ANNEXE

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Chemistry Toxicity Tests

Substance name	Group	Unit	Criterion[3]	Signal value[5]
Amphipod *C. volutator*	Combination toxicity	Mortality (%)		50
Microtox SP, Bacteria *V. Fisheri*	Combination toxicity	Bioluminescence ($1/EC_{50}$)[1]		100
DR-CALUX cell-line	Dioxine-type	ng TEQ/kg dw		50
Tributyltin	Organometal	µg Sn/kg dw	100-250[4]	
Copper[2]	Metal	mg/kg dw	60	
Arsenic[2]	Metal	mg/kg dw	29	
Cadmium	Metal	mg/kg dw	4	
Mercury	Metal	mg/kg dw	1.2	
Chromium[2]	Metal	mg/kg dw	120	
Zinc[2]	Metal	mg/kg dw	365	
Nickel	Metal	mg/kg dw	45	
Lead	Metal	mg/kg dw	110	
Sum 10-PAH	PAH	mg/kg dw	8	
Hexachlorobenzene	Pesticide	µg/kg dw	20	
Sum DDT/DDD/DDE	Pesticide	µg/kg dw	20	
Mineral oil C10-40[2]	Oil	mg/kg dw	1250	
Sum 7-PCB	PCB	µg/kg dw	100	

1. EC_{50} corrected for fraction of fine silt.
2. On these parameters the 50%-rule applies.
3. The criteria are upper levels, with the exception of the parameters where the 50%-rule applies for which exceedence of the criteria with a maximum of 50% is allowed for one or two parameters.
4. For tributyltin a range in criteria is used. Within this range the actual criterion is determined for individual permits for relocation of dredged material in marine waters.
5. Exceedence of a signal value will not lead to disqualification.

Annex 2 - Samples, contaminations and assigned hazard classes that were the basis for this report

HAZARD	Ort	Mess-stelle	River km	Zn	Cd	Cu	Cr	Hg	Pb	Ni	PCB	PAH	SumDDT+DDD+DDE	HCB	HCH	Dieldrin	dioxins
3		Marckolsheim				100		4,2						3000,00			
3		Iffezheim				60				60				600,00			
0	Neckar	Feudenheim, unterer Vorhafen der Schleuse		105,4	1,2452	24,64	41,14			12,1							
1		Kochendorf		217,0		55,18	80,6			32,24							
3		Lauffen, Stauhaltung		709,9	18,3535	193,688	366,289		134,332	63,261	170,7						
3	Rhein	Augst	155,00											2500,00			
2		Birsfelden	163,00											44,00			
2		Märkt	174,00											106,00			
2		Vogelgrün	223,70											250,00			
2		Burkheim	234,30											82,50			
2		Weisweil	249,00											130,00			
2		Rhinau	256,00							10,58				250,00			
2		Gerstheim	268,00											190,00			
2		Straßburg	283,40			63,9		1,98		49,5				356,00			
3		Kehl	297,30	672,5		70,219			142,416		341			21,00			
3		Gambsheim	308,00			40,35							113	470,00			
2		Fort Louis	328,35			55,106								90,00			
2		Iffezheim	333,00			33,158				32,596				180,70			
2		Karlsruhe	359,90			27,636				25,1685				80,00			
3		Germersheim	384,40							46	110			900,00			
2		Speyer	399,40			59,024				48,552				65,00			
2		Speyer Flosshafen	400,40			34,17				26,52				109,00			
2		Altrip	416,95							49				53,00			
3		Bellenkrappen	422,30			91,68		1,8145		43,93			69	370,00			
1		Mannheim (Mündung Neckar)	426,50			60,636				63,57							
2		Worms	443,20							43,505				60,00			
2		Bauhafen	443,00			30,96		0,612						460,00			
3	Binnenhäfen	Loreley	555,00	448,5	2,82	111,75		3,3225	112,5	46,5	211	9,17	60	106,00			
1		Ehrenbreitstein	591,00	475,0		79,56			94,38	48,36							
1	Neckar	MA-Feudenheim	8,30			72,303				46,95							
0		Schwabenheim	18,10			26,78											
0		Neckargmünd	30,90			38,124				30,1815							
1		Neckarsteinach	39,70			51,392				38,72							
1		Hirschhorn	48,00			58,646				41,3							
1		Eberbach	56,97			86,13											
1		Rockenau	61,60			58,743											
1		Guttenbach	73,70			60,828											
1		Neckarzimmern	86,10			74				48							
2		Gundelsheim	94,10		36	119				52	212		29				
1		Kochendorf	104,10			83,42				39,56		8,90					
1		Heilbronn	111,45			77,22				37,44							
1		Horkheim	118,00			56,625				36,24							
1		Lauffen	125,50			66,385				39,831							
1		Besigheim	137,05			102,5685				41,622							
1		Hessigheim	143,60			50,481				28,755							
1		Pleidelsheim	150,60			69,048				46,032							
1		Poppenweiler	165,40			98,78											
1		Aldingen	172,30			97				46							
2		Hofen	177,00			75,696				44,688	209						
2		Cannstadt	183,00			92,872		2,679		41,971	99						
1		Untertürkheim	186,90			72				43,2							
1		Obertürkheim	190,00			53,586											
1		Esslingen	195,60			67,536				45,024							

