NILU OR 2/2001
JUNE 2001

COMPREHENSIVE ATMOSPHERIC MONITORING PROGRAMME

Observations from Coastal Stations in 1999

OSPAR Commission
for the Protection of the Marine Environment
of the North-East Atlantic

Working Group on Inputs to the Marine Environment (INPUT)

Norwegian Institute for Air Research
P.O. Box 100, N-2027 Kjeller, Norway

NILU: OR 2/2001
REFERENCE: O-97146
DATE: JUNE 2001
ISBN: 82-425-1236-1

Observations from Coastal Stations in 1999

Kevin Barrett

Norwegian Institute for Air Research
P.O. Box 100, N-2027 Kjeller, Norway

Preface

This report was presented as a draft at the INPUT meeting in London 30 January–1 February 2001. Corrections received from the Parties between January and May 2001 were taken into account during the preparation of this corrected report.

This final version was delivered to the OSPAR secretariat in June 2001. A full list of national data originators can be found in Appendix D. At NILU the following have been responsible for CAMP data management: Jan Schaug, Anne-Gunn Hjellbrekke, Torunn Berg, Rita Larsen, Terje Krognes, and Kevin Barrett.

Kevin Barrett
Scientist
Norwegian Institute for Air Research

Contents

Observations from Coastal Stations in 1999

1 Introduction

This report describes the observations reported by coastal monitoring stations across the OSPAR region (see Figure 1.1) under the Comprehensive Atmospheric Monitoring Programme (CAMP) for the year 1999. It was presented to the Working Group on Inputs to the Marine Environment, OSPAR, London, 30 January – 1 February, 2001, and is now released after this review.

The monitoring regime proposed by CAMP is summarised in chapter two. This section lists the components for which monitoring is suggested, the methods of sampling, and the recommended location of monitoring sites. In support of this summary, the Principles for the CAMP as described in the Summary Record for the Environmental Assessment and Monitoring Committee (ASMO) of OSPAR annual meeting at Spa, 1998, is given in Appendix B. For reference, a description of the NASA/Ames format in which form the reporting of data is requested is provided in Appendix C.

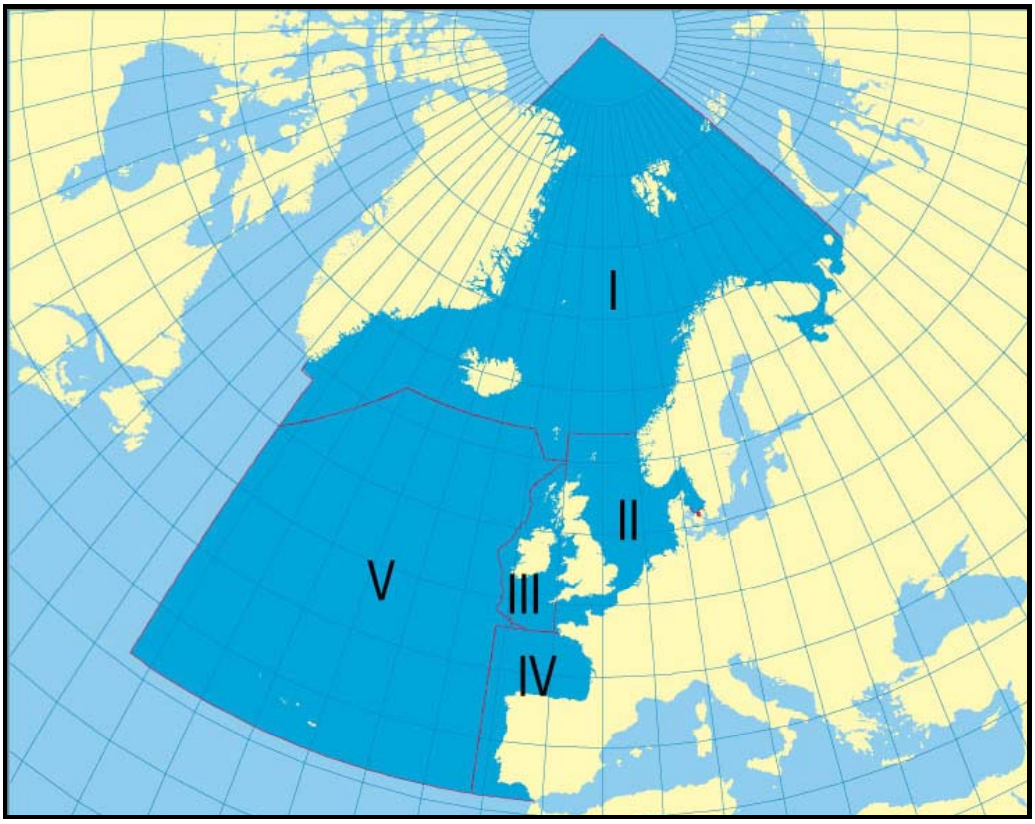


Figure 1.1: OSPAR maritime area and regions: 1: Arctic waters 2: Greater North Sea 3: Celtic Seas 4: Bay of Biscay and Iberian Coast 5: Wider Atlantic. Source: www.ospar.org.

