Summary

i Reasons

Ultraviolet (UV) disinfection has been used in water treatment for many years and its implementation in the UK is increasing for general disinfection or specifically to deal with Cryptosporidium. In addition, advanced oxidation processes (AOPs) incorporating UV at much higher doses than used for disinfection have been developed over recent years for destruction of organic micropollutants such as pesticides and algal metabolic products.

Whilst the risk of formation of disinfection by-products (DBPs) from the use of UV is believed to be low, this work will identify the implications of UV treatment for changing water chemistry, particularly in relation to DBP formation.

The results of this work will be used to further inform the use of UV in water treatment.

ii Objectives

The aim of this project was to increase DWI’s understanding of the impact of UV disinfection on the chemical composition of water, with specific reference to potential formation or removal of DBPs.

iii Résumé of Contents

This report presents a review of the literature on the effects of UV disinfection on the chemical composition of water (Section 2), a review of UV treatment in public supplies (Section 3), the effect of UV dosage and/or pre-oxidation as evidenced from selected treatment works (Section 4), a review of UV treatment in private supplies (Section 5), a review of the health significance of DBPs identified as being formed by UV (Section 6), and suggested areas for future research to fill knowledge gaps regarding DBP formation as a result of UV treatment (Section 7). Conclusions are presented in Section 8.

iv Conclusions

The potential formation of DBPs as a result of treatment by appropriately designed and maintained UV systems is low. The most significant DBPs are nitrite (formed from nitrate) and bromate (formed from prechlorinated supplies containing bromide); the formation of both can be minimised by appropriate water treatment and UV system design.
A survey of water companies in England and Wales (73% response) identified 89 UV plants (existing and proposed) with a total treatment capacity of 1,492 Ml/d used mostly at small groundwater sites for general disinfection and where there is a Cryptosporidium risk.

The full extent of UV treatment of private supplies is unclear from Local Authority (LA) returns to DWI. UV treated private supplies used for commercial purposes appear to account for around 90% of persons served and 97-98% of water capacity. Whilst it is unlikely that formation of DBPs is a significant risk for private supplies, the risk might be greater for supplies used for commercial purposes where water treatment might include prechlorination or the UV system might incorporate medium pressure (MP) lamps.