

# Chemical Investigation Programme 2

## Scotland

Bess Homer  
Scottish Water



# Why should we be concerned ?

1920 WWTW

70 priority and priority hazardous substances

Scotland to achieve compliance with EQS by 2027

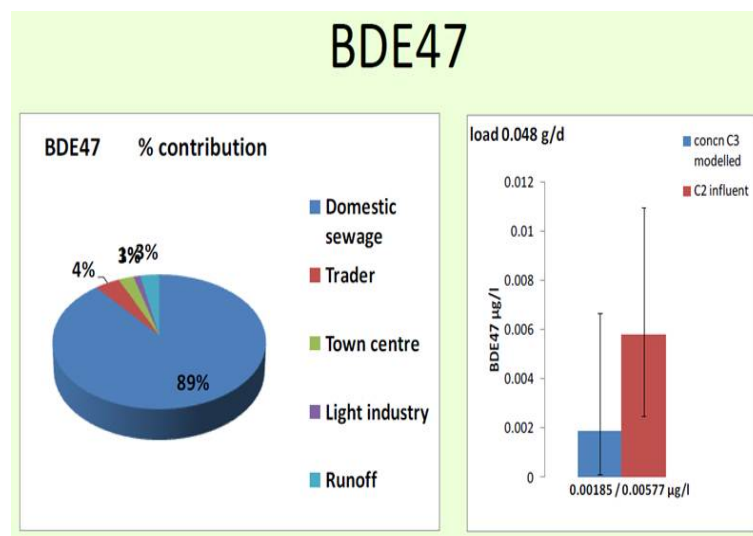
Evolving Watch List of substances

### Under the “Greener Scotland” heading National Substance Strategy

- “Work with SEPA, water service providers and sewerage service providers (as appropriate) to undertake catchment management and customer education to reduce the impact of priority substances being disposed of via the sewer and drainage system”
- “Undertake research to assist in identifying the effective treatment of priority substances that catchment management may not be successful in reducing to acceptable levels.”

# What did UKWIR CIP1 provide 2010-2013

- knowledge of influent and effluent concentration at 162 WWTWs, 15 WWTWs in Scotland
- process investigations gave removal rates at 28 WWTWs
- Majority of substances were coming from domestic sources
- Did not give impact of WTW on the environment



PBDE flame retardant

# Substance Prioritisation - templates

- Classification based on a **number of criteria** bringing together:
  - Studies undertaken in Scotland
  - UK wide studies, results from CIP1
  - European level studies and data bases
  - International guidance

Over 140 documents/databases consulted:

- ✓ SEPA factsheets
- ✓ Scottish Government reports
- ✓ latest DEFRA/UKTAG reports with regards to Priority Substances
- ✓ the European Pollution Transfer Register
- ✓ a number of EC reports
- ✓ World Health Organisation guidance US EPA reports
- ✓ scientific publications.



**Scottish  
Water**

Trusted to serve Scotland





Priority Substance Name	anthracene
Was this substance analysed during CIP1 in Scotland?	yes
Did CIP1 identified this as an issue? yes/no	No (0.00% of WwTw concentrations exceeded the EQS, before taking into account dilution).
Was this substance analysed by SEPA in WFD classification 2012?	Yes (57 sites sampled in 2012)
Has WFD classification data 2012 identified this as an issue? yes/no	No
Sources / applications	Applications: Anthracene is extracted from coal tar to be used in dyes and occasionally for pyrotechnics; also found (as part of a complex mixture of PAHs) in creosote, tar paints, waterproof membranes and other products. Only relatively small amounts of anthracene are intentionally manufactured. Most anthracene is released from vehicle exhausts and domestic wood and coal fires. Emissions also arise from: industrial effluents, municipal waste water treatment facilities, waste incinerators and aluminium smelting. Extracted from SEPA (2014).
Historic production and use	2.14 tonnes reported to have been released to water in 2007 in the EU (E-PRTR, 2014).
Current production and use	355 kg reported to have been released to water in 2011 in the EU (E-PRTR, 2014).
Existing controls on this substance	Regulated under the UK Pollution, Prevention and Control (PPC) Regulations; EU Directive on Dangerous Waste; Priority Substances Directive (2013/39/EU), Commission Regulation (EC) No 466/2008 (further controls on PAH manufacturers/distributors). As a polycyclic aromatic hydrocarbon (PAH), anthracene is also controlled through the UK National Air Quality Strategy. Anthracene oil is not listed as authorised for use in the UK by the Pesticide Safety Directorate. Anthracene is listed as a substance for priority action under the OSPAR Convention. Information extracted from SEPA (2014).
Do existing controls remove this substance, has this substance been banned or is it being phased out?	Existing controls do not ban or require phasing out of the use of this substance.
Is issue to do with a specific issue i.e contaminated land and if so what is this? (some of WFD classification sources are contaminated land please check with us)	N/A as the 2012 WFD classification data did not indicate any issues relating to this substance.
Do we expect the use of this substance to increase or decrease and why?	Existing controls do not ban or require phasing out of the use of this substance, but the E-PRTR (2014) data suggest that emissions to water have decreased significantly between 2007 and 2011 (latest available data).
Can we remove this substance from further study / sampling and why? Discuss	Yes - as the CIP1 concluded that levels of anthracene were significantly lower than regulatory levels of interest (UKWIR, 2013). Monitoring as part of the WFD 2012 classification did not indicate any failures with regard to this substance.