Chapter three summarises the monitoring activities which served CAMP in 1999, listing the stations reporting, their individual monitoring regimes, and the components they have reported. This is intended as an overview of the achievement of the implementation of CAMP recommendations. Actual observations are summarised as annual mean values in chapter four. The monthly values themselves from each station for 1999 are provided in Appendix A either as reported, or after aggregation to monthly values from shorter periods. Finally, Appendix D supplies a list of the current contact names and addresses for the data originators in each country, and for the CAMP Data Manager.

2 The Comprehensive Atmospheric Monitoring Programme

The Comprehensive Atmospheric Monitoring Programme forms one element within the wider Joint Assessment and Monitoring Programme of OSPAR. Amongst the intentions of CAMP are assessment of the atmospheric input of selected contaminants to the OSPAR maritime area and regions (see Figure 1.1). This is to be achieved via a monitoring regime with indicated substances, time resolution, methodologies, and sampling locations. Thus defined, the programme may assist in assessment of the quality status of the marine environment.

The components of interest to CAMP are divided into two groups, for measurement on a mandatory basis and for measurement on a voluntary basis. These are listed in table 2.1.

2.1 Components

Table 2.1: Components to be measured within CAMP.

	Mandatory	**Voluntary**
Precipitation	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, γ-HCH, NH_4^+, NO_3^-	PCB 28,52,101,118,138,153,180 Phenanthrene, anthracene, flouranthene, pyrene, benzo(*a*)anthracene, chrysene, benzo(*a*)pyrene, benzo(*ghi*)perylene, indeno(*1,2,3-cd*)pyrene
Airborne	NO_2, HNO_3, NH_3, NH_4^{+a}, NO_3^{-a}	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, γ-HCH, PCB 28,52,101,118,138,153,180, Phenanthrene, anthracene, flouranthene, pyrene, benzo(*a*)anthracene, chrysene, benzo(*a*)pyrene, benzo(*ghi*)perylene, indeno(*1,2,3-cd*)pyrene, NO

[a]) total ammonium (NH_3 + NH_4^+) and total nitrate (HNO_3 +NO_3^-) is an alternative.

For quality assurance purposes the reporting of pH, electrical conductivity, and concentrations in precipitation of all major ions (Na^+, K^+, Mg^{2+}, Ca^{2+}, SO_4^{2-}, Cl^-, NH_4^+, NO_3^-, HCO_3^-) is also encouraged.

2.2 Sampling

Precipitation sampling using wet-only samplers is recommended. Regular inter-comparisons between wet-only and bulk samplers should be undertaken where bulk samplers are used instead. Account should be taken of any need to undertake summer cooling of samples.

For measuring precipitation amount practice has shown variable results in the efficiency of chemical samplers. According to design, problems such as poor capture, evaporation or snow blow-out can influence results. The use of a standard rain-gauge parallel to the chemical sampling can assist in the calculation of deposition fluxes from concentrations and precipitation amounts.

Currently acceptable precipitation sampling frequencies are between one week and one month. The recommendation, however, is for one week sampling, possibly with combination of samples to longer periods (e.g. one month) prior to analysis. It is recommended to have two sampling periods for weeks which cross month boundaries, even if one of these is only a one-day sample. Achieving equal months in reported values greatly aids comparability between samples taken in different countries. Where weekly samples are simply assigned to the month in which most days fall noticeable temporal errors in data may, of course, be introduced. This is even more true where two-week samples are taken. The recommendation to change samples on the first day of the month in addition to the periodic routine is most strongly endorsed by NILU as CAMP Data Manager for all sample periods, and most especially when longer/two week sampling periods are used. As an aid to achieving consistency, it is recommended that samples are always changed at a fixed time, e.g. at 08.00 UTC on each Tuesday and on the first day of each month.

Amongst airborne components, a sampling period of 24 hr is recommended for heavy metals and for POP's, not less than 24 hr for nitrate and ammonia, with continuous monitoring of NO and NO_2 aggregated to hourly values.

2.3 Station siting

The Principles for CAMP call for each Contracting Party bordering the maritime area (excluding EU) to operate at least one monitoring station as part of CAMP. Where Parties border more than one region (see Figure 1.1) at least one station should be operating in each. These stations should be so-called *background stations*, i.e. not directly influenced by emission sources local to them. The intention of the programme is assessment of inputs to the marine environment. In accordance with this, the Principles explicitly call for stations to be located not more than 10 km from the coastline.

