

**COMMON IMPLEMENTATION STRATEGY FOR THE
WATER FRAMEWORK DIRECTIVE**



**GUIDANCE ON CHEMICAL MONITORING OF SEDIMENT
AND BIOTA UNDER THE
WATER FRAMEWORK DIRECTIVE**

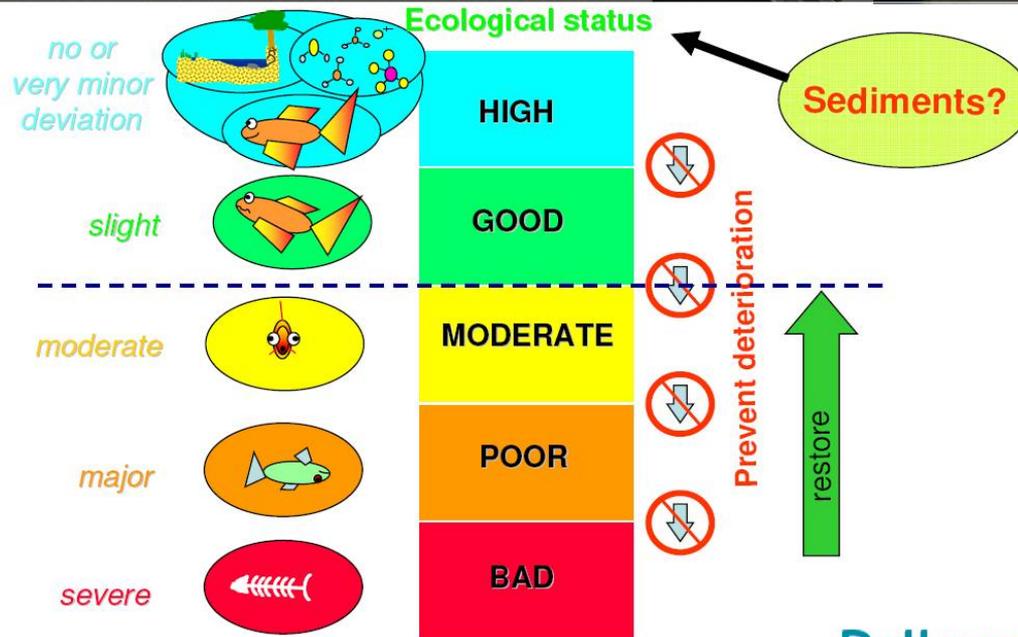
VERSION 6

MAY 2010

**Implementation of
sediments/SPM in
the WFD 2010**

WFD EQR related action levels

(D'Eugenio, 2003)



Deltares

Legal Basis for monitoring PS in sediment and biota (80% of the PS are sorbent reactive/bioaccumulative):

Water Framework Directive 2000/60/EC (WFD)

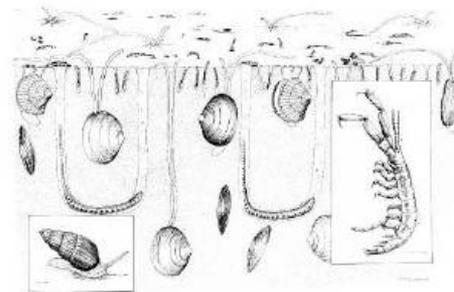
Directive 2008/105/EC (Environmental Quality Standards Directive)

define the good chemical status for all water bodies to be achieved by all Member States in 2015

Obstruction of channels
Rivers fill and flood
Reefs get smothered
Turbidity

Beaches erode
Riverbanks erode
Wetlands are lost
River profile degradation

Construction material
Sand for beaches
Wetland nourishment
Soil enrichment
Habitat and food for life



Sediment =
essential and integral part of our river basins

Sediments are a temporary and “permanent” sink for pollutants and play a major role in transformation and bioavailability of released compounds (especially during storm events) - showing indirect effects, not in the water phase alone.

Cost-effective and easy to handle technology (Science & Stake Holders) has to be developed and applied

1) Environmental Quality Standards (EQS) for 33 priority substances and 8 certain other pollutants at Community level have been limited to concentrations in the water column (whole water samples up to 500 mg SPM/L) - *EQS ARE NOT MENDATORY but are not to exceeded!*

2) Member States should be able either to monitor and apply those EQS for sediment/biota, or to establish stricter EQS for surface water providing the same level of protection. Member States can decide the matrix for certain substances.

3) Member States should be able to establish EQS for sediment and/or biota at national level and apply those EQS instead of the EQS for water set out in the Directive through a transparent procedure, involving notifications to the Commission and other Member States, so as to ensure a level of protection equivalent to the EQS for water established at Community level.

- Member States shall arrange for the long-term trend analysis of concentrations that tend to accumulate in sediment and/or biota.
- In accordance with the RBM plans (including **specific contaminants**) it has to be ensured that the existing levels of contamination in biota and sediments will not significantly increase.