Annex 2 - Samples, contaminations and assigned hazard classes that were the basis for this report

1		Deizisau	199,90			64,9515							
1		Kirchentellinsfurt	243,00			64				47			
	Wiesloch	Wiesloch											
	Brühl	Brühl											
	Nonnenweihr	Nonnenweihr											
	Main												
1	Mosel	Mündung		264,9		33,88			59,4	29,48		11,00	24
1	Lahn	Schleuse Altenberg		399,6		70,2	97,2		75,6	70,2			
0	Sieg	Mündung	1,30 U	519,1					78,4				
0	Sieg	bei Buisdorf	14,80 U	390,3		37,52	61,6		97,44	30,8			
1	Sieg	in Hennef vor der Bröhl	24,05 U	436,2		52,08	71,12		107,52	38,08			
1	Sieg	bei Rosbach	63,75 U	635,6		54,88	86,24		161,84	43,68			
1	Sieg	bei Eiserfeld	121,30 U	810,9		75,04	168,56		140,56	66,08			
3	Sieg	nach Zufluß der Ferndorf	130,25 U	780,1		78,4	194,32		160,72	67,2		8,09	
1	Sieg	bei Deutz	140,70 U	224,56			77,84		40,88	43,68			
3	Wupper	Mündung	0,50 U	400,4		156	176,8	2,236	177	47,84		12,43	
1	Wupper	oh. Dhünn	1,85 U	312		104				35,88			
1	Wupper	un Opladen unterhalb Brücke B8	5,70 U	312		62,4	88,4		109	36			
3	Wupper	in Wipperaue vor dem Wehr	16,10 U	572		156	145,6	2,34	218	52		14,81	
3	Wupper	bei Pfaffenberg	25,40 U	484		109,2	135,2	1,04	213	46			
3	Wupper	bei Schloss Burg	27,70 U	624		124,8	114,4	0,624	250	57		15,55	
3	Wupper	in Müngsten unterhalb Morsbach	31,90 U	504		135	119,6	1,404	234	49		15,07	
1	Wupper	oberhalb Morsbach	32,25 U			62	114,4	0,78	130	36			
3	Wupper	in Kohlfurt unterhalb der Kläranlagen	36,20 U	780		244	119,6	5,2	338	57		36,17	
3	Wupper	am Wehr Buchenhofen	39,85 U	642		130	85,8		276	44		17,07	
3	Wupper	oberhalb Wehr Buchenhofen	41,10 U	780		172	104	0,728	374	52	110	19,78	
1	Wupper	Wuppertal-Oberbarmen unterhalb Schwelme	53,20 U	572		99	78		198	50		12,70	