2.4 Data reporting

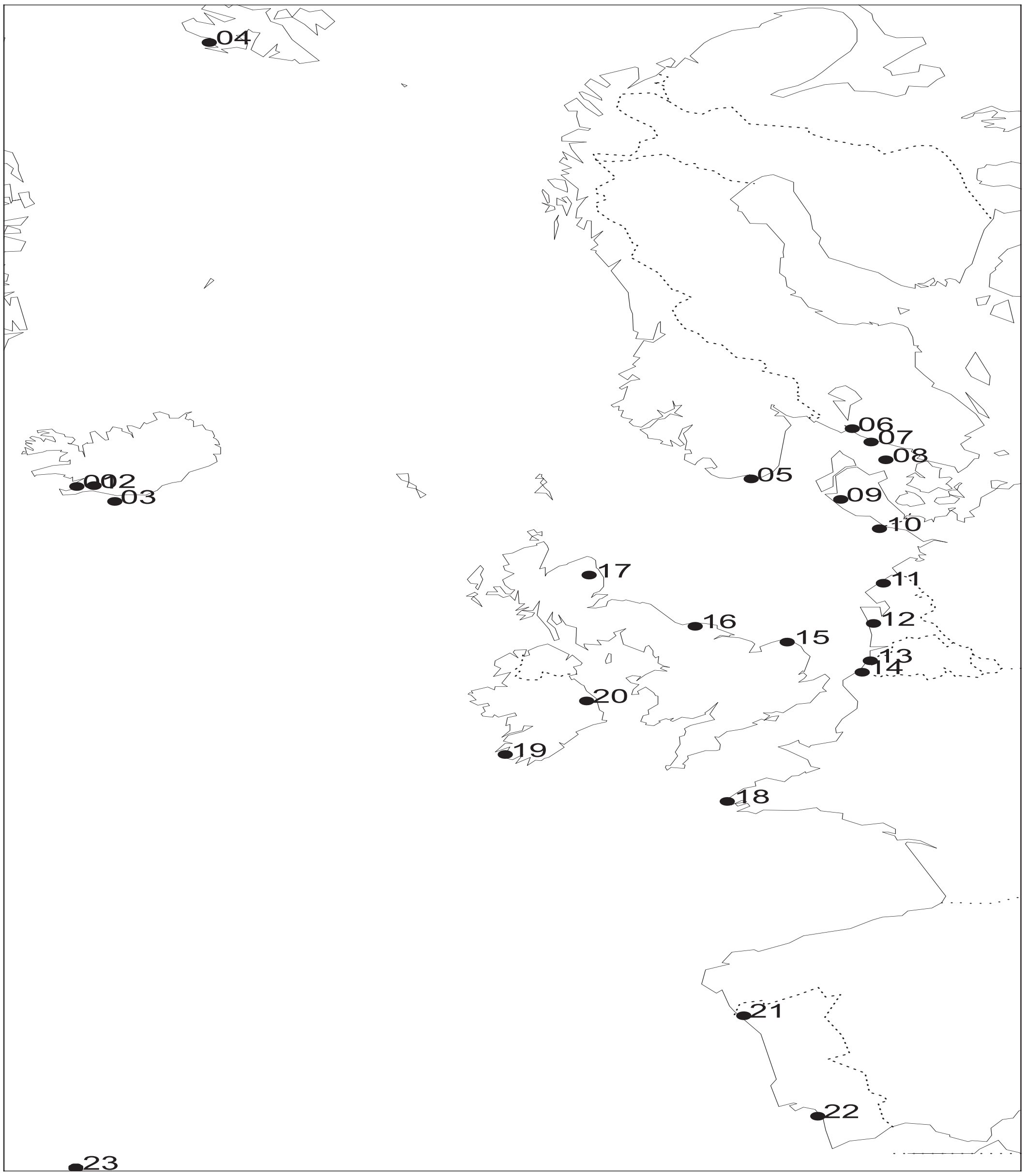
The monitoring data assembled through CAMP is stored on a relational database. This must account for considerable diversity in procedures across countries. In some cases several separate instruments operate side-by-side to serve different programmes. In others data is aggregated from the same instrument in different ways before submission to different programmes. On occasions different components are reported to different programmes from the same instrument. More than one person in some countries may have responsibilities in reporting data to programmes. Correct association of observed concentrations with observed precipitation amounts is vital. The potential for data duplication or mis-attribution is significant.

In consequence, all data reported to CAMP should be very carefully identified. As well as station and component identification, all data originators in participating countries are asked to assign unique names to the field instruments, to the methodologies, and to ensure programme labelling. Reporting is also requested in a standardised format which seeks to ensure comparability and allow quality assurance. The NASA/Ames format of reporting is used for data files, being thus-named after development by NASA. A description of the format is given in Appendix C.