Monitoring matrices for Priority Substances and certain other pollutants listed by the EQS Directive (for the water phase).

Alachlor, Anthracene, Atrazine, Benzene, Brominated Diphenyl Ethers, Cadmium and its compounds, C10-13-Chloroalkanes, Chlorfenvinphos, Chlorpyrifos (-ethyl, -methyl), 1,2-Dichloroethane, Dichloromethane, Di(2-ethylhexyl)phthalate (DEHP), Diuron, Endosulfan, Fluoranthene, Hexachlorobenzene, Hexachlorobutadiene, Hexachlorocyclohexane, Isoproturon, Lead and its compounds, Mercury and its compounds, Naphthalene, Nickel, Nonylphenols, Octylphenols, Pentachlorobenzene, Pentachlorophenol, PAH (MW 252, 276, 278), Simazine, Tributyltin compounds, Trichlorobenzenes, Trichloromethane, Trifluralin, DDT (including DDE, DDD), Aldrin, Endrin, Isodrin, Dieldrin, Tetrachloroethylene, Tetrachloromethane, Trichloroethylene.

Based upon $\log K_{ow} > 3.0$ different options are given

White	=	water phase	preferred
Blue	=	particulate phase	optional
Yellow	=	particulate phase suggested	no recommendation

Only for Hg and its compounds (EQS 20 ng/g), HCB (EQS 10 ng/g) and HCBd (EQS 55 ng/g) in prey tissues established

For particulate phase As (EQS 20 mg/kg), Cr (EQS 640 mg/kg), Cu (EQS 160 mg/kg), Zn (EQS 800 mg/kg), PCB (EQS 20 ng/g each congener), DBT (EQS 100 ng/g), TeBT (EQS 40 ng/g), TPT (EQS 20 ng/g) are given by EU-Guidance 76/464/EWG

The guideline brings up by 2010 the tools for monitoring

freshwater ecosystems - transition zone and marine zone

- **controlling the EQS and RBM requirements** for compliance checking and temporal trend monitoring to assess compliance with the no deterioration objective of the WFD.
- **to assess long-term changes** in natural conditions and due to anthropogenic activities.

Assistance is given in selection of **sampling sites (spatial heterogeneity, trend analysis) based upon a probabilistic design (diffuse sources) and a targeted design (surveillance).**

Sites should be representative of the water body or clusters of water bodies (hydrological and geomorphological informations as well as pollution sources) - known point sources need special attention.

The design should be large enough to supply multiple samplings if grab samples or sediment cores are taken.

QA/QC recommends 2 replicates at the same point (for initial identification 6-10).

In tidal areas the sampling location should be positioned upstream of a weir. There is no sampling recommended within the tidal zone.

3 options are given for the monitoring matrices: *Sediments* (top 5 cm; 1-10 cm; depending on the sediment accumulation rate) as actual habitat of the benthos; *SPM* and *freshly deposited sediments in traps* (muddy material, rich in TOC and at least 5 % fine fraction (< 63 µm) is preferred).

The application of normalisation techniques (grain size < 63 µm, additionally TOC, Li, Al) is necessary (include in setting up program).

For trend analysis (< 20 µm, < 63 µm) the continuity of existing monitoring programmes has to be maintained. If the analysis is performed in the 2 mm grain-size fraction, the data are to be converted to < 63 µm assuming 100 % of the contaminants are in < 63 µm. This might be a worst case scenario.

In addition to factors like sampling location availability, sampling costs, additional information on concentration factors, bioaccumulation rates, metabolic capacity and excretion rates, for biota, are valuable. ***New PS will be suggested and included via NORMAN-NETWORK.***

The minimum frequency for surface sediment analysis is once every year for compliance and every third year for trend analysis (a decrease in frequency is possible in the case of improvements and as a good ecological status is achieved).

For freshly deposited sediments in traps 4 times a year is the minimum, monthly sampling preferred is preferred (pooling of the samples is possible) and the median should be used to observe the trend.

The WFD reporting cycle is every 6 years.

For highly dynamic systems the adequate sampling strategy has to be carefully selected.

