ASPECTS OF EXPOSURE ESTIMATES OF DISINFECTION BY-PRODUCTS FROM WATER: A REVIEW OF WATER INTAKE AND CONTACT AND THE UPTAKE OF DISINFECTION BY-PRODUCTS BY DIFFERENT EXPOSURE ROUTES

EXECUTIVE SUMMARY

There is continued interest in the possible health effects of by-products of drinking water disinfection. After initial concern regarding the potential carcinogenicity of a number of disinfection by-products, possible adverse effects on reproductive endpoints are now receiving increasing attention in epidemiological studies, particularly in the USA. Attempts are being made to refine the methods used in such studies to estimate the exposure of individuals to disinfection by-products. Some researchers have made detailed assessments of the consumption of drinking water by the subjects under study. However, exposure to disinfection by-products can also result from showering, bathing and swimming with dermal absorption and inhalation as potentially important routes of uptake. The importance of these exposure routes will differ between disinfection by-products, depending on their volatility and the extent to which they are absorbed through the skin.

The first part of this review investigates the extent of the data available on the exposure of UK adults, and pregnant women in particular, to water through different activities. It compares this information with data for the population of the USA. UK data on the frequency and duration of showering and bathing are limited and little is known about the amount of time which UK adults spend in swimming pools. There is little information specific to pregnant women in the UK. Nonetheless, the available data on drinking water intake, showering/bathing and swimming habits suggest that these are, overall, not dissimilar between the UK and the USA.

However, it is apparent from the available information that there is enormous inter-individual variability within both countries between the individuals within each country in the frequency and duration of showering, bathing and, in particular, swimming. Such exposures could make major contributions to the internal doses of some individuals if there was significant absorption of disinfection by-products during these activities. It is possible, therefore, that exposure assessments based on average exposures or which take only ingestion of drinking water into account may result in misclassifications of exposure. Part Two of the report, therefore, examines the available information on how different exposures to water relate to internal doses of disinfection by-products.

Some disinfection by-products, such as the trihalomethanes (THMs), volatilise readily in showers and swimming pools, often resulting in significant exposure by inhalation. These compounds are also lipophilic and can be fairly readily absorbed through the skin. In contrast, the haloacetic acids are non-volatile and penetrate the skin poorly. For THMs, and other disinfection by-products with similar properties, exposure assessments which do not take into account swimming, showering and other water-based activities are likely to lead to misclassification. However, for other classes of disinfection by-products which are non-volatile (or less volatile) and poorly absorbed dermally, the
contribution of such exposures is unlikely to be significant, and an accurate assessment of the consumption of drinking water and drinking water-derived drinks may be more important.

The third part of the report discusses the methodologies that would be needed to fill gaps in our present knowledge. For information about habits of bathing, showering, swimming or attendance at swimming pools by members of the UK population, it would be straightforward to conduct surveys with data recorded by diary. If attention were to be focussed on pregnant women, the recruitment of the survey sample would be more difficult, but the diary method would still be used. However, to obtain information about the relative contributions of different types of exposure to the total uptake of disinfection by-products, the required studies would involve serial measurements of intakes and uptake. Such studies would be complicated and expensive to carry out.