Flagging of data is an important aid to quality management in use of the data. Data originators may be aware of unusual uncertainties associated with individual data elements. It is also important to be able to indicate such factors as concentrations being found to be below the analytical detection limit. Also in Appendix C is a list of the flags which may be used to mark any data element.

The time schedule for data reporting calls for initial submission of data by countries to the CAMP Data Manager by 31 August in the year subsequent to monitoring. Following initial reporting-back by the Data Manager in draft form, participants are requested to submit revised or corrected data by 30 October.

3 N.E. Atlantic coastal atmospheric monitoring, 1999



Region	map no	code	Station name	Region	map no	code	Station name	Region	map no	code	Station name
I	1	IS0002	Irafoss	**II**	8	DK0008	Anholt	**II**	15	GB0014	High Muffles
	2	IS0090	Reykjavik		9	DK0031	Ulborg		16	GB0090	East Ruston
	3	IS0091	Storhofdi		10	DE0001	Westerland		17	GB0091	Banchory
	4	NO0042	Zeppelin			DE0041	Wstlnd Tinnum	**II/III**	18	FR0090	Porspoder$^{\text{(also IV)}}$
		NO0057	Ny-Ålesund		11	NL0009	Kollumerwaard	**III**	19	IE0001	Valentia
II	5	NO0099	Lista		12	NL0091	De Zilk		20	IE0002	Turlough Hill
		NO0001	Birkenes		13	BE0003	Brugge	**IV**	21	PT0003	V. d. Castelo
	6	SE0002	Rorvik			BE0004	Knokke		22	PT0004	Monte Velho
	7	SE0097	Gardsjoen			BE0011	Moerkerke	**V**	23	PT0010	A. d. Heroismo
		SE0098	Svartedalen		14	BE0013	Houtem				

Figure 3.1: Stations reporting atmospheric monitoring data to CAMP, 1999.

Table 3.1: List of coastal stations reporting to CAMP for 1999.

Country	**Station code**	**Station name**	**Latitude**	**Longitude**	**Altitude (m)**	**Distance from sea (km)**
Belgium	BE0003R	Brugge	51.15N	3.12E	10	8
	BE0004R	Knokke	51.21N	3.20E	0	1
	BE0011R	Moerkerke	51.01N	2.35E	0	9
	BE0013R	Houtem	51.15N	3.21E	10	12
Denmark	DK0008R	Anholt	56.43N	11.31E	40	
	DK0031R	Ulborg	56.17N	8.26E	40	20
France	FR0090R	Porspoder	48.3N	4.46W	50	0.5
Germany	DE0001R	Westerland	55.36N	8.33E	5	0.55
	DE0041R	Westerland-Tinnum				3
Iceland	IS0002R	Irafoss	64.06N	21.01W	66	26
	IS0090R	Reykjavik	64.08N	21.54W	52	1
	IS0091R	Storhofdi	63.24N	20.17W	118	0.5
Ireland	IE0001R	Valentia Observatory	51.56N	10.15W	9	0
	IE0002R	Turlough Hill	53.02N	6.24W	420	19
Netherlands	NL0009R	Kollumerwaard	53.2N	6.16E	1	7.5
	NL0091R	De Zilk	52.18N	4.31E	4	2.5
Norway	NO0042R	Zeppelin	78.54N	11.53E	474	2
	NO0057R	Ny Ålesund	78.54N	11.55E	8	0.3
	NO0099R	Lista	58.06N	6.34E	13	0.1
	NO0001R	Birkenes	58.23N	8.15E	190	20
Portugal	PT0003R	Viana do Castelo	41.42N	8.48W	16	3
	PT0004R	Monte Velho	38.05N	8.48W	43	1.5
	PT0010R	Angra do Heroismo	38.4N	27.13W	74	1
Sweden	SE0002R	Rørvik	57.25N	11.56E	10	0.65
	SE0097R	Gårdsjøn	58.03N	12.01E	113	12
	SE0098R	Svartedalen	57.59N	12.06E	120	16
United Kingdom	GB0014R	High Muffles	54.20N	0.48W	265	22
	GB0090R	East Ruston	52.48N	1.28E	5	8
	GB0091R	Banchory	57.05N	02.32W	120	26.5

The CAMP principles call for monitoring stations to be located where possible within ten kilometres of the coast. By-and-large this objective is met, although observations from a few more distant sites have been reported for 1999.

In addition to that indicated in Table 3.2, national data originators have indicated that monitoring of nitrogen has been conducted by the United Kingdom, and monitoring of γ-HCH has been undertaken by Germany. These results are to be supplied to CAMP in the future as soon as national processing is completed.

Table 3.2: National submissions of precipitation data for 1999 – Mandatory List.