1	Wupper	an der alten Zollbrücke oberhalb Schwelme	54,80 U	390		83	83,2		135	68			
1	Wupper	Wuppertal-Laaken bei Firma Vorwerk	57,20 U	520		62	88,4		130	94			
1	Wupper	in Beyenburg	62,10 U	390		57	109,2		104	78			
1	Wupper	Niederwipper	97,30 U				62,4		57	36			
1	Wupper	in Schmitzwipper oberhalb Kläranlage	106,90 U	281		52	67,6		88	44			
1	Erft	an der Wassermühle in Gnadenthal	2,50 U	275	4				134	79			
1	Erft	OH EINMDG.VEYBACH	7,83 U	199						42			
0	Erft	MÜHLENSTAU IVERSHEI	9,06 U										
3	Erft	an der Gustorfer Mühle	21,20 U	610	7	55,51			268	177			
3	Erft	Sindorf	42,95 U	732	5				256	207			
3	Erft	unterhalb Bergheim am Pfaffendorfer Wehr	51,95 U	671	5	61			256	244			
3	Erft	bei Brüggen am Wehr	52,30 U	1220	7	42,7			512	384			
3	Erft	bei Brüggen; uh WWK Dirmerzheim	52,40 U	1543	5	45,14			529	448			
3	Erft	unterhalb Einmündung Rotbach	53,80 M	2056	5	55,51			641	580			
3	Erft	Dirmerzheim	54,45 U	1708	8	48,8			159	604			
3	Erft	bei Klein-Vernich	66,20 M	5203	11	81,13			244	1678			
3	Erft	in Hausweiler am Wehr	69,20 U	4514	16	97,6			250	1525			
0	Erft	Brücke Roitzheim	78,04 U		3				61	29			
1	Erft	in Iversheim am Wasserwerk	89,00 U	238	3				128	35			
1	Erft	in Holzmühlheim an der Schochermühle	102,40 U						92				
3	Ruhr	vor Schloß Duisburg-Kasslerf.	3,30 U	830,96	7	176,8	136,24		146	68			
3	Ruhr	Wasserwerk Mühlheim/Ruhr	10,05 U	1596,92	11	300,04	194		282	124	328	1277,45	
3	Ruhr	bei Schloß Oefte	25,05 U	562,64	6	175,24	127		206	46,28			
3	Ruhr	nach Baldeneysee	26,40 U								462,80		
3	Ruhr	in Holthausen	39,15 U	873,08	5	163,8	142		144	73,32			
3	Ruhr	an der Brücke nach Dahlhausen	50,55 U	1196	9	275,6	230		236	104,52	214,00		
3	Ruhr	Witten-Bommern	74,50 U	791,96	5	167,96	150		108	66,56	162,70		

