



# Developing risk assessment approaches for PFAS and watch list parameters under the recast Drinking Water Directive

## PFAS, 17 $\beta$ -estradiol, nonylphenol

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### Background

The project examined three groups of chemicals: per- and polyfluoroalkyl substances (PFAS), 17 $\beta$ -estradiol, and nonylphenol. These substances are of growing international concern due to the risk they may pose to human health and the wider environment, and their potential presence in drinking water.

A new standard for PFAS was introduced for Scottish drinking water in January 2023, and Scottish Water commenced a nationwide risk-based sampling programme. 17 $\beta$ -estradiol and nonylphenol have been put on an EU 'watch list'; while there is no formal standard, upon adoption of the watch list, drinking water providers will need to monitor for the presence of 17 $\beta$ -estradiol and nonylphenol in their supplies.

### What we did

A comprehensive list of potential sources for the substances was drawn up and their distribution in Scotland mapped. Conditions facilitating movement from sources to water supplies were also mapped. Areas with higher densities of potential sources were highlighted as having a higher likelihood that water with detectable levels of the pollutants may be entering water treatment plants.

### What we found

A higher theoretical likelihood of PFAS and nonylphenol presence was identified for those areas with higher population and industry densities (predominantly the central belt and east of Scotland). The highest likelihood of 17 $\beta$ -estradiol presence was found in areas with more intensive agricultural use (predominantly the northeast and south of Scotland).

**PFAS** are a class of synthetic chemicals produced since the 1940s. They are used in a wide array of commercial and industrial products; for example in packaging, textiles, and firefighting foam. PFAS are often called 'forever chemicals' because they don't degrade easily in the environment, and they can build up in animals and plants. Increased exposure to PFAS has been linked to detrimental impacts on childhood development, cancers, and immune system disorders.

**17 $\beta$ -estradiol** is a natural oestrogen hormone produced by mammals and birds. It is also used in medication, for example to treat menopause symptoms or certain types of breast cancer. Increased levels of oestrogens in freshwater have been linked to feminization of male fish, and malformations and reduced reproduction in animals. In humans, increased levels can lead to cancer, reduced fertility and obesity.

**Nonylphenol** is an industrially produced chemical. While now banned in the UK, it is still present in the environment from historic use. Its structure resembles 17 $\beta$ -estradiol, and increased levels are connected to health implications such as reduced birth weight and cancers. It is also toxic to fish, amphibians, and invertebrates.

### What it means

Identification of these areas now allows more targeted monitoring to aid our understanding of whether these substances are present, their sources and possible treatment requirements. This in turn will, if necessary, inform the best strategies and actions to minimise risk from these contaminants, not only in drinking water, but also in the environment.

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