	As	**Cd**	**Cr**	**Cu**	**Pb**	**Hg**	**Ni**	**Zn**	**γ-HCH**	**NH_4**	**NO_3**
Belgium	●	●	●	●	●	●	●	●	●	●	●
Denmark	●	●	●	●	●		●	●		●	●
France	●	●	●	●	●		●	●		●	●
Germany	●	●	●	●	●	●	●	●		●	●
Iceland	●	●	●	●	●		●	●	●	●	●
Ireland	●	●	●	●	●	●	●	●	●	●	●
Netherlands	●	●	●	●	●	●	●	●	●	●	●
Norway	●	●	●	●	●	●	●	●	●	●	●
Portugal		●		●	●		●	●		●	●
Spain											
Sweden	●	●	●		●	●	●	●		●	●
United Kingdom	●	●	●	●	●		●	●		●	●

In general a number of countries found the reporting deadlines rather tight. Whilst some 1999 data was received at the database in the summer of 2000, the latest dataset received which is included in this report arrived on January 4th, 2001. No data was available from Spain before reporting, and data was still anticipated from a number of countries.

Table 3.3: Submissions of air concentration data for 1999 – Mandatory List.

	NO_2	**NO_3**	**NH_x**
Belgium	●		
Denmark	●	●	●
France		●	●
Germany	●	●	●
Iceland		●	
Ireland			
Netherlands		●	●
Norway	●	●	●
Portugal			
Spain			
Sweden	●	●	●
United Kingdom			

Table 3.4: Submissions of precipitation data for 1999 – Voluntary List.

	PCB's	Phenanthrene	Anthracene	Flouranthene	Pyrene	Benzo(α)anthracene	Chrysene	Benzo(α)pyrene	Benzo(x)perylene	Indeno(1,2,3-cd) pyrene	others
Belgium											pesticides
Denmark											
France											
Germany											
Iceland	•^{10}										pesticides
Ireland	•^{7}										pesticides
Netherlands											
Norway											
Portugal											
Spain											
Sweden											
United Kingdom											

Number in superscript for PCB indicates number of individual congeners reported.

The recommended CAMP voluntary monitoring programme for components in precipitation has not been closely adhered to. It should be mentioned that monitoring of a number of these components has been undertaken by Germany, and that these results are anticipated to be released to CAMP in the near future.

Table 3.5: Submissions of air concentration data for 1999 – Voluntary List.

	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	γ-HCH	Other organics	NO
Belgium	•	•		•	•		•	•			•
Denmark	•	•	•	•	•		•	•			
France											
Germany	•	•		•	•		•				
Iceland	•	•	•	•	•	•	•	•	•	•	
Ireland						•					
Netherlands	•	•			•			•			•
Norway	•	•	•	•	•		•	•	•		
Portugal											
Spain											
Sweden											
United Kingdom	•	•	•	•	•		•	•			

Table 3.6: Sampling regime for components in precipitation.

Station code	Station name	Nutrients	Heavy Metals	Organics
BE0003R	Brugge	W1W		
BE0004R	Knokke		WM *plus* BM As,Cd,Pb,Zn	WM
DK0008R	Anholt		BM	
DK0031R	Ulborg		BM	
FR0090R	Porspoder	B2W	B2W	
DE0041R	Westerland-Tinnum	W1W(M)	W1W(M)	
IS0002R	Irafoss	BW	B1W	
IS0090R	Reykjavik	BW	B1W	
IS0091R	Storhofdi			B2W
IE0001R	Valentia Observatory		BM	
IE0002R	Turlough Hill	WD	BM	BM
NL0009R	Kollumerwaard	W4W	W4W	
NL0091R	De Zilk	W4W	W4W except WW Hg	B4W
NO0057R	Ny Alesund	BHW		
NO0099R	Lista	BD	BHW	
PT0003R	Viana do Castelo	BD	BD	
PT0004R	Monte Velho	BD	BD	
PT0010R	Angra do Heroismo	W1W	W1W	
SE0002R	Rørvik	WD	BM	
SE0097R	Gårdsjøn		BM	
SE0098R	Svartedalen	BM		
GB0014R	High Muffles	WD	BM	
GB0090R	East Ruston		BM	
GB0091R	Banchory		BM	

Code:
First letter: B = Bulk sampler; W = wet-only sampler
Subsequent letters: D = daily; 1W = 1 week samples; 2W = 2 week samples
4w = 4 week samples; M = Monthly samples
Letters in parenthesis: Reporting frequency

The sampling regimes across the stations do not always permit ready estimates of equivalent monthly observations. Notable is the procedure in the Netherlands with four-week sampling irrespective of calendar months, and the single two month sample at one UK site on one occasion. This produces 13 sampling periods per year with a somewhat uncertain attribution within calendar months. Several countries do not recommence their chosen monitoring period at the start of each month as recommended. A similar issue of comparability arises with the temporal resolution of reported data. Whilst some countries collect samples during a month and combine these prior to analysis, others analyse samples at a finer resolution. These may then be reported directly in ‘raw’ state, or may be aggregated by the host country to monthly values for reporting. There is potential for inconsistent treatment of data in consequence, notably with respect to flagged data.

