

Table of contents	Page
Table of contents.....	I
List of tables.....	V
List of diagrams.....	IX
List of abbreviations.....	XI
1. Introduction.....	1
1.1 State of knowledge.....	1
1.2 Objective of the work.....	3
1.3 Formulation and path to solution.....	4
2. Material and Methods.....	5
2.1 Selection of monitoring stations.....	5
2.2 Selection of test parameters.....	7
2.3 Determination of concentration levels.....	10
2.3.1 Sampling.....	10
2.3.2 Analysis.....	10
2.3.2.1 Heavy metals.....	12
2.3.2.2 Volatile halogen hydrocarbons.....	13
2.3.2.3 Non-volatile halogen hydrocarbons.....	14
2.3.2.4 Nonylphenoethoxylates.....	16
2.3.2.5 Sum parameter AOX.....	17
2.3.2.6 Polycyclic aromatic hydrocarbons.....	18
2.3.2.7 Nitrogen and phosphorus based pesticides.....	18
2.4 Determination of discharges and wastewater quantities.....	19
2.5. Methodology of load calculation.....	20
2.6. Influence of the limits of quantitation.....	22

3. Results	23
3.1 Heavy metals	23
3.1.1 Introduction	23
3.1.2 Bases of parameters	23
3.1.3 Test results	28
3.1.3.1 Heavy metal loads in wastewater	28
3.1.3.2 Heavy metal loads in the rivers	30
3.2. Volatile halogen hydrocarbons	34
3.2.1 Introduction	34
3.2.2 Bases of parameters	34
3.2.3 Test results	37
3.2.3.1 VHHC loads in wastewater	37
3.2.3.2 VHHC loads in the rivers	39
3.3. Non-volatile halogen hydrocarbons	41
3.3.1 Introduction	41
3.3.2 Bases of parameters	41
3.3.3 Test results	44
3.3.3.1 Non-volatile halogen hydrocarbon loads in wastewater	44
3.3.3.2 Non-volatile halogen hydrocarbon loads in the rivers	46
3.4. Nonylphenoethoxylates	47
3.4.1 Introduction	47
3.4.2 Bases of parameters	47
3.4.3 Test results	48
3.4.3.1 Nonylphenoethoxylate loads in wastewater	48
3.4.3.2 Nonylphenoethoxylate loads in the rivers	50
3.5. AOX	52

3.5.1 Introduction	52
3.5.2 Bases of sum parameter AOX	52
3.5.3 Test results	53
3.5.3.1 AOX loads in wastewater	53
3.5.3.2 AOX loads in the rivers	55
3.6. Polycyclic aromatic hydrocarbons (PAH)	57
3.6.1 Introduction	57
3.6.2 Bases of sum parameter PAH	57
3.6.3 Test results	58
3.6.3.1 PAH loads in wastewater	58
3.6.3.2 PAH loads in the rivers	59
3.7. Pesticides (PSM)	61
3.7.1 Introduction	61
3.7.2 Bases of parameters	61
3.7.3 Test results	63
3.7.3.1 Pesticide loads in wastewater	63
3.7.3.2 Pesticide loads in the rivers	67
3.8 Emission inventory of the German Oder catchment area	69
3.8.1 Introduction	69
3.8.2 Approach	70
3.8.3 Test results	71
3.9 Emission inventory of the German Baltic Sea catchment area	74
3.9.1 Introduction	74
3.9.2 Approach	74
3.9.3 Test results	77
3.10 Special measurement programme 1999	81

3.10.1 Introductory remarks.....	81
3.10.2 Pharmacological residue in WWTP discharges.....	82
3.10.2.1 Introduction.....	82
3.10.2.2 Bases of parameters.....	82
3.10.2.3 Test results.....	83
3.10.3 Organotin compounds in WWTP discharges.....	86
3.10.3.1 Introduction.....	86
3.10.3.2 Bases of parameters.....	86
3.10.3.3 Test results.....	88
3.10.4 Nonylphenol in WWTP discharges.....	91
3.10.4.1 Test results.....	91
4. Summary.....	93
5. Bibliography.....	99
6. Appendix.....	105
Appendix 1: Pollution loads at monitoring stations.....	107
Appendix 2: Pollution concentrations at monitoring stations.....	111
Appendix 3: Special measurement programme 1999.....	163

