Executive Summary

There is increasing concern over the health effects of engineered nanoparticles (ENPs). Humans can be exposed to these particles directly during product use or indirectly following release to the natural environment. One potential indirect exposure route is through the consumption of contaminated drinking waters. This study therefore explored the potential for ENPs to contaminate drinking water supplies and to establish the significance of the drinking water exposure route compared to other routes of exposure. This study examined risk in the sense of likelihood of exposure to nanoparticles via drinking water, analysis of health risks was beyond its scope.

The study began with a detailed review of the occurrence and quantities of engineered nanoparticles in different product types as well as possible release scenarios (direct & indirect release to air, soil and water), their possible fate and behaviour in raw water and during drinking water treatment. Based on the available data, engineered nanoparticles which are likely to reach water sources (such as ENPs that are produced in large quantities or are used in a free form) were identified and categorised. The classification was based on a categorisation framework to aid exposure assessment of nanomaterials in consumer products.

A conservative approach was used to estimate worst case concentrations of engineered nanoparticles in raw water and treated drinking water, using a simple exposure model.

Exposure estimates for raw water and treated drinking water were then qualitatively compared to available estimates for human exposure through other routes, e.g. direct exposure from consumer products. This allowed an estimate of the amount of exposure to a range of engineered nanoparticles from drinking water as well as a relative qualitative risk of exposure to ENPs from drinking water compared to other routes.

A range of metal, metal oxide and organic-based ENPs were identified that have the potential to contaminate drinking waters. Worst case predicted concentrations in drinking waters were in the low to sub- μg/l range and more realistic estimates were tens of ng/l or less. For the majority of product types, human exposure via drinking water is predicted to be less important than exposure via other routes. The exceptions were some clothing materials, paints and coatings and cleaning products.

The particles contained in these products include Ag, Al, TiO_2, Fe_2O_3 and carbon-based materials. Although predicted concentrations of these materials in UK drinking water are low, any future work on risks of ENPs to drinking waters should probably focus on these materials and the development of the UK market for products containing these materials.

It is clear from this study that there are significant gaps in our current knowledge regarding the use, environmental fate and exposure of ENPs in the UK environment, and recommendations for future studies are made in this report. It should also be noted that this is a product by product analysis and does not reflect human exposure at an individual level.