

The Sediment Quality Index

Integrative classification and assessment system

Ilka Carls¹, Michael Bergemann¹, Dr. René Schwartz¹

¹Ministry of Environment, Climate, Energy and Agriculture
Free and Hanseatic City of Hamburg, Germany

Phone: +49 40 42840 5244
E-mail: ilka.carls@bukea.hamburg.de

Introduction: In the Elbe catchment area contaminated sediments are one of the main reasons for the failure to meet the WFD management objectives. As a consequence, the member states in the International Commission for the Protection of the Elbe River (ICPER) decided to develop a sediment management concept [1]. The concept was elaborated in support of the general management goals as declared for the Elbe catchment according to the EU Water Framework Directive (WFD) and the EU Marine Strategy Framework Directive (MSFD). These are to reach and keep the good ecological and chemical status and to guarantee permanently all functions and services that are necessary for the intended human uses. The latter includes fulfilling all the criteria in order to protect human health, e.g. with respect to fish consumption or the agricultural use of floodplains.

Methods: With the definition of the Environmental Quality Standards (EQS) and the statement in Annex V, that standards can be set for water, sediment or biota, the EU allows the member states to name additional river basin relevant pollutants and to define the medium for the EQS itself. Because the WFD provides a legal framework as outlined before, the ICPER developed an integrative classification and assessment system (so-called threshold concept) to evaluate the status of the system in terms of quality. Reference monitoring sites are used to characterize a sub-basin that is relevant for the interregional sediment management in qualitative terms. These stations usually provide long-term time series of data from quality-assured monitoring programmes. The risk analysis under the quality aspect was done for 29 Elbe relevant contaminants with respect to each of the identified management goals. For each of them a specific lower and upper threshold value (LTV and UTV) was allocated. The LTV is a pollutant-specific limit (formally most stringent requirement = lowest concentration in the sequence of relevant quality requirements), below which – in accordance with current knowledge and regulation status – all water management objectives that depend on good sediment status (good chemical and ecological status of the water bodies, integrity of the aquatic communities, soil protection (meadows/marshland), human health) can be achieved regardless of time and location. The UTV was mostly established based on values obtained

through recognised derivation methods for environmental quality standards. Insofar as they are not available, eco-toxicologically derived values (state of knowledge) or the strictest values of other national regulations available (good professional practice) apply. Pursuant to the sediment management concept exceeding the UTV requires a source-related risk analysis combined with the development of recommendations for action [2].

Sediment quality index

Based on that threshold concept the Elbe sediment quality index was created. The sediment quality index (SQI) is derived to describe and document temporal and spatial changes (trends) as well as the intensity of pollutant levels in suspended matter and sediments. If the annual average (AA) equals the UTV, the SQI of that pollutant is 1.0 ($SQI = AA / UTV$).

Results:

As a result, the relevant sources in the basin districts are described and ranked. Altogether, 38 source-related recommendations are given in the concept. Depending on hydraulic conditions, sediments may be sources or sinks of contaminants. Therefore, besides the source function (mainly induced by floods), the sink function was also included in the analysis. This refers first of all to the role of floodplains but also to examples for further types of sinks such as natural and artificial river lakes, storage reservoirs, and harbour basins. Consequently, recommendations in the concept refer also to the potential sink functions.

The presentation gives an insight of how threshold values from different sources can be integrated into and used within a river basin management plan.

References: [1] IKSE (Ed.) (2014) Sedimentmanagementplan für die Elbe. Magdeburg; [2] IKSE (Ed.) (2019): Derivation of an ICPER Sediment Quality Index, Magdeburg