List of Tables	Page
Tab. 2.3-1: Limits of quantitation of some parameters in comparison	11
Tab. 2.3-2: Analysis of heavy metals	13
Tab. 2.3-3: Analysis of volatile halogen hydrocarbons	13
Tab. 2.3-4: Analysis of non-volatile halogen hydrocarbons	14
Tab. 2.3-5: AOX analysis	17
Tab. 2.3-6: PAH analysis	18
Tab. 2.3-7: Analysis of nitrogen and phosphorus based pesticides	19
Tab. 3.1-1: Heavy metal loads in the rivers	31
Tab. 3.5-1: MWWTP AOX loads in comparison	54
Tab. 3.5-2: AOX loads of the rivers Warnow and Trave	56
Tab. 3.8-1: Wastewater quantities in German Oder catchment area	70
Tab. 3.8-2: Emission inventory of German Oder catchment area	72
Tab. 3.9-1: Wastewater quantities in German Baltic Sea catchment area	76
Tab. 3.9-2: Emission inventory of German Baltic Sea catchment area	79
Tab. 4-1: Pollutant emissions in the entire German Baltic Sea catchment area	94

Appendix 1

Tab. A.1-1: Pollution loads of monitored industrial companies 1998	107
Tab. A.1-2: Pollution loads of monitored municipal wastewater treatment plants 1998	108
Tab. A.1-3: Pollution loads of monitored wastewater discharges 1998	109
Tab. A.1-4: Pollution loads of monitored river measurement points 1998	110

Appendix 2

Tab. A.2-1: Monitoring station (MS) 1 (EKO Stahl VEO / Brandenburg)	111
Tab. A.2-2: MS 2 (Haindl Papier GmbH / Brandenburg)	112
Tab. A.2-3: MS 3 (PCK GmbH Schwedt / Brandenburg)	113

Tab. A.2-4: MS 4 (Schwedter Papier und Karton GmbH / Brandenburg)	114
Tab. A.2-5: MS 5 (Energiewerke Nord / Mecklenburg-Western Pomerania)	115
Tab. A.2-6: MS 5 (thermal power station Rostock / MV)	116
Tab. A.2-7: MS 7 (Hydro Agri AG / Mecklenburg-Western Pomerania)	117
Tab. A.2-8: MS 8 (hard coal power station Rostock / Mecklenburg-Western Pomerania)	118
Tab. A.2-9: MS 9 (Feinpapier Bad Muskau / Saxony)	119
Tab. A.2-10: MS 10 (Telux Spezialglas Neuwerk / Saxony)	120
Tab. A.2-11: MS 11 (Glücksklee GmbH Neustadt / Schleswig-Holstein)	121
Tab. A.2-12: MS 12 (Pomosinwerke Grossenbrode / Schleswig-Holstein)	122
Tab. A.2-13: MS 13 (Sugar factory Schleswig / Schleswig-Holstein)	123
Tab. A.2-14: MS 14 (municipal WWTP Frankfurt/O. / Brandenburg)	125
Tab. A.2-14 (cont.): MS 14 (municipal WWTP Frankfurt/O. / Brandenburg)	126
Tab. A.2-15: MS 15 (municipal WWTP Eisenhüttenstadt / Brandenburg)	127
Tab. A.2-15 (cont.): MS 15 (municipal WWTP Eisenhüttenstadt / Brandenburg)	128
Tab. A.2-16: MS 16 (municipal WWTP Schwedt/O. / Brandenburg)	129
Tab. A.2-16 (cont.): MS 16 (municipal WWTP Schwedt/O. / Brandenburg)	130
Tab. A.2-17: MS 17 (municipal WWTP Altfriedland / Brandenburg)	131
Tab. A.2-17 (cont.): MS 17 (municipal WWTP Altfriedland / Brandenburg)	132
Tab. A.2-18: MS 18 (municipal WWTP Rostock / Mecklenburg-Western Pomerania)	133
Tab. A.2-18 (cont.): MS 18 (municipal WWTP Rostock / Mecklenburg-Western Pomerania)	134
Tab. A.2-19: MS 19 (municipal WWTP Stralsund / Mecklenburg-Western Pomerania)	135
Tab. A.2-19 (cont.): MS 19 (municipal WWTP Stralsund /	

