



Susanne Heise

Wolfgang Calmano

Wolfgang Ahlf

Dörte Lange

Walter Leal

Hamburg – Elbe case study

Introduction

The area of Hamburg has been chosen because of its high economic importance for the region and the characteristics of conflicts that occur in this area due to interests of economic maintainance, ensurance of environmental quality and securing quality of human life, that in some aspects need weighting against each other or/and new management solutions while complying with the water framework directive. Of special importance is the fact that Hamburg is situated near the mouth of the river Elbe and its problems and conflicts are partly a result of activities upstream. Solvation of conflicts need to be seeked for in a surrounding of partially autonomically deciding Federal States.

The aim of the study

The aim of this study is to identify ecological problems connected with the Elbe in Hamburg, describe their sources, demonstrate economic aspects of these ecological problems, and to describe the catchment situation, which will have to be the basis for decision making with regard to any solutions that need to be discussed.

The problems encountered

The ecological situation

Quality of the Elbe River water has improved significantly over the last decades. Current environmental problems are connected mainly to the sediments in which the industrial history of the Elbe is reflected. In sediments, with the exception of chromium and nickel, all other heavy metals and arsenic exceed the target values of the International Commission for the Protection of the Sea (IKSE) in more than 90 % of the cases. Additionally HCHs, TBT, PCB, HCB, Dioxin, and DDT are frequently measured in elevated concentrations. Most of these substances are transported to Hamburg in substantial quantities from industrial sources or historically contaminated sediments from upstream. Sources comprise e.g. the former industrial region of Bitterfeld, ore mining in the Mulde catchment area, which is a tributary of the Elbe, industrial activities in the Czech Republic. Even though most industrial point sources have been reduced to such an extent, that they rank second in line now compared to diffuse pollution and communal discharges, their former impact on sediment quality in the Elbe catchment area will continue to cause environmental problems for the next decades.

It needs to be stressed, that even though emissions from upstream cause major problems in the Hamburg area, current or former industrial discharges of industries in Hamburg itself have added to the overall environmental situation. According to EPER (European Pollution Emission Register), 4 industrial plants in Hamburg have been recorded in 2001 to emit substances like 1,2-dichloroethane (DCE), phenol-compounds, arsenic, cadmium, copper, nickel, lead and zinc in substantial quantities directly to the water. An inventory of historical sources within Hamburg is being prepared.

The economical situation

Hamburg is the 3rd largest industrial area in Germany, comprising mobile industry, precision engineering, mechanical engineering, chemical production, metal industry, and oil processing industry. The most important industry in Hamburg, however, is the harbour - in terms of international reputation, of employment and of income for Hamburg.

Directly or indirectly, 125.000 people are employed in Hamburg in connection with harbour activities, which adds up to almost 12 % of all jobs in Hamburg. This resulted in 12.5 % of the whole Gross Domestic Product in the city. The tax revenue from harbour activities amounts to about 600 mio Euro per year. Accordingly the harbour is of high economical importance for the city.

Harbour activities, however, are threatened by an increasing amount of sediment that settles in the harbour basins, increasing the volume of material that needs to be dredged for maintenance of navigational water depth to about 9 mio m³ in 2004 (compared to 2 to 3 mio m³ in the 90s). Hamburg is only allowed to relocate dredged material of a certain quality within the borders of the Federal State of Hamburg. Studies have shown that 80 % of the material is transported back to the harbour.

Due to pressing needs to find immediate solutions for the deposition of the material it has been agreed upon together with the advising Federal Institute of Hydrology to dispose the material in the North Sea.

As this material is contaminated above the usually permitted concentration levels, this is regarded as a tentative not a permanent solution.

Reducing the amount of incoming suspended matter and at the same time improving the quality of the sediments in the harbour area are the most urgent and most sustainable solutions to the maintenance problems of the harbour.

The catchment situation

Improvement of sediment quality in the harbour is mainly a catchment issue as most of the contaminants derive from areas upstream. The catchment of the Elbe River, however, lies in two countries (Czech Republic and Germany) and touches 9 Federal States. Responsibility for management activities that reduce the impact of historically contaminated sediments in the basin is not easily taken over especially by the new Federal States in the former GDR, because of another political regime having caused this pollution and because of the financial implications that would result.

The impact matrix

Hamburg is the second largest city in Germany with 1.7 mio inhabitants. 36 % of the area is taken up by open space and buildings, 27% by agricultural fields, 12 % by traffic, and another 12 % by areas assigned to recreational activities. Lakes, rivers and canals take up 8 % and of the area, leaving about 5 % for various functions. According are the main contributors to the impacts: As a densely populated area, the influence of communal discharges and urban drainage (incl. storm water and surface run off of rainwater) to the water quality is reckoned to be substantial, as is the impact of agricultural activities.

Point sources are mainly located in the catchment areas, but also to some extent in Hamburg.

		Impacts =>										Physico-chemical quality elements						Biological quality elements					Hydromorphological quality elements			
<= Pressure		Transparency/turbidity?	Temperature	Oxygen conditions	Conductivity	Salinity	Nitrogen	Phosphorous	Suspended solids	Acidification	Priority substances	Other pollutants	Phytoplankton	Planktonic blooms	Macrophytes	Benthic invertebrates	Fishes	Hydrological regime	Morphology	River continuity	Tidal regime					
		Diffuse sources	Scattered settlements sewage																							
Agriculture diffuse																										
Forestry																										
Urban storm waters																										
Atmospheric deposition																										
surface-run off of rainwater antifouling-emission from ships and dockyards																										
Point sources	Industrial wastewaters																									
	Municipal wastewaters																									
	Mining																									
	Contaminated lands																									
	Animal husbandry																									
	Solid waste management																									
	Aquaculture																									
	Peat production																									
	Contaminated sediment upstream																									
Abstraction	Raw water supply																									
	Agriculture																									
	Industry																									
	Fish farming																									
	Hydropower																									
	Open cast coal mining Relocation of dredged material																									
Morphological pressures	Dams (transversal)																									
	Weirs (transversal)																									
	Longitudinal embankments																									
	Straightening																									
	Dredging																									
	Shore protections																									
	Urbanisation																									
Hydrological pressures	Flow regulation (rivers)																									
	Hydropeaking																									
	Level regulation (lakes)																									
	Deepening of navigational channel																									
	Change in riverprofile																									
Other anthropogenic pressure	Recreation																									
	Fishing/angling																									
	Climate changes/increasing flood frequency																									
	Land drainage																									
	Overgrazing																									
	Introduced species																									
	Introduced diseases																									



The main reason, why Hamburg will not comply with the objectives of the water framework directive and will be mostly defined as heavily modified water body are the morphological changes that the Elbe has undergone in the Hamburg area for reasons of flood protection and harbour development. A weir upstream of Hamburg at Geesthacht influences the hydrological regime during flood events.

The reason, why dredging and relocation has relatively little influence on various quality elements is, that it is only allowed during times outside the fish breeding and hatching season and if the oxygen content of the water is high enough. In general, relocation of dredged material can be regarded as having the larger influence, as loss of suspended material during dredging has been reduced by choosing appropriate dredging apparatus.

Conclusions

The main conflicts of Hamburg arise from its location within the Elbe River due to

- transport of contaminants to Hamburg from upstream
- no direct access to the North Sea, and hence restriction to relocation of DM to Hamburg borders
- high sedimentation of material coming in with the tides
- flood protection measures and harbour development operations that change morphology and hydrodynamic of the area, impeding achievement of WFD objectives.

Decision processes are prolonged due to the Federal State system in Germany which allows every State executive power with regard to the realization of (environmental) regulations.