# Prioritisation of substances

## 70 Substances classified into three categories:

Tier 1: Further study required as part of CIP2



benzo(a)pyrene, diclofenac, E2, EE2, fluoranthene, PBDE, TBT, triclosan, zinc

Tier 2: Further monitoring required in order to determine likely risk and relevance in Scotland



cadmium, copper, lead, mercury, cypermethrin, PFOS, DEHP, HBCDD

Tier 3: Substances which can be excluded from further investigation



53 Tier 3 substances



**Scottish  
Water**

Trusted to serve Scotland

# Substances to be Analysed

- Tier 1 & Tier 2 substances
- Watch list substances as agreed with SEPA
- Substances of emerging concern  
(additional pharmaceuticals)
- Substances to support interpretation  
(Sanitary parameters)





# Where do these substances come from?



- PBDE found in flame retardants
- E1 & E2 naturally occurring female hormones
- Diclofenac an anti-inflammatory drug
- Erythromycin an antibiotic
- DEHP a plasticiser
- PFOS found in detergents
- PAHs found in incomplete burning of fossil fuels



**Scottish  
Water**

Trusted to serve Scotland

# Selection of sampling locations



- reviewed all WWTWs discharging to inland water bodies
- Calculated the nominal dilution available at WWTWs
- CIP1 results used to identify levels at risk of non compliance
- Rivers identified where multiple discharges increase the risk
- locations selected to represent range of sizes of WWTWs



**Scottish  
Water**

Trusted to serve Scotland

# Sampling to confirm levels

- Upstream of WWTW
- Downstream of WWTW
- Inlet and outlet of WWTW
- Through sludge treatment process



*This will give us knowledge on how much of the substance is found in the environment and removal rates across the works.*



**Scottish  
Water**

Trusted to serve Scotland



# Process optimisation

To investigate removal using existing treatment facilities



**Scottish  
Water**

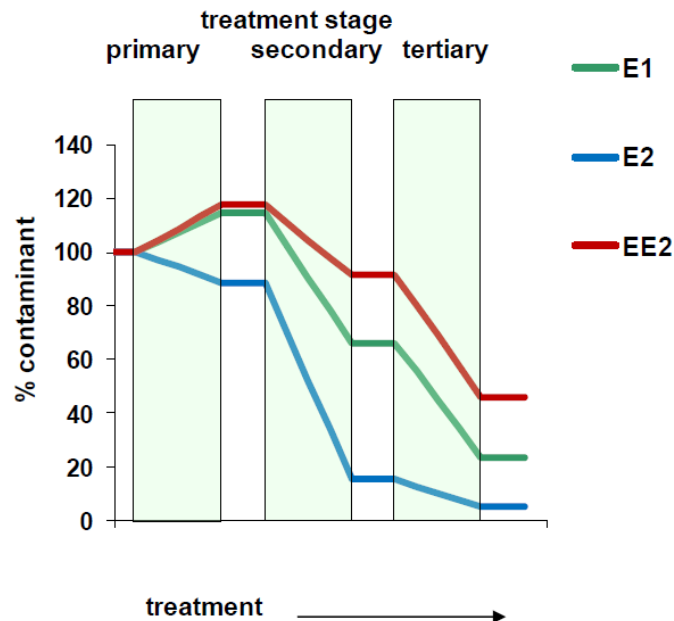
Trusted to serve Scotland

# Process optimisation

## Sampling to identify the removal of each substance from WWTW



### Steroids



An illustration of the well established behaviour of the steroids - E1 and E2 are relatively well removed EE2 less so.

Note: the apparent increases during primary treatment are probably not errors – rather they probably indicate the release of the steroid from conjugated forms that are present in crude sewage.



Scottish  
Water

Trusted to serve Scotland

# Catchment modelling

- Following completion of sample analysis catchment modelling may be used to understand cumulative impact and optimise solutions.
- It is anticipated that modelling may be required for the Rivers Clyde, Almond, Avon and Carron catchments.
- This will identify risk at each WWTW and each substance to allow specific strategies to be developed.



**River Almond  
catchment**



**Scottish  
Water**

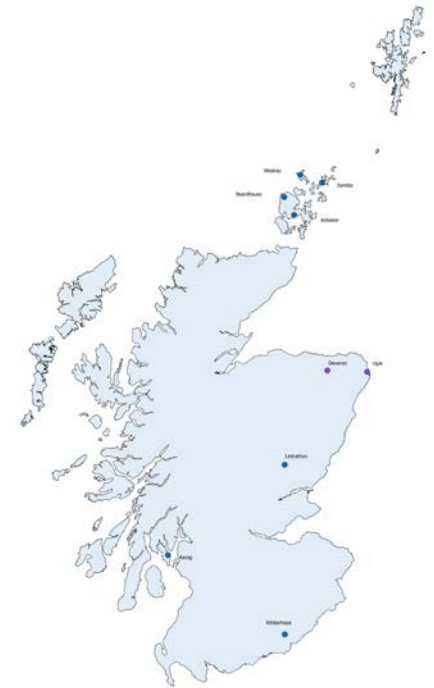
Trusted to serve Scotland



# Potential source control options

Source control opportunities will be considered once we quantify extent of the problem

- Control levels, trader controls, phosphates, diclofenac
- Product substitution, triclosan
- Customer education, No PILLS safe disposal of medicines
- Catchment management, Surface Water Action Plans, Sustainable Land Management



SLM locations



**Scottish  
Water**

Trusted to serve Scotland

# Outcomes of CIP2 Scotland

- Supporting development of the **National Substance Strategy**
- **Substance templates** to understand the source, uses of substances, existing legislation
- **Targeted sampling** to identify where at risk of non compliance
- **Knowledge of environmental impact**
- Further **knowledge of substance removal** at WWTWs
- **Catchment modelling** to optimise solutions
- Allow **specific strategies focused on sustainable options** to be developed with SEPA



**Thank you**

**Bess.homer@scottishwater.co.uk**

