SUMMARY

Humans may potentially be exposed to veterinary medicines in the environment by a number of routes including the consumption of: 1) crops that have accumulated substances from soils as a result of exposure to contaminated manure and slurry; 2) livestock that have accumulated veterinary medicines from food material that has accumulated substances from contaminated soils or water; 3) fish exposed to treatments used in aquaculture; and 4) abstracted groundwater and surface waters containing veterinary medicines. Whilst veterinary medicines are routinely monitored in target food materials to ensure that concentrations are below the maximum residue limits, the magnitude of the exposure via many of the routes listed and the health impacts of such exposure have not been extensively quantified. While assessments for human medicines in the USA and UK indicates that consumption of humans medicines via drinking waters poses no appreciable risk to human health, our knowledge of the risks of veterinary medicines in drinking waters is much less developed. This project therefore addressed this knowledge gap by exploring the occurrence of veterinary medicines in raw and treated waters, assessing potential exposure for veterinary medicines in use in England and Wales and carrying out a desk-based assessment of the health risks.

In the first instance, a review was performed of the published and grey literature on the fate and occurrence of veterinary medicines in the environment. Following this review a systematic evaluation of the potential levels of contamination and health risks of veterinary medicines in use in England and Wales was performed. Data were obtained on the usage, treatment regimes, metabolism, environmental fate and toxicity of around 450 active ingredients in use in the UK. Simple modelling approaches were then used to identify those active ingredients that are likely to pose the greatest risk to human health.

Twenty six substances were identified of potential concern and these were then evaluated using more complex modelling approaches for estimating exposure levels in raw waters and for estimating removal in different drinking water treatment processes. The outputs from these exposure predictions were then combined with data on toxicity to assess potential risks to adults, toddlers and infants. The exposure modelling considered concentrations in waterbodies in close proximity to fields where veterinary medicines are applied. In reality, there would be significant dilution of the water between an area of veterinary medicine use and a drinking water abstraction point. The exposure predictions and subsequent risk assessments therefore provide a highly conservative assessment of risks of veterinary medicines to consumers.

Even though a conservative approach was used, with the exception of a few cases where more information on exposure, toxicokinetics or toxicology is required, the results of this risk assessment were judged to be highly reassuring. For 14 of the 26 selected priority veterinary medicines, the estimated intakes from conventional or advanced treated water were less than 10% of the Acceptable Daily Intake (ADI) for all sections of the population evaluated. It is concluded, therefore, that these 14 veterinary medicines — albendazole, amoxicillin, chlortetracycline, chlorsulon, cypermethrin, cyromazine, diazinon, enrofloxacin, eprinomectin, lasalocid, salinomycin, tiamulin, trimethoprim and tylosin — are not a potential risk to consumer health. Very minor exceedences of the guide value (equivalent to 10% of the ADI) in all populations assessed were found for a further two compounds: halofuginone and tilmicosin. However, these were not considered to be a potential risk to consumer health.

For the remaining 10 compounds (acetyl salicylic acid, altrenogest, apramycin, cefapirin, dicyclanil, florfenicol, lincomycin, luprostiol, monensin, sulfadiazine), the worst case predicted exposure levels, based on consumption of either raw (environmental) water or conventionally treated water were close to or exceeded ADI values. In some cases the predicted levels of exposure significantly exceeded ADI values. The highest exceedences of ADI values arose from exposure to water sourced from groundwater. There is some evidence that the groundwater model, that was used in the study, significantly over estimates actual concentrations in the real environment. In the advanced water treatment scenario, which is widely used in England and Wales, worst case predicted exposure estimates only exceeded the ADI value for four compounds (acetylsalicylic acid, florfenicol, lincomycin and luprostiol). All of these ADI exceedences were related to the groundwater scenario. Whilst concentrations above an ADI do not necessarily imply a risk to human health, a risk for these substances cannot currently be ruled out. As the approach used in this study was modelling-based, used a number of conservative assumptions and employed conservative defaults where model input data were not available for individual compounds, further work may be required on these compounds to better establish the potential risks.