Environment Agency
PSD Projects

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The Challenge:

How should we assess and manage risks from lipophilic substances under the WFD?
EA interest in PSDs

Three studies between 2011-2015

1. 2011-12: Exploratory study to compare matrices (PSD/water/sediment/caged fish)

2. 2013-14: Comparison of PSD (SPMD vs silicone rubber) performance

3. 2014-15: EQS compliance assessment, PSDs vs biota (wild roach)
Study 1- 2012: 4 Matrix comparison

- Sediment
- Water
- Caged chub
- SPMD samplers
Key questions

1. Do different matrices tell the same story?
2. Can we predict biota concentrations from PSD results?
3. Can we base compliance assessment against biota standards on measured water concentrations?
4. Can we detect hotspots?
5. Can we use caged fish to assess compliance?
Which is the best matrix for lipophilic chemicals?
Study 1- What did we learn?

- Caged fish can be used for up to a month
- Fish will take up a range of compounds when deployed
- High variability in duplicate fish – issues with compliance assessment?
- Very weak relationship between concentrations in biota and PSDs (PSDs unsuitable as a direct “surrogate” for biota)
- Sediment samples often contain the highest concs (site & chemical screening role?)
- High number of less than values – water and PSDs
Study 2- Performance testing of 2 types of PSD

- Comparison of SPMD and Silicone rubber
  - (1) between-sampler variability in estimated water concentrations on a single occasion (6 samplers of each type) and
  - (2) variability in estimated water concentrations when comparing occasions (4 occasions)

- Three study sites on the Thames and its tribs
- 6 week deployment (Dec 13-March 14)
Freely dissolved Anthracene concentration

AA-EQS ISW = 100,000 pg/L

Average concentrations ranged: from 69 to 141 pg/L for SRs from 15 to 47 pg/L for SPMDs
Freely dissolved Benzo[a]pyrene concentration

AA-EQS ISW = 50,000 pg/L

TWA concentration (in pg/L)

Average concentrations ranged: from 23 to 36 pg/L for SRs from 9 to 42 pg/L for SPMDs
Study 2 – What did we learn?

By measuring rate loss of reference compounds during deployment we can estimate sampling rates ($R_S$) allowing us to calculate dissolved TWA concs.

- Can then assess compliance with water column EQS – either directly derived or “back-calculated” from biota EQS.
- Agreement between samplers ....
- SPMD vs SR ....
Study 3 – compliance assessment with biota

EQS: SR and native roach

Freshwater sampling sites, 2014

Green = roach/trout
Red = crayfish

SR PSDs deployed for 6 weeks at sites where 10 replicate fish also collected
Same locations, different times

Research Qs:

1. Do we reach the same conclusions about compliance if we assess against $Q_{\text{water}}$ vs $Q_{\text{biota}}$?

2. Can PSDs be used to screen sites to reduce reliance on biota sampling?
Compliance with $Q_{\text{biota}}$ (biota) vs $Q_{\text{water}}$ (PSD)

**Mean PSD (ng/l) vs Mean biota (ug/kg)**

- **ΣpBDEs**
- **HCB**

**Mean dissolved (ng/l) from PSD**

**Mean biota (ug/kg)**

Concentration

Site ID

<table>
<thead>
<tr>
<th>Concentration</th>
<th>Site ID</th>
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<tbody>
<tr>
<td>10 ug/kg</td>
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**Mean biota (ug/kg)**

- Site ID
- Concentration
- Mean PSD (ng/l)
- Mean biota (ug/kg)
Study 3 – What did we learn?

- SR PSDs pick up the same substances as those found in wild roach
- SR PSDs also pick up substances for which fish are unsuitable (PAHs)
- Research QS:
  1: We reach the same Pass/Fail decisions using PSDs/QS\text{water} and fish/QS_{\text{biota}} ... but the test was not very challenging!
  2: Ranking by site of chemical concs using PSD ≠ chemical concs in biota.

Unable to compare PSD and biota for “more interesting” substances (mercury and PAHs, where compliance with biota EQS is more marginal)
Where next?

- Influencing commission to accept PSD data
  - Role in trend monitoring and screening
  - Total – v- dissolved issue
- Collaborative research to widen ‘window of use’ and use of meta data
- Cost-benefit $1m question…..

Regulated community

- Water Companies
  - CIP return
  - UKWIR project