



# Moving Sediment Management Forward

## River basin case studies

### The Elbe

The Elbe is the third largest river in Central Europe both in terms of length (1,091 km) and area (148,268 km<sup>2</sup>). Its source is in the Giant Mountains (Krkonoše) in the Czech Republic. The German part of the basin encompasses around two-thirds of the entire area and most of the remaining one third lies in the Czech Republic, with less than 1% in either Austria or Poland. The long-run discharge mean at the mouth into the North Sea is 877 m<sup>3</sup>/s.



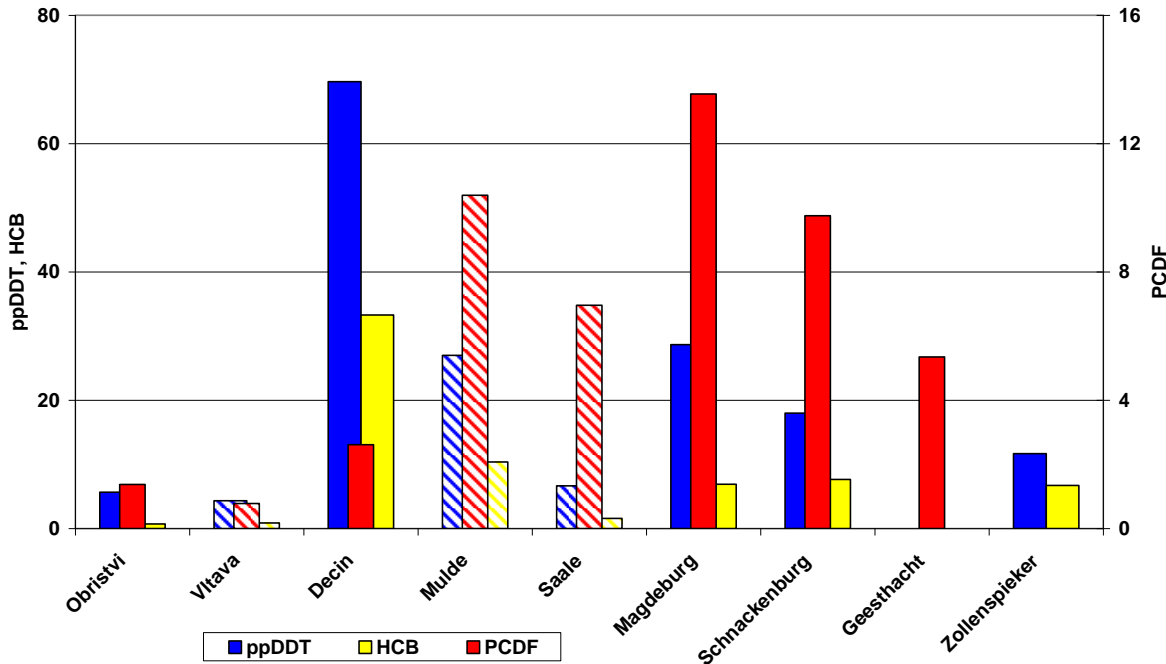
Fig. 1: The Elbe catchment

About 60% of the basin area spans the Middle and North German Lowland. More than 25 million people live in the catchment area including in the major cities of Berlin, Hamburg, Prague, Leipzig, and Dresden. The Elbe comprises a transboundary European Region with a very long and intensive industrial and mining tradition. Furthermore, around 56% of the entire catchment area is used intensively for agriculture. Dynamic developments took place since the political changes in the late 1980s. However, despite having been (and in some respects still being) a heavily polluted river, the Elbe stands out among large central European rivers for its natural resources including its wetland and floodplain forest habitats.

**Sediment quality challenges**

The first Elbe management plan prepared under the EU Water Framework Directive (WFD) highlighted contamination as one of the most important supra-regional issues in water resources management. The plan underlines that contaminated sediments are one of the main reasons for the failure to meet the WFD environmental objectives. The situation is illustrated by two examples.

Fig. 2 presents the contamination pattern for three of the most relevant particle-bound contaminants in the longitudinal section of the Elbe between Obristvi in the Czech part above the Vltava (Moldau) and the tidal border (Geesthacht) or the upper tidal reach above Hamburg (Zollenspieker). The trend for the priority pollutants pp-DDT, HCB (ICPER 2010) and the candidate substance group of the dioxins/furans (PCDF; ICPEP 2008) is indicated as factor exceeding the respective quality standard which is included in the Elbe sediment management concept.