Mecklenburg-Western Pomerania).....	136
Tab. A.2-20: MS 20 (municipal WWTP Wismar / Mecklenburg-Western Pomerania).....	137
Tab. A.2-20 (cont.): MS 20 (municipal WWTP Wismar / Mecklenburg-Western Pomerania).....	138
Tab. A.2-21: MS 21 (municipal WWTP Güstrow / Mecklenburg-Western Pomerania).....	139
Tab. A.2-21 (cont.): MS 21 (municipal WWTP Güstrow / Mecklenburg-Western Pomerania).....	140
Tab. A.2-22: MS 22 (municipal WWTP Görlitz Nord / Saxony).....	141
Tab. A.2-22 (cont.): MS 22 (municipal WWTP Görlitz Nord / Saxony).....	142
Tab. A.2-23: MS 23 (municipal WWTP Zittau / Saxony).....	143
Tab. A.2-23 (cont.): MS 23 (municipal WWTP Zittau / Saxony).....	144
Tab. A.2-24: MS 24 (municipal WWTP Rothenburg / Saxony).....	145
Tab. A.2-24 (cont.): MS 24 (municipal WWTP Rothenburg / Saxony).....	146
Tab. A.2-25: MS 25 (municipal WWTP Kiel / Schleswig-Holstein).....	147
Tab. A.2-25 (cont.): MS 25 (municipal WWTP Kiel / Schleswig-Holstein).....	148
Tab. A.2-26: MS 26 (municipal WWTP Osterby / Schleswig-Holstein).....	149
Tab. A.2-26 (cont.): MS 26 (municipal WWTP Osterby / Schleswig-Holstein).....	150
Tab. A.2-27: MS 27 / river MS 1 (Lausitz Neisse 3-country region).....	151
Tab. A.2-27 (cont.): MS 27 / river MS 1 (Lausitz Neisse 3-country region).....	152
Tab. A.2-28: MS 28 / river MS 2 (Lausitz Neisse at Ratzdorf).....	153

Tab. A.2-28 (cont.): MS 28 / river MS 2 (Lausitz Neisse at Ratzdorf).....	154
Tab. A.2-29: MS 29 / river MS 3 (Oder at Frankfurt/O.).....	155
Tab. A.2-29 (cont.): MS 29 / river MS 3 (Oder at Frankfurt/O.).....	156
Tab. A.2-30: MS 30 / river MS 4 (Oder at Hohenwutzen).....	157
Tab. A.2-30 (cont.): MS 30 / river MS 4 (Oder at Hohenwutzen).....	158
Tab. A.2-31: MS 31 / river MS 5 (Warnow at Kessin).....	159
Tab. A.2-31 (cont.): MS 31 / river MS 5 (Warnow at Kessin).....	160
Tab. A.2-32: MS 32 / river MS 6 (Trave at Sehmsdorf).....	161
Tab. A.2-32 (cont.): MS 32 / river MS 6 (Trave at Sehmsdorf).....	162

Appendix 3

Tab. A.3-1: Pharmacological residues in the municipal WWTP's of Rostock, Stralsund und Wismar.....	163
Tab. A.3-2: Organotin substances in the municipal WWTP's of Rostock, Stralsund und Wismar.....	165
Tab. A.3-2 (cont.): Organotin substances in the municipal WWTP's of Rostock, Stralsund und Wismar.....	166
Tab. A.3-3: Nonylphenol in the municipal WWTP's of Rostock, Stralsund und Wismar.....	167

List of diagrams	Page
Diag. 2.1-1: List of monitoring stations for the research project	6
Diag. 2.2-1: HELCOM list of priority harmful substances as modified for the research project	9
Diag. 2.2-2: Additionally tested parameters in the research project	9
Diag. 2.3-1: Gas-chromatogram of a pure water sample contaminated with various environmentally relevant NVHH's (GC/ECD)	15
Diag. 2.3-2: Actual sample with positive NP1EO and NP2EO results	16
Diag. 2.5-1: Calculation of copper load 1998 for the Oder/Hohenwutzen	21
Diag. 3.1-1: Total heavy metal loads for the monitored wastewater sources	29
Diag. 3.1-2: Heavy metal loads for the Oder at Frankfurt/O. and at Hohenwutzen	32
Diag. 3.2-1: VHHC loads of the monitored wastewater sources	38
Diag. 3.2-2: Riverine VHHC loads	39
Diag. 3.3-1: NVHH loads of the monitored wastewater sources	45
Diag. 3.4-1: Nonylphenoethoxylate loads of the monitored wastewater sources	49
Diag. 3.5-1: AOX loads of the monitored wastewater sources	53
Diag. 3.5-2: AOX loads in the rivers	55
Diag. 3.6-1: PAH loads of the monitored wastewater sources	58
Diag. 3.6-2: PAH loads in the rivers	60
Diag. 3.7-1: Pesticide loads of the MWWTP's	64
Diag. 3.7-2: Share of simazine emission from the rural WWTP's of the monitored MWWTP's	66
Diag. 3.7-3: Pesticide loads in the rivers	67
Diag. 3.8-1: Border Oder segment	69
Diag. 3.9-1: German Baltic Sea catchment area with FuE project monitoring stations	75
Diag. 3.10-1: Drug residues in the municipal WWTP's of Rostock, Stralsund and Wismar	84
Diag. 3.10-2: Monobutyltin in the discharges of the MWWTP's of Rostock, Stralsund and Wismar	90

Diag. 3.10-3: n-Butyltin compounds in sludge of MWWTP at Stralsund	90
Diag. 3.10-4: Nonylphenoethoxylates and nonylphenol at the Wismar MWWTP	92