NanoFATE Deliverable 6.6

Maps of the regional risk assessment of selected ENPs; including and representation of PECs and exceedances of threshold effect values for a range of endpoints PNECs for taxa or sub-groups, biomarker endpoints) under different usage scenarios

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Research Report Summary

The spatio-temporal variability of nano silver (nano Ag) and nano zinc oxide (nano ZnO) concentrations in surface waters and soil across Europe has been modelled using the GIS-based model GWAVA and a gridded population dataset (GPW v3). Loading of nano Ag and nano ZnO from sewage to rivers is modelled by accounting for connectivity to sewerage, sewage treatment efficiency, and the spatial distribution of sewage treatment plants with their associated populations. The resulting nano Ag and nano ZnO concentrations in lakes, wetlands and rivers are modelled by considering the effect of processes such as dilution, transport, and water abstraction. GWAVA simulated behaviour of nano-particles in flowing surface waters over the 1970-2000 period using daily rainfall values. Over this 31 year period, the highest predicted concentrations that aquatic organisms could be exposed to in the EU reached up to 20 ng/L for nano Ag and up to 300 ng/L for nano ZnO. These high concentrations were typically found in areas such as the Rhine basin, Po basin, south-east England, and densely populated parts of the Mediterranean. The highest predicted water concentrations were 30-40 times lower then the most sensitive effect concentrations recorded. The soil predictions assumed all the nano Ag and nano ZnO removed from sewage effluent were available for application to agricultural land via sewage sludge. The load going to land was refined by two geographic elements, firstly knowledge of national sludge disposal policies and secondly the location of agricultural land. A conservative mixing depth of 12 cm for the sewage sludge was used in predicting soil concentrations. The highest predicted soil value (assuming 3 successive applications over 12 years) for nano Ag was 3.9 µg/kg dry weight for UK agricultural soils whilst the most conservative value for nano Ag toxicity was an

HC5 of 1.38 mg/kg. Similarly, the highest nano ZnO soil concentration was 67.8 μg/kg dry whilst the most conservative value for nano ZnO toxicity was an HC5 of 34.71 mg/kg. As there is more than a factor of 1000 between the highest predicted soil concentration and the selected HC5s in soil, this suggests that there is little risk for soil organisms from these nanoparticles.

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