removed during drinking water treatment. While cyanotoxins do occur in raw water, their potential presence can be readily identified by the fact that they are only present at significant concentrations in association with large blooms of cyanobacteria or blue-green algae. In addition, they are readily removed by a number of treatment processes. Monitoring for such substances is

unhelpful and the guideline value primarily provides a benchmark for assessing the efficiency of treatment.

DEHP is widely used as a plasticizer and there is clear evidence that it does reach drinking water at low concentrations, which are well below the WHO guideline value.

EDTA and NTA are chelating agents that have been found at low concentrations, well below WHO guidelines, in many waters receiving treated wastewater. EDTA is a food additive and NTA is a detergent builder. Both appear to be removed by advanced water treatment and would not be expected to be present at concentrations of concern.

A number of disinfection by-products (DBPs) are included in the list. These are primarily included in the WHO Guidelines as a benchmark against which to assess the importance of such substances, which have received a great deal of research and media attention. European standards include a value for total trihalomethanes (TTHMs) while WHO sets guideline values for individual substances. Two other jurisdictions also include a total haloacetic acids value because these, with THMs, form the dominant chlorination DBPs. The most appropriate mechanism for controlling chlorination DBPs is the removal of natural organic matter (NOM) with which chlorine reacts. This will reduce all of the halogenated organic by-products while actually helping to maintain effective disinfection. It also means that there is no need to monitor a very wide range of by-products, the great majority of which always occur at concentrations below guideline values or health-based guidance concentrations. However, in some specific situations, for example chlorination at low pH haloacetic acids (HAAs) will increase even if THMs are reduced.

Several recommendations are made as a consequence of this study.

- Data on raw water sources of considerable interest with regard to drinking water quality is collected by the Environment Agency and DEFRA, either directly or through commissioned research. It is recommended that lines of communication be established to ensure that such data are made available to DWI to assist in judging the need for any action and to allow DWI to respond to any legitimate questions regarding contaminants/constituents of drinking water.
- The most important inorganic substances for which more data were required are uranium and molybdenum. However, DWI has commissioned work on both of these substances and the work on uranium has been completed. Consideration should be given to whether it is possible to carry out some specifically targeted investigations into the presence of thallium, taking into account natural and industrial sources.
- It would be appropriate to target monitoring for additional volatile chlorinated organic substances where tri- and tetrachloroethene and carbon tetrachloride have been identified in anaerobic groundwater, or where they have reached groundwater following passage through anaerobic conditions.
- Data show that the health risks for drinking water associated with microcystins from cyanobacteria in the UK are very low and most water companies successfully manage drinking water sources to minimise the numbers of cyanobacteria. However,

- The data on DEHP are relatively limited and it would be of value to have a better view of the range of concentrations in drinking water, which might be achievable by closer examination of water company GC-MS scans.
- Although the data that exist indicate that EDTA and NTA are present in raw and drinking water at concentrations well below the WHO guidelines, it would be useful to obtain some modern data on their occurrence in waters receiving significant inputs of wastewater. However, this is not considered to be a high priority.
- When water companies are introducing processes to achieve or assess reductions in THMs it would be appropriate also to consider whether concentrations of HAAs have been reduced.