**Fig. 2:** Contaminants in the longitudinal section of the Elbe (shaded columns show tributaries)

The main source regions of sediment contamination by pp-DDT, HCB and PCDF are easily identified from Fig. 2. The serious management challenges in order to avoid unacceptable risks to human health, environment and economy are illustrated below by two examples.

### *Safe water depths for navigation in the port of Hamburg*

As in many other North Sea estuaries, continuous maintenance dredging is necessary to maintain safe water depths for navigation in the Port of Hamburg. In the tidal Elbe 15-20 million m<sup>3</sup> need to be dredged annually. Concentrations of pp-DDT and HCB are considered to pose an unacceptable risk to the marine environment so up to one million m<sup>3</sup> of dredged material cannot be relocated in the estuary and has to be safely disposed of on land. The associated additional costs can reach nearly 50 million Euros per year.

### *Grassland along the river for food production*

The grassland along the lower Elbe has long been used for grazing cattle and sheep. However, due to regular flooding, the grassland has been contaminated by dioxins from the river sediments. This results in restrictions on agricultural use. In order to avoid dioxin levels exceeding the upper levels allowed in the foodstuff and in milk and meat, a specific management regime had to be introduced. Obligatory measures include requirements for multi-site production; means of identifying animals and areas; sampling and dioxin analyses; and constraints e.g. on harvesting techniques, on the production of hay and silage, and on the watering of animals. As a consequence, production costs rise.

### **Actions - Perspectives – Uncertainties**

As a result of the findings of the first Elbe river basin management plan, the states cooperating in the International Commission for the Protection of the Elbe River (ICPER) decided to develop a sediment management concept in preparation for the second management cycle. To this end, a Czech-German expert group was established in late 2009.

Generally, measures have to be taken at national level. However, when sediments are involved, areas of regulation and interest beyond water management come into play – for example navigation or agriculture interests (see above). Therefore, to ensure the success of the work of the international expert group, it was necessary to form working structures under the responsibility of the Czech Ministry of the Environment and the German River Basin Community Elbe on the Czech and German sides respectively. Through these working structures it was possible not only to integrate all relevant management perspectives but also to activate a broad scientific and technical expertise. For example, in Germany more than 30 experts from different fields of knowledge contributed to the working process at different stages.

The sediment management concept of the Elbe, approved by the member states of the ICPER, considers the deficits of the sediment regime in terms of both chemical and ecological status and with regard to the derivation of supra-regional management objectives. It then suggests, in priority order, options to overcome these deficits. The sediment management challenges in the Elbe catchment relate to both quality and quantity. Therefore, one of the basic decisions of the ICPER was to integrate qualitative, quantitative and hydromorphological aspects of the sediment regime into a single concept. The relative order of management priority depends on the character and the intensity of these interrelations.

In terms of sediment quality, 29 relevant particle-bound contaminants have been identified. 'Intervention at source' as the best solution is one of the principles applied to the prioritisation exercise. For the desired source-oriented risk analysis of each of the relevant contaminants, an understanding of sediment dynamics and fluxes is crucial. Further, from the risk analysis of quality aspects it is clear that uncertainties result mainly from (i) the huge amounts of cohesive contaminated sediments which are stored in zones of low transport energy and (ii) the emissions of old mines and industrial areas. Even if the latter can be fully monitored it will not be possible to close them at reasonable cost within a clear time span. Old contaminated sediments are also accessible to high flows and extreme hydrological events.

Pilot studies as well as adaptive management approaches will therefore need to be suggested to cope with these various uncertainties.

The Elbe case study illustrates some of the practical implications associated with sediment quality and remobilisation:

- the main challenges in the Elbe River Basin relate to the effects of the downstream movement of historic contamination - including implications for maintenance dredging at the Port of Hamburg and for agricultural land use
- transboundary collaborative work on an integrated sediment management concept has identified priority actions which include adaptive management measures and pilot studies to deal with uncertainty.

## Links

International Commission for the Protection of the Elbe River (ICPER)

[www.ikse-mkol.org](http://www.ikse-mkol.org)

Czech Ministry of the Environment

[www.mzp.cz](http://www.mzp.cz)

German River Basin Community Elbe

[www.fgg-elbe.de](http://www.fgg-elbe.de)

### *Disclaimer*

This document has been prepared by the SedNet coregroup as showcase for the brochure "Moving Sediment Management Forward – The Four SedNet Messages", see [www.sednet.org](http://www.sednet.org)  
SedNet shall not be held liable for improper or incorrect use of the data described or information contained on these pages.

June 2014