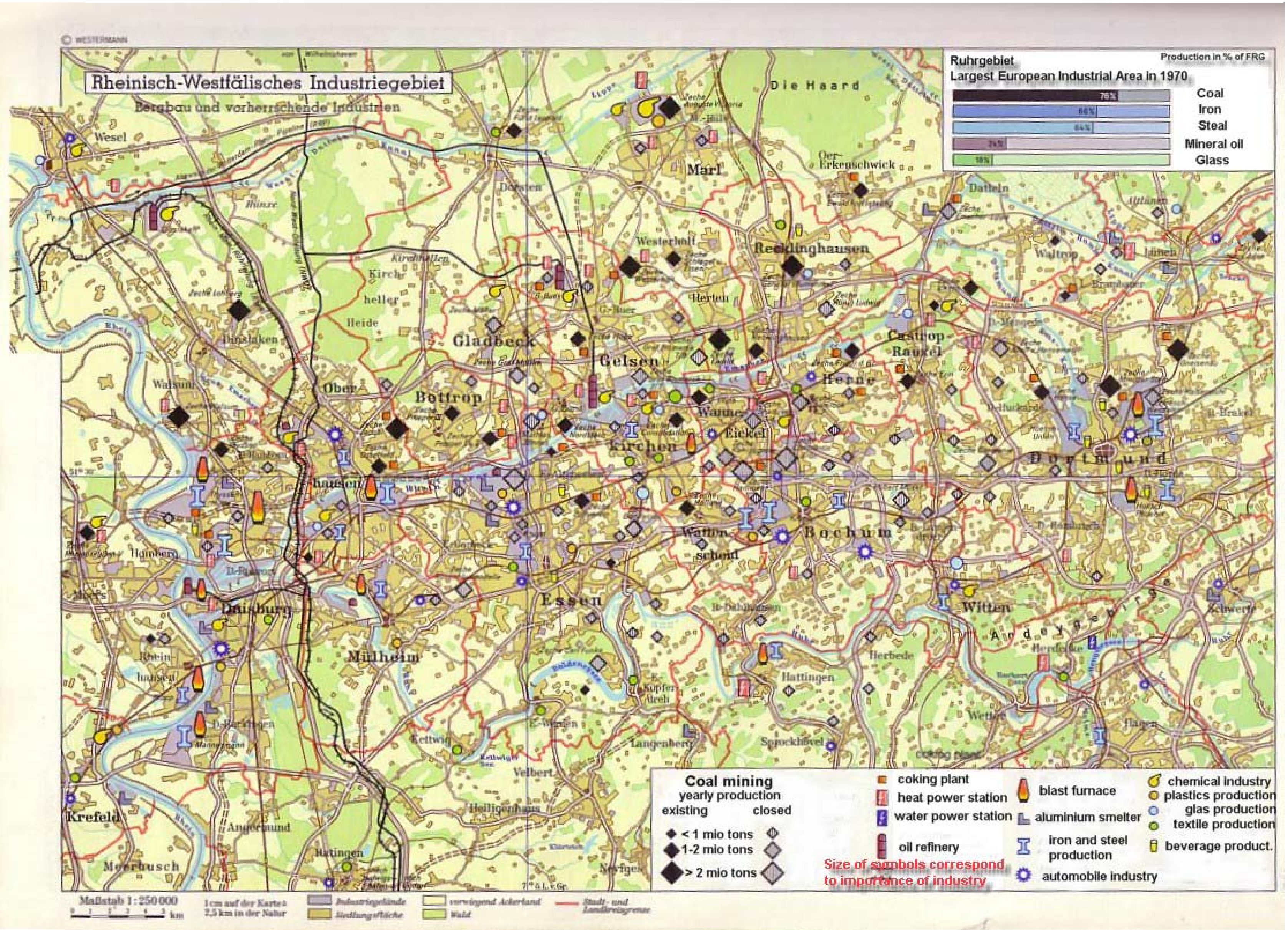
Annex 2 - Samples, contaminations and assigned hazard classes that were the basis for this report