Table 3.7: Sampling regime for airborne components.

Station code	**Station name**	**Nitrogen components**	**Heavy Metals**	**Organics**
BE0004R	Knokke		FD	
BE0011R	Moerkerke	MnH		
BE0013R	Houtem	MnH		
DK0008R	Anholt	FD	FD	
DK0031R	Ulborg	FD	FD	
DE0001R	Westerland	AD		
	Westerland-Tinnum	HVD	HVM	
IS0091R	Storhofdi	HV2W	HV2W	F2W
NL0009R	Kollumerwaard	FD NO3,NH4: MnH NO,NO2	FD	
NL0091R	De Zilk	FD NO3,NH4: DH NH3: MnH NO,NO2		
NO0001R	Birkenes	FD		
NO0042R	Zeppelin	FD	FHW	
NO0099R	Lista	FD	FHW	
SE0002R	Rørvik	FD HNO3+NO3,NHx: AD NO2		

Code:
First letters: Mn = Monitor; F = Filter; A = Absorbing solution; HV = High Volume sampler; D = Denuder
Subsequent letters: H = hourly; D = daily; HW = half weekly, 2W = 2 weekly samples; M = monthly.

4 Observed Atmospheric Quality

In this chapter the annual average values of the mandatory and the voluntary list substances are provided as an overview of atmospheric conditions around the North East Atlantic in 1999. Observations of nitrogen and of arsenic, cadmium, copper and lead are plotted to provide a view of spatial distributions. The reported data in monthly format is provided in Appendix A.

In making the annual estimates all samples flagged 659, 658, 654, 653, 599, 499, 460, 459, 458, 260, 259, or 256 were excluded (see Appendix C for list of data flags). **NOTE**: The CAMP principles have been followed with respect to detection limits. Where flag 780 was given, this data value was employed. Where 781 was flagged, a value of half the detection limit was used.

4.1 Nitrogen

In Figures 4.1 and 4.2 the estimated depositions of nitrogen in precipitation across the CAMP region are shown. Values represent the sum of precipitation-weighted monthly mean concentrations multiplied by precipitation amount for those CAMP stations reporting nitrogen in precipitation. The summed annual values can be found in Table 4.1. Some of the tabulated data was not employed where this was apparently elevated in comparison to neighbouring stations or previous years. Preliminary evaluation of data at NILU led to withdrawal and resubmission of revisions through to January 2001. This new data is included here. Associated air concentration data is presented in Table 4.2 (mean annual values).

Table 4.1: Mean precipitation weighted concentrations of reduced and oxidised nitrogen in precipitation(mg N l^{-1}), plus estimated annual wet depositions (mg N m^{-2}). Year: 1999.

		concentrations			depositions	
		NH_4^+	**NO_3^-**	**precip**	**NH_4^+**	**NO_3^-**
		mg N /l	*mg N /l*	*mm*	*mg N /m²*	*mg N /m²*
BE0003	Brugge	0.41	0.55	670	275	369
NL0009	Kollumerwaard	0.86	0.46	651	560	299
NL0091	De Zilk	0.54	0.49	951	514	466
DK0008	Anholt	0.42	0.53	798	335	423
DE0001	Westerland	0.48	0.51	812	390	414
SE0002	Rorvik	0.47	0.50	867	407	434
SE0098	Svartedalen	0.48	0.50	1405	674	703
NO0099	Lista	0.48	0.59	1273	611	751
NO0057	Ny Ålesund	0.21	0.19	227	48	43
IS0002	Irafoss	0.10	0.07	1381*	137*	100*
IS0090	Reykjavik	0.27	0.11	570*	151*	64*
IE0002	Turlough Hill	0.30	0.18	1744	521	320
GB0014	High Muffles	0.46	0.41	862	410	351
FR0090	Porspoder	0.22	0.28	1086	239	304
PT0003	V.d.Castelo	0.14	0.12	1496	209	180
PT0004	Monte Velho	0.24	0.16	560	134	90
PT0010	A.d.Heroismo	0.05	0.17	951	48	162

* 9 months only.

