Sediment quality guidelines

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Contaminant fate and behaviour

Work Package 3
Quality and impact assessment
What is sediment?

- matrix of materials
- “end of the path” for many materials
- 4 main components
  - interstitial water
  - inorganic (e.g. minerals and shell fragments)
  - organic matter (1 - 5%)
  - anthropogenic materials
• we understand the sediment and its physical environment
• we understand what contaminants are present
• we understand the sources

So what?
An Objective-based Framework?

• It is likely that many sites will have unique characteristics:
  – location, ecology, social and economic factors

• Principle we work to:
  – Safe Levels
  – Precautionary
  – Best Available Technology
Sediment Quality Assessment

Significant (death)

Low level significance (enzymatic)

Reactive

Pro-active

Non-active

observed effects

Low sensitivity of measurement

High
Sediment Environmental Quality Standards

• WFD talks about sediments in relation to setting EQS

• EQS need to be developed for priority substances (where logK_{ow} > 5 \textit{or} > 3?)

• EQS \textit{may} be set for water sediment or biota

• Basis for setting sediment EQS
  – Not yet developed
  – Complexity of derivation
Setting values to EQS

• Putting a numerical value to an EQS
  – Suspended or bed sediments ?

• Receptors
  – Is data relevant

• Geographical range

• Degree of protection
  – PNEC or species sensitivity ?

• Uses
  – Is it mandatory or does failure trigger further study ?
Relevance of sediment EQS

• First tier of a WoE based risk assessment?
• Probable effect concentration

• Health status a better indicator?
  – Base decisions on observed effects

• only for limited, priority compounds
Measures of Sediment Quality

- Sediment Toxicity (SEDTOX)
- Sediment Chemistry (SEDCHEM)
- Tissue Chemistry (TISCHEM)
- Pathology (PATHOL)
- Community Structure (COMMSTRU)
(Biological) Indices

• Classification of sites according to ecological quality
  – AMBI proposed in Spain (marine benthos)
  – Belgian Biotic Index; RIVPACS in UK

• Integrative Index of (Sediment) Quality
  – High
  – Good
  – Moderate
  – Poor
  – Bad
Weight of Evidence Approaches

• Take a holistic view and utilise reductionist data

• Combine a number of measures
  – Sediment chemistry
  – Community structure
  – Toxicity
  – biomagnification

• Whole is greater than the sum of the parts
Combining lines of evidence

• Differences in chemistry provide one line of evidence

• Differences in chemistry (exceeding an EQS) does not confirm effects

• Exceeding any EQS – what action?
Interpretation of data

• Understand relationships
  – relationship between sediment and tissue concentration

• Needs to be treated with caution
  – do not need bioaccumulation to observe effects
  – toxicity test and endpoints may be non-specific
Ideals and Reality

Sediment Chemistry

Sediment Toxicity

Ecological Effects
Regulation of inputs

• Biocidal Products Directive

• Criteria used for evaluation
  – toxicity
  – persistence
  – availability
We use a new chemical

Adverse effects are observed

We restrict use

It is toxic

It will enter the environment
Trapped in a cycle… ?

Life Cycle Analysis ?
Improving quality = cost

• Proposed UK programme to reduce discharge of EDCs

• Water industry AMP 4 settlement
  – “Demonstration program”
  – Monitoring across a range of unit treatment processes
  – Installation of tertiary treatment (GAC ?) at two full scale works