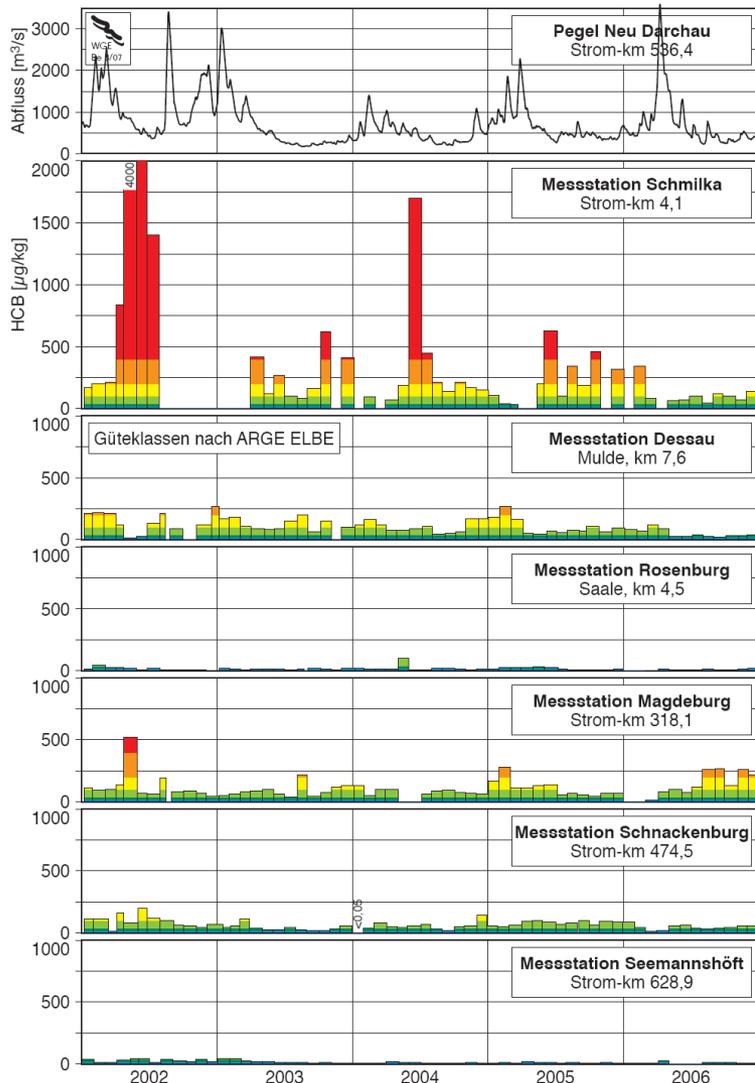


Abb. 35 Hexachlorbenzen in frischen schwefstoffbürtigen Sedimenten mit ARGE-ELBE-Güteklassen - 2002 - 2006

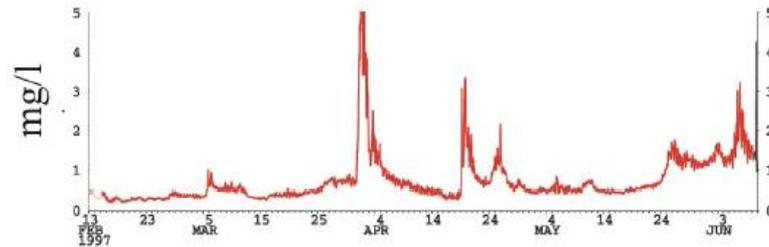
Examples for rivers (Elbe)

Massachusetts Bay Long-term Monitoring

Sediment trap bottles



Relative suspended sediment concentration



Bottom current speed due to storm waves

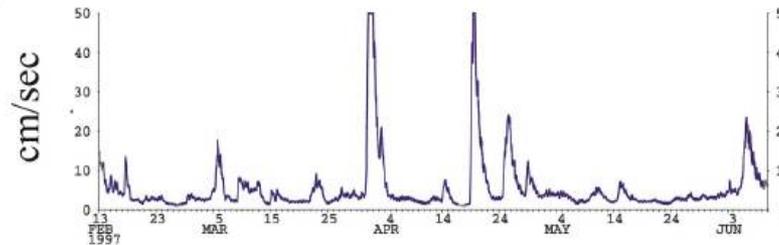


Figure 6: Collection bottles from a time series settling trap show how amounts of sediment can vary with resuspension events.

Examples for lakes/bays

For marine areas with > 20 m water depth there is a differentiation of SPM and sediment resuspension.



In the case of applying passive sampling systems for SPM via sedimentation traps, different models are available and tested for years. The application of flow through centrifuges requires at least 2 samplings per month. Filtration $< 0.45 \mu\text{m}$ delivers a very low amount of material.



Input from science and stakeholders, authorities - suitable EQS

Establishment of QA/QC for biota and chemical EQs, indicating good water quality via Sediment/SPM/Biota/Benthos

- 1) $< EQs_1$ and Ecstatus ok
- 2) $> EQs_1$ but no significant deterioration
- 3) $> EQs_2$, system is deteriorated (e.g. dredging QC exceeded*)

3) *TRIAD/TIE/EDA/Biomarker analysis/Toxtests/Bioaccumulation experiments*

* depending on national regulations and site-specific decisions

Biota:

For **Lakes:** Perch; bream, arctic char (alpine and scandinavian lakes)

For **Rivers:** bream; brook trout or rainbow trout, zebra mussels (and alternatives)

Transitional, coastal and territorial waters: Mollusks and benthic or demersal fish suggested

The guideline provides to tool to perform a European-wide monitoring program and to elaborate EQS for sediments/biota as alternatives for the water phase.

Thank You for Your attention