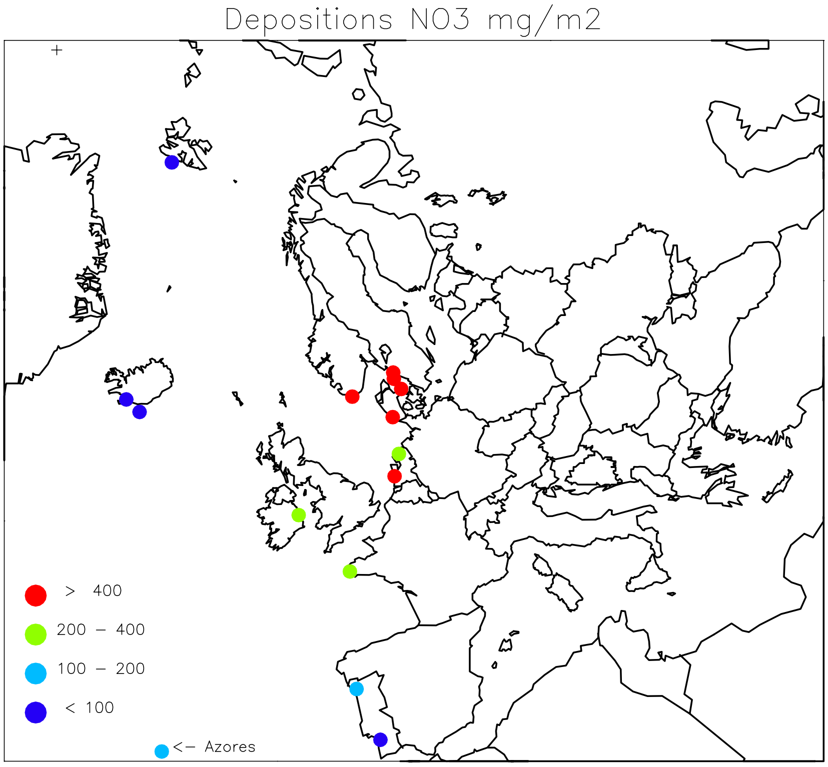


Figure 4.1: Estimated deposition of oxidised nitrogen in precipitation at coastal stations.
Units: mg N m^{-2} yr^{-1} *. Year 1999.*

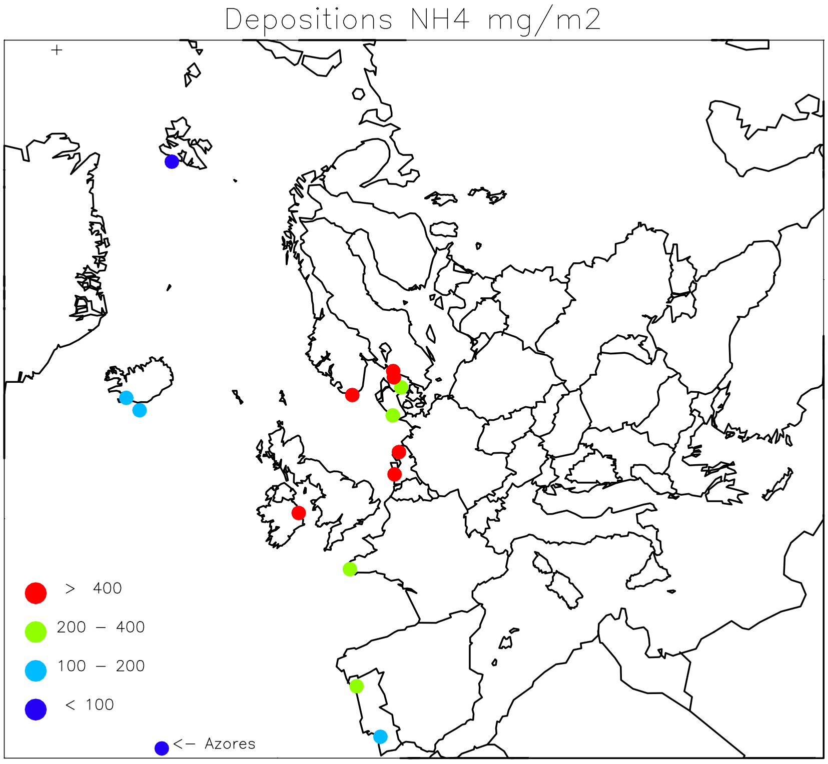


Figure 4.2: Estimated deposition of reduced nitrogen in precipitation at coastal stations.
Units: mg N m^{-2} yr^{-1}*. Year 1999.*

Table 4.2: Observed annual mean air concentrations of reduced and oxidised nitrogen, 1999.
Units: $\mu g\ N\ m^{-3}$.