1	Ruhr	in Herdecke vor Harkortsee	85,45 U	888,68	5	209,56				82,68				
1	Ruhr	Pumpwerk in Schwerte	101,50 U	592,28	3	110,24	77		93	53,04				
1	Ruhr	in Wickede vor der Staustufe	122,90 U	664,56	3	94,64	59		161	28,08				
1	Ruhr	Neheim	136,50 U	531,96		93,08	66		116	85,8				
2	Ruhr	Oeventrop unterhalb Wildshausen	158,90 U	927,16		41,6	58		75	35,88				
2	Ruhr	Ruhr Wildshausen	159,00 U	783,6	4,16	40,56	45		83	32,24				
2	Ruhr	Freienohl	165,20 U	927,2		38,48	53		72	33,28				
1	Ruhr	in Meschede	176,90 U	1343,2	6,76	60,84	74		157	49,92				
1	Ruhr	vor Zufluss der Neger	198,40 U	320,8		40,56	90		69	37,96				
1	Ruhr	Hönne-Mündung bei Fröndenberg				111,8	62		82	41,6				
3	Lippe	am Lippeschlößchen in Wesel	2,35 U	468,48		70,15		1,342	67,1		81		436,64	
2	Lippe	in Dorsten-Bricht	22,10 U	594,75		88,45		1,159			222		51,33	
2	Lippe	in Dorsten	32,50 U	567,3		97,6		1,769			102		71,67	
2	Lippe	an der Brücke in Dorsten-Hervest	37,10 U	527,65		84,79		1,5067	79,3		177		38,15	
3	Lippe	Wultener Brücke unterhalb Hüls West	41,20	603,9		109,8		1,4518	79,3		182	12,26	140,00	
2	Lippe	Oelder Brücke	43,90	525,2		95,77		1,3786	78,69		106,3	15,31	70,00	
1		unterhalb Sickingsmühlenbach	45,40	428,8										
1		Mündung Sickingmühlenbach	*46,00*	339,8		39,65		1,0614	84,18		76,2		22,20	
1		an der Lippramsdorfer Brücke	46,90 U	499,0		99,43			76,25		86,8			
1		in Ahsen	68,90 U	481,3		114,68			68,32		55,3			
1		in Waltrop	84,90 U	430,1		106,75			95,77		54,7			
2		Pumpwerk in Lünen	94,40 U	481,9		137,25			68,93					
1		in Rünthe	106,80 U	323,3		73,81					36,6			
1		bei Stockum	113,40 U	277,6		70,76					34,7			
1		am Wehr in Hamm				62,83								
0		Ahse in Caldenhof	0,00 U											
0		in Hamm Uentrop	134,90 U	228,8		40,26								
0		in Kesseler	149,70 U	250,1										
0		in Lipperode	173,00 U											
0		oberhalb Lippesee	200,80 U											
	Emscher													
2	Rhein	Hafen in Oberwinter	639,10 U							31,96			34,88	
2		Königswinter	646,70 R										46,70	
1		Hafen in Mondorf	659,80 R	570,15		40,74	74,55		94,5	34,965			34,78	
0		Hafen in Godorf	672,00 L	224,175		43,4625	73,81		57,1875	30,805				
2		Köln-Zündorf	677,30 R	238,875						32,3375			48,36	
1		Hafen in Köln Deutz	687,30 R	385,7412		57,2197			89,5544	41,08				
2		Rheinauhafen in Köln	687,60 L							34,505			54,93	
2		Hafen Köln-Niehl	695,60 L			43,6104							55,58	
2		Köln-Niehl Ölhafen	699,00 L										54,30	
3		Hafen in Hitdorf	706,90 R	318,5866		82,5922	104,8061	1,7228	89,164317	38,7922	228,82		42,47	
2		Sporthafen Gnadenthal	735,80 L	309,4105		48,8078			82,7966	47,7566			44,30	
2		Hafeneinfahrt Neuss	740,10 L	398,825		35,9075	82,15		64,5275	32,595			43,13	
1		Neuss Hafenbecken 2 Mitte	740,30 L		5,712							9,38		
2		Industriehafen Düsseldorf	743,10 R			43,55				30,81			54,42	
2		Sporthafen Golzheim	747,10 R							28,985			74,78	
1		Yachthafen Düsseldorf	748,80 L							36,9			24,61	
1		Hafen Krefeld	764,10 L	344,729		59,5182	153,069		75,48	44,1854				
1		Duisburg-Hüttenheim	770,30 R	562,6		36,685	91,35		135,43	31,61			24,05	
2		Hafen Rheinhausen	773,60 L			42,372	87,7392		89,0712	39,78			36,44	
1	Rhein	Duisburg-Wanheimerort Süd	774,20 R			125,055	86,625		88,6725			107,69	23,10	
2		Wanheimerort Südhafen Ost, Hinten	774,20 R									69,00		
3		Duisburg-Aussenhafen	776,60 R	484,2018	4,428	64,26	147,51018		80,9082	26,3682	126,16		41,39	
3		Hafen Diergard in Duisburg-Homberg	778,10 L	346,95		62,505	249,75	2,5002	97,2	36,99	149,3	10,06	56,92	473,33

