EDCs - The problem and way forward

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Outline

- Why the Endocrine Disruption Demonstration Programme (EDDP) is needed & what it is
- About the EDDP
- Complementary work
- Where next

The First 20 Years

- **Intersex fish in rivers**
- **A range of course fish are affected**
- **Intersex is apparently permanent, severity increases with age**
- **Affects fertility, reproduction, health of fish**
- **Some populations have large proportions of intersex fish**
- **Oestrogenic substances in effluents identified**
- **Strong associations between intersex in rivers and sewage effluent discharges**

Wild Fish Surveys

- 51 sites, in 5 regions, 1600 roach
- 86% of sites had intersex fish
- >1/3 of males caught were intersex
- Most sites had greater than 30% incidence
- Severity indicates reproductive effects expected at over 20% of sites

This is a widespread issue of concern

Steroid Oestrogens & AlkylPhenols

- 'Individual' PNECs:
  - Ethinyloestradiol 0.1 ng/l
  - Oestradiol 1.0 ng/l
  - Oestrone 3.0 ng/l
- 'Total' PNEC =EE2 / 0.1 + E2 / 1 + E1 / 3 < 1ng/l
- Nonyl Phenol concentration of concern 1ug/l

Endocrine Distruptors Demonstration Programme (EDDP)

Purpose

- Provide the scientific, technical & economic basis for investment in STW infrastructure to reduce oestrogenic risks to acceptable levels, if required
- Provide information to help regulators define, and water industry to meet, potential future regulatory requirements

EDDP Objectives

- Investigate the performance and efficiency of a wide range of current treatment technologies
- Demonstrate the performance and efficiency of advanced treatment (GAC) at full scale
- Evaluate the costs of improved treatment
- Evaluate the costs and effectiveness of various existing treatment options

Process Types

Process type	Number
No primary sedimentation	2
Primary sedimentation	8
Chemically-aided primary sedimentation	7
Biofilter	10
Biofilter and nitrifying BAF	2
Sand filters	4
Lagoon	1
Membrane bioreactor	1
Activated sludge (including oxidation ditch)	4
Chlorine Dioxide	1
UV disinfection	1
Total number of sites	17

EDDP Activities

Monitor reduction in ED chemicals & biological activity through treatment

- Short term intensive study of variability
- Long term monitoring
- Fish testing

Short term Intensive Study

- Investigation and demonstration sites
- Informs treatment optimisation and long term monitoring
- Influent, intermediate and final effluent
- Standard operating parameters e.g. BOD, suspended solids, ammonia
- Steroids, alklphenols, in-vitro biological activity
- Hourly for 1 day
- Every 4 hours for 6 days

Long-term monitoring

- Investigation and demonstration sites
- Informs - average treatment efficiency and annual variability
- Influent, intermediate and final effluent
- Standard operating parameters e.g BOD, suspended solids, ammonia
- Steroids, alkylphenols, in-vitro biological activity
- Every 2 weeks over 1 year

Fish testing

Investigation sites

- **Only where steroids removed**
- **Final effluent**
- **Vitellogenin induction**

Demonstration Sites

- **Final effluent**
- **Vitellogenin induction**
- **Paired- breeding**

EDDP Timeline

- WRc to provide logistical support
  - site study manuals
  - co-ordinate AQC
  - support data analysis, interpretation and reporting
- Two investigations start April 2006
- Review Summer/Autumn 2006
- Other investigations 2007-08
- Full scale demonstrations 2008-10

Complementary work

- EDCAT
- Fish Population Modelling
- Catchment Risk Assessment

EDCAT

- Environmental assessment on River Ray downstream of Swindon STW demonstration
- Impacts on fish populations
  - Stickleback populations
  - Reproductive capability of intersex Roach
- Evaluate exposure - chemistry, bioassays and models

Fish Population Modelling

- Model impact of :
  - steroids on individual fish
  - intersex on their reproductive success
- EDCAT will provide data linking intersex severity in roach to reproductive success
- Two elements:
  - mathematical - laboratory dose-response curves
  - statistical - incidence and severity in the wild
- Underway - concludes 2008/9

Catchment Risk Assessment

- Identifies:
  - Catchments potentially at risk across England and Wales
  - Hotspots and STWs that contribute
- Refinements:
  - contributions from upstream
  - differential treatment
  - risk threshold
- Concludes 2007

Where Next

Habitats Directive

- Must prove no adverse effect of discharge alone or in combination to Natura 2000 sites
- Or we must take action to remove adverse effect
- Steroids not generally included in review of consents
- Except - R. Itchen SAC where intersex observed
- We will review risks from new or existing STWs discharging upstream or to Natura 2000 sites
- Initially using the Catchment Risk Assessment

Where Next

Water Framework Directive

- Pollution " the introduction.. of substances…which may be harmful to... the quality of aquatic ecosystems
- Annex VIII "substances..., which may affect steroidogenic, reproduction or other endocrine-related function in or via the environment".
- Member States need to derive EQSs - if released in significant quantities.

Water Framework Directive

- Characterisation identifies potential risks
- Monitoring confirms risks
- Annex VIII Pollutants considered as part of ecological status (pass/fail EQS)
- Final Classification driven by poorest
- Set objectives e.g. good ecological status
- Identify cost effective measures
- Is cost disproportionate to benefit?
- Set objectives/measures in River Basin Plan

Regulation of industrial sources

- UK Chemical Stakeholder Forum voluntary agreement to phase out nonyl and octylphenol
- Nonylphenol and ethoxylates banned for most uses since January 2005
- Octylphenol being considered for risk reduction under UK co-ordinated chemical risk management programme
- REACH from 2007?

Summary

- Intersex is widespread in English rivers
- The EDDP will evaluate the costs and effectiveness of current and advanced treatment options
- Further work is being undertaken to assess the effects on fish populations and catchment risks
- Water Framework and Habitats Directives are future regulatory drivers