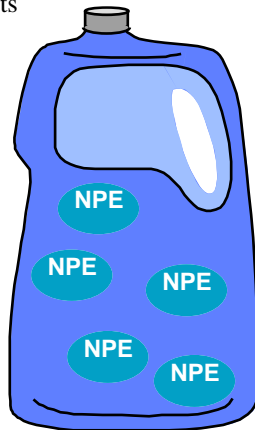


Nonylphenol Ethoxylates (NPE)

Use

Nonylphenol ethoxylates (NPEs) have many uses, primarily as surfactants in detergent formulations, both industrial and domestic. NPEs are no longer used in the UK in domestic detergents, although, due to their suitability for liquid detergents, their domestic use has increased in the USA. NPEs are also used as wetting agents and as dispersants or emulsifiers in some pesticide formulations.

The bulk of NPEs used reach the water environment via the foul sewer system with an estimated 37% reaching the wider aquatic environment undegraded, 46% reaching the soil via sludge spreading on agricultural land and 17% degraded or destroyed. NPE production accounts for 80% of global production of alkylphenol ethoxylates (APE) with octylphenol polyethoxylates making up most of the remaining 20%.



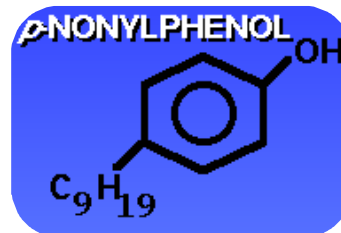
Toxicity

Nonylphenol (NP), a breakdown product of NPEs, has been shown to mimic the action of the female hormone oestrogen. Concerns have focussed on the potential for NP and NPE to cause feminisation in wildlife, such as fish exposed to NP and NPE contaminated effluents, as well as being a potential factor in the increasing incidence of reproductive organ disorders and decreasing sperm counts in men. Whereas NPE is reasonably readily degradable, its breakdown product NP is more persistent. NP has a

bioconcentration factor of between 13 and 410, dependent on species, with macrophytic algae, such as *Cladophora glomerata*, particularly able to bioconcentrate nonylphenol.

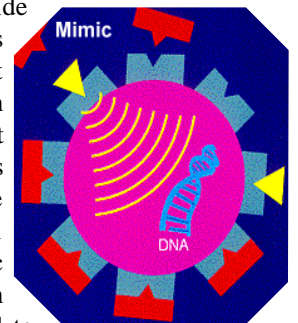
Human exposure

NPEs and an octylphenol ethoxylate (OPE) have been detected in drinking water in New Jersey at levels of 15-29ng/l. However, the drinking water supply in the UK has not been regularly screened for alkylphenol ethoxylates. It has been concluded that given the low oestrogenic potency for alkylphenols in drinking water it seems unlikely that small concentrations of ethoxylates would result in any detectable oestrogenic effects in humans. Nevertheless, the disposal of sewage sludge contaminated with NP to agricultural land may result in another exposure route, through food to humans. Nor has there been any study of the possibly synergistic effects of exposure to low concentrations of NP with other endocrine disrupting chemicals.



Wildlife exposure

NP and other breakdown products from both domestic and industrial detergent use will enter rivers and estuaries via the sewage system. They are also spread on agricultural land in sewage sludge and applied in certain pesticide formulations. Researchers have concluded that vitellogenic effects seen in male fish exposed to effluent in a number of UK rivers were likely, at some locations, to have been caused by alkylphenolic substances. The River Aire in northern England was found to be most heavily contaminated with NP. Research has also been commissioned by the UK Ministry of Agriculture, Fisheries and Food (MAFF) to investigate sources of alkylphenolic substances in the human diet.



**Endocrine
Disrupting Chemicals:
Nonylphenol
Ethoxylates (NPE)**

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European and International Action

In 1992 the Paris Commission (PARCOM 92/8) recommended that all contracting parties should:

- study NPEs and similar substances which lead to the discharge of these substances to sewers or surface waters with a view to reducing these discharges;
- phase out the use of NPEs in domestic cleaning agents by 1995:

- phase out the use of NPEs in industrial cleaning agents by 2000;
- exercise care in ensuring the replacement materials for the current use of NPEs are less damaging to the aquatic environment;
- report on progress in 1994, 1997 and 2000 and to exchange information on acceptable substitutes.

The 1995 Ministerial Declaration on the Protection of the North Sea at Esbjerg specifically highlighted EDCs and requested the Oslo and Paris Commissions (OSPAR) and the European Commission to “adopt necessary measures” by the year 2000. Specifically, the Esbjerg Declaration at the end of the Fourth Ministerial Meeting on the Protection of the North Sea required signatories to substitute NP, NPE and related substances with less-hazardous alternatives where available.

In 1997, the United Nations Economic Commission for Europe (UNECE) negotiated a Protocol on Persistent Organic Pollutants to focus initially on 15 or so groups or substances, some of which are EDCs. However by no means all identified EDCs are covered by this Protocol.

The Danish Government appears to be acting faster than most, proposing to ban the production and use of

UK Case Study

In 1992, 18,000 tonnes of NPE were made and used in the UK. NPE is discharged to UK rivers from the wool treatment industry with up to 400 tonnes per year used in this industry alone. This has been significant in prompting action by the Environment Agency, particularly in relation to the effects on fish seen in the River Aire. Researchers concluded that vitellogenic effects seen in male fish exposed to effluent in a number of UK rivers were likely, at some locations, to have been caused by alkylphenolic substances. The River Aire was found to be most heavily contaminated with NP.

In January 1998, the Environment Agency for England and Wales called for unilateral action from industry to minimise the entry of known or potential endocrine disruptors to the environment by phasing out the use of existing products and developing substitutes. The Agency specifically cites nonylphenols. The Agency suggested identifying potential endocrine disrupting chemicals (EDCs), developing a complete set of environmental quality standards which take into account endocrine disrupting activity, using Integrated Pollution Control and the new Integrated Pollution Prevention and Control (IPPC) Directive to minimise the discharge of EDCs by industry and carrying out further research to look at the effects of EDCs on wildlife.

Following this, in February 1998, the House of Commons Environment Sub-Committee called on the water industry in particular to carry out more research as “a matter of highest priority” to establish which substances within effluents are responsible for hormone disruption.

alkylphenols by 2000. This follows concerns from the Agricultural Council of Denmark at the contamination of farmland with sludge containing NP. The Danish cosmetics and soap industry has removed all APEs from their products. There is also a Swiss Government ban on all APEs and the UK Soap and Detergent



Industry Association has recommended a voluntary phase out of all APEs by its members. - On the negative side, in the USA some companies have reported increased sales of NPE due to its suitability for use in liquid detergents.

Reduction of Inputs

WWF recommends that the amount of NP and NPE released into the environment should be reduced in line with the precautionary principle, with a view to phasing out the use and discharge of NPE or NP to the environment. In most cases this should not pose a problem as alternatives are already available.

In relation to all EDCs, WWF believes that

- The OSPAR Commission should take immediate action to phase out and eliminate already identified endocrine disruptors. Furthermore endocrine disrupting properties should rank high under the prioritisation process for hazardous substances to be considered for such measures;
- Current toxicity tests need to be improved with re-testing of substances undertaken;
- Research needs to be adequately funded, prioritised and co-ordinated;
- An international task force needs to be set up to assess the potential effects of hormone disrupting chemicals and opportunities to reduce their use;
- The European Commission should establish a unit or working group on endocrine disrupting chemicals.

Text prepared by Guy Linley-Adams

References/Further Reading:

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