Annex 2 - Samples, contaminations and assigned hazard classes that were the basis for this report

2	Hafen Diergard 30 m nach Einfahrt außen	778,10 L											2900
2	Ruhrort Becken C	780,30 R									18,70		
2	Ruhrort Becken B	780,30 R									18,30		
2	Ruhrort Becken A	780,30 R									17,20		
2	Duisburg-Ruhrort Becken Nord/Süd Mole	780,30 R									10,68		
2	Duisburg Eisenbahnhafen Hinten	781,10 R				80					26,20		
1	Duisburg Rheinpreussen Hinten	781,10 L									13,40		
2	Hafen Rheinpreussen	781,10 L	286		41,509				32,032			41,42	
2	Duisburg-Eisenbahnhafen	781,10 R	313,6		59,2				33,76			55,70	
0	Duisburg Hafen Schwelgern	790,10 R	122,925		20,2125	43,23			16,17				
1	Südhafen in Walsum	791,10 R	387,925	2,891	54,28	85,55	0,69502	86,435	32,3025		10,68	34,17	
1	Nordhafen in Walsum	793,00 R	321,2		53,8375	85,775			38,1425				
2	Baggerloch Rheinberg	807,20 L										54,64	
1	Einfahrt Wesel-Datteln-Kanal	813,10 R	286,6676		46,1448	80,5256			32,3476			28,90	
1	Hafen in Wesel	814,60 R			63,798	80,199			32,697			29,50	
2	Sporthafen Wesel	816,60 R	338,0096		40,8				29,6			38,70	
2	Baggerloch bei Xanten km 826,9 l	826,90 L							34,0377			49,60	
2	Baggerloch Lohrward	830,00 R	205,381		35,354				25,597			52,00	
1	Sporthafen Niedermörmter	838,00 L							32,3811			29,30	
3	Baggerloch Müllerhof	848,20 L	401,412		81,708	154,044		122,496	40,92	332,54		96,40	
1	Einfahrt Hüthumer Meer	853,80 R	305,359		51,3409				35,5291			22,70	
2	Altrhein Keeken-Bimmen	863,80 L	274,3686		39,6				32,175			37,13	

Annex 3: Industrial sites in the „Ruhrgebiet“ (Ruhr area) in Germany in 1970



Annex 4: overview over available recording data from the monitoring stations.

Pollutant		Discharge		Measuring period	Flood event data	Flood return period
Monitoring station	Source	Gauging station	Source			
Iffezheim, Rhine	LfU data base	Maxau	LfU data base Gewässerkundliches Jahrbuch	1993 - 2000	LfU Gütebericht	LfU - Regionalisierung
Mannheim/Feudenheim, Neckar	LfU data base	Rockenau	Gewässerkundliches Jahrbuch	1992 - 2000	LfU Bericht	LfU - Regionalisierung
Bischofsheim, Main	HLUG	Raunheim	BfG HYDABA1 data base	1999 - 2002	-	-
Koblenz, Mosel	BfG - IKSR data base	Cochem	BfG Gewässerkundliches Jahrbuch	1991 - 2001	-	Gewässerkundliches Jahrbuch, BfG Mittelungen Nr. 10
Koblenz, Rhine	BfG - IKSR data base	Kaub	Gewässerkundliches Jahrbuch	1991 - 2001	04/94, 02/97, 2/99	Gewässerkundliches Jahrbuch, BfG Mittelungen Nr. 10
Bad Honnef, Rhine	LUA data base	Andernach	Gewässerkundliches Jahrbuch	1993 - 2003	02/99	LUA - Regionalisierung
Essen, Rhur	Ruhrverband	Hattingen	Ruhrverband	1994 - 2003	daily measured	Ruhrverband
Kleve-Bimmen, Rhine	LUA data base	Rees	Gewässerkundliches Jahrbuch	1991 - 1999	02/99	LUA -Regionalisierung

Annex 5: Additional information on measures planned or implemented in areas of concern