		NH_3	NH_4^+	NH_x	NO_3^-	HNO_3+NO_3	NO	NO_2
		$\mu g\ N/m^3$	$\mu g\ N/m^3$	$\mu g\ N/m^3$	$\mu g\ N/m^3$	$\mu g\ N/m^3$	$\mu g\ N/m^3$	$\mu g\ N/m^3$
BE0011	Moerkerke						1.71	6.62
BE0013	Houtem						1.05	4.84
NL0009	Kollumerwaard		1.27		0.82		1.45	3.38
NL0091	De Zilk	1.57	0.96		0.59		5.35	
DK0008	Anholt	0.13		1.36		0.86		
DK0031	Ulborg			1.75	0.82			
DE0001	Westerland		0.36		0.40			2.02
SE0002	Rorvik			1.02		0.73		1.58
NO0001	Birkenes			0.51		0.20		0.52
NO0042	Zeppelin			0.19		0.03		
IS0091	Storhofdi				0.05			

4.2 Metals

Tables 4.3 and 4.4 lists the annual summary data for metal deposition in precipitation around N.E. Atlantic coasts. The spatial patterns are illustrated for arsenic, cadmium, copper and lead in Figures 4.3-4.6. Table 4.5 provides annual average concentrations in air.

Included in the precipitation tables for BE0004 are estimates on the basis of two samples collected simultaneously at the station using both bulk and wet-only sampling devices. The CAMP principles propose side-by-side comparisons where bulk samplers are used. However, comparison in this case is complicated through different laboratories and different methodologies being used for analysis of samples from each sampler. Samples from the bulk collector are analysed at a laboratory in Antwerp using AAS, whilst samples from the wet-only collector are analysed using Graphite furnace AAS at a laboratory in Ghent which commonly undertakes water quality analysis. Example estimates from these two monitoring and analytical regimes are given in Table 4.6. The difference in estimates can amount to a factor of ten. Monthly values for each of these can be found in Appendix A. Metal measurements are generally difficult due to the low concentrations and the contamination problem. A bulk sampler will collect dry as well as wet deposition, and the sample will be concentrated due to water evaporation during the warm season. In this case, however, the bulk results are the lowest and should be given most confidence. Although sampling method intercomparison is hampered by differences in analysis method, this case provides a good example of the value to be gained from precise labelling of field instruments, and informative reference labelling of laboratory methods. Different data sets such as these can thus be identified in the database. Following review at INPUT 2001, Belgium has decided to undertake CAMP analysis at the Antwerp laboratory in future.

The mercury concentrations in precipitation at BE00021 are too low compared with other measurements, and there is in general a need to review this data. The high concentrations of cupper at IS0090 may be due to local influence.

Metal data frequently are below the detection limits of analytical devices. When all or nearly all results are below the detection limit, the averages and depositions in Table 4.3 and 4.4 have been given as upper limits only. This calculation may not be completely consistent in this report, and there is a need to work out better calculation procedures, preferably in co-operation with HELCOM and EMEP.

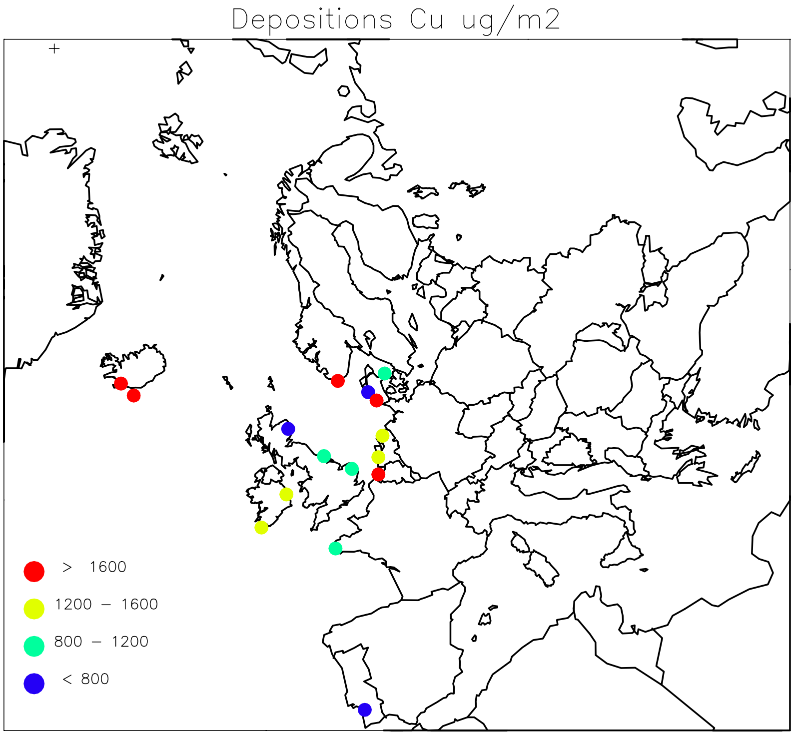


Figure 4.3: Estimated deposition of copper in precipitation, 1999. Units: µg Cu $m^{-2}yr^{-1}$.

