

Science for Environment Policy

Pharmaceutical pollution levels in European rivers assessed

Concentrations of three pharmaceuticals (ethinylestradiol, oestradiol and diclofenac), have been mapped in a recent study of European rivers. The researchers predict that levels of ethinylestradiol, a contraceptive and hormone replacement drug, could exceed the WFD's suggested environmental quality standards in 12% of the total length of Europe's rivers

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1. <http://ec.europa.eu/environment/water/water-framework/>

Widely used pharmaceutical products can enter [waterways](#), often via sewage outfalls, and some have been shown to have adverse effects on aquatic wildlife, for example, disrupting the hormonal systems of fish. Three chemicals in particular — ethinylestradiol, estradiol and diclofenac — were recently suggested for inclusion in the WFD¹, which sets environmental quality standards to ensure that water-borne [chemicals](#) do not have negative environmental impacts.

Ethinylestradiol is a synthetic version of the hormone oestrogen and is used in contraceptive pills and hormone replacement therapy. Estradiol is also used in contraceptives and as a hormone replacement, as well as being a natural hormone. Finally, diclofenac is an anti-inflammatory painkiller. All three have been linked to damage to wildlife and are currently on a monitoring 'watch' list, as well as being under consideration in the review of the priority substances list that began in 2014.

In this study, researchers examined whether the environmental quality standards suggested in 2011, which stipulate threshold concentrations, are exceeded in European rivers. The suggested standards are: 0.035 ng/L (nanogram per litre) for ethinylestradiol, 0.4 ng/L for oestradiol and 100 ng/L for diclofenac.

To estimate the concentration of these chemicals in sewage outfall, they first estimated drug consumption per person using data from national databases and academic studies, and then subtracted from this figure the amount of the drug that is not excreted and which is removed in sewage treatment. The researchers note that data were not available in some eastern European countries, and average European consumption rate was thus used in calculations for these areas.

These data were then incorporated into a geographic-based water resources model, a previously tested model which simulates river flows and estimates water quality over large scales.

The results suggested that 2-25% of the total length of Europe's rivers could exceed the suggested standards for ethinylestradiol. The range in percentages is due to uncertainties in the data, but 12% is considered the most likely figure. For estradiol, 1.5% of river length was considered likely to exceed standards, with the range of estimates varying between 0% and 6%. Finally, concentrations of diclofenac were expected to be above the thresholds in 0.1-8.3% of river length, with 2.4% the most likely percentage.

The most exposed countries included Germany, the Netherlands, Poland and Romania, where approximately a third of their total river length appears likely to exceed the suggested standard for ethinylestradiol. Other affected countries include the Czech Republic, Hungary and the UK (specifically England), where 25-30% of rivers are predicted to be affected. Three Scandinavian countries (Finland, Norway and Sweden) and the Baltic states (Estonia, Latvia and Lithuania) are predicted to have the best water quality in terms of these chemicals.