Iffezheim – HCB-contamination

The following methods have been investigated as potential alternatives to the current containment of HCB contaminated material at the Iffezheim barrage (BfG, 2003):

a) Intermediate storage of dredged material in the existing mole of the barrage or in a hydraulic structure downstream, which would have to be constructed. The idea was to store the material until the HCB concentration became reduced by natural degradation and then flush it into the Rhine current. It was decided, that too many unknown factors like HCB half life and depth-dependency of degradation would make the applicability of this option questionable.

b) Disposal of dredged material in gravel pits of the vicinity. This measure was assumed to be relatively cheap. The possibility of HCB desorption with consequent groundwater contamination was put into question. Extensive licensing would be required for this measurement with dubious chances of success.

c) Usage of HCB contaminated material as covering layer of potash spoil dumps. This option was regarded as having an environmental risk due to the unknown extent of remobilisation of HCB and to be very expensive due to high costs of treatment and transport of the material.

d) Land disposal: existing soil protection values for HCB are much higher than the highest measured concentrations in dredged material in Iffezheim (4000 µg/kg on playing grounds), so that land disposal would be an option, if suitable areas were available. A necessary purchase of grounds would make the process lengthy. Before storage, the dredged material would have to be treated, adding costs of transport and processing to the measure.

e) As a short-termed solution, 330.000 m^3 sediment were dredged from the barrage and flushed into the still water zone below the spur-jetty of the barrage between summer 2000 and March 2001.

Investigations were carried out, whether the HCB concentration in the sediment would prevent extensive flushing of sediment from the barrage into the Rhine. This was primarily not an option, because the HCB concentration in the dredged material in Iffezheim (55 – 1700 µg/kg dw in the dredging area with an average value of 300-350 µg/kg) was much too high to comply with the relocation criteria of the HABAB-WSV and the ICPR values. They do not allow relocation if contaminant concentration in the dredged material exceeds more than three times the concentration in suspended matter in the planned relocation area, which in this case were 35 µg HCB/kg in Lauterbourg and 30 µg HCB/kg in the surface water at Iffezheim. Discussion about this option started when investigations showed, that HCB in Iffezheim does not bind to 90 % to the <20 µm grain size fraction but is enriched in the 60 to 200 µm fraction, leading to modification in the interpretation of the HABAB.

Ruhr River

The Ruhr river provides a good example of integrated water resources management in Germany, facilitated by the "Ruhrverband" (Ruhr River Association for water quality management). The association has been founded 80 years ago by the Prussian State and is nowadays a self-governing public body, controlled by the Ministry of the Environment of the State of North Rhine Westphalia. It has the function to secure and develop a functional water supply and wastewater disposal infrastructure. In total, the wastewater load of 3.6 million population equivalents bein contained in a volume of 400 mio m^3/a(?) wastewater is treated in the Ruhrverband's 84 treatment plants. The tasks are divided between the communities and the Ruhrverband. The communities are responsible for the construction and operation of the sewage systems up to a location where a wastewater treatment plant can be constructed. After that, the Ruhrverband takes over. Associates of the Ruhrverband are, by compulsory membership, all those who benefit from the activities of the association, in particular the communities, manufacturers and other enterprises who contribute to the pollution of the Ruhr River and its tributaries, as well as the water works. Unhampered by political borders, the Ruhrverband could set up a system-wide management, which has the potential of balancing and minimizing costs (Bode *et al.*, 2003). In the coming years, a number of wastewater treatment plants, that do not fulfill current technical standards, will be modified and modernized, and partly combined (Essen-Kettwig, Essen-Rellinghausen, Essen-Steele, Essen-Burgaltendorf, (LUA, 2002)). As purification is done by the wastewater treatment plants, the impounded lakes now only have a minor function for removal of heavy metals from the system (Podraza, 2000). In the scope of the WFD, the following objectives for the Ruhr River are discussed which mainly aim at reducing effects of the impoundments on the lower Ruhr River, thus possibly influencing sediment dynamics to a different extent – depending on the eventually chosen scenario (Podraza, 2000)

a) Increase of flow velocity, and reduction of flow residence time. The flow residence time in the lower Ruhr River is assessed as 7.25 days compared to 2 hours flow time under natural conditions.
b) Restoration of a continuous stream without back-waters, meaning that impounded lakes would have to be abandoned or their volumes reduced, and weirs would have to be replaced by artificial riffle sections.

Accompanying measures could be the removal by bank fixation, planting of alluvial forest, grove or wood. In her report on the Ruhr River as an example for Heavy Modified Water Bodies in the frame of the WFD, Dr. Podraza emphasizes that removal of heavy metal contaminated dredged material from the river and especially the lakes will be a necessary measure. Remediation dredging in this respect could perhaps compensate for the increased flow velocity, which would also increase the shear stress on the sediment.

GAP and flood protection

Restoration of the Ruhr River is also part of the "Gewässerauenprogramm" of the Ministry of the Environment of ?Nordrhein-Westfalen? (NRW), which has been founded in 1990 and aims at the restoration of larger rivers in Nordrhein-Westfalen from source to mouth. The idea behind it is the support of a natural development of formerly intensively used and modified regions along the rivers. Consequently, usage of areas along the riverbanks will become restricted or even completely terminated (other word).

Due to the usual stabile riverbank constructions, increased discharges lead to strong erosion with depth. Allowing areas next to the river to turn into flood plains will reduce erosion, current velocity and the height of the flood wave that is transported downstream in case of high waters. Therefore the "Gewässerauenprogramm" of NRW is connected with the flood protection programmes that have been initiated republic-wide in Germany.

Lippe River

The following observations were made and consequences of the increased TBT contamination in the Lippe have been drawn (LUA, 2002):

- For the industrial wastewater effluents of the TBT producing company in Bergkamen, a treatment plant specifically for elimination of organotin-compounds is constructed in cooperation with the Technical University Paderborn. With the start of operation in 2002, the requirements of appendix 22 (chemical industry) of the wastewater regulation as well as the regulation for aquatic environments (LAWA: 0,1 ng/L TBT; GewQV NRW: 0,01 µg/l DBT, 0,001 µg/L TTBT) shall be fulfilled.
- Sewage sludge from the Seseke-River water treatment plant will not be applied to agricultural land anymore but incinerated completely.
- No organotin (with the exception of slightly elevated monobutyltin-concentrations) were measured on agricultural land on which sludge from the Lippe area had been applied.
- On flood plain soils, organotin compounds were detected.
- In Kuhbach, Seseke and Lippe, elevated organotin concentrations were measured that can have adverse effects on the aquatic community.

- Fish in the Lippe showed elevated concentrations of dibutyltin and tributyltin, but still below the maximum concentration level for human consumption.

Emscher-PLUS : Emscher Project for the long-time study of the sanitation success

Nearly 80% of the water flux of the Emscher consists of sump water from coal-mining and municipal and industrial wastewater. As it has become possible to restore the Emscher waters by technical means, when the coal-mining induced subsidence stopped, the plan for the ecological restoration of the Emscher system was developed: It aims at the reestablishment of the Emscher's ecological function in 25 to 30 years, which was mainly addressed by:

- building wastewater treatment plants;
- Separation of combined water;
- pretreatment of highly contaminated industrial effluents.

The oxygen conditions along the Emscher have improved significantly since the start of the Emscher PLUS-Programm. Toxicities in the Emscher have decreased due to improvements of chemical quality of the water. Biologial re-colonization has been observed in parts of the river. However, there are still peak effluents of industrial processes which can not be removed by the wastewater treatment plants and especially some tributaries are still of bad quality. Due to the chain of treatment plants with the final plant at Dinslaken, that treats the whole River water, ecological restoration of the area downstream Dinslaken has been observed, where the Emscher confluences with the Rhine.
However, historic contamination due to former industrial areas and mining sites, that are introduced into the Emscher by ground- or surface water still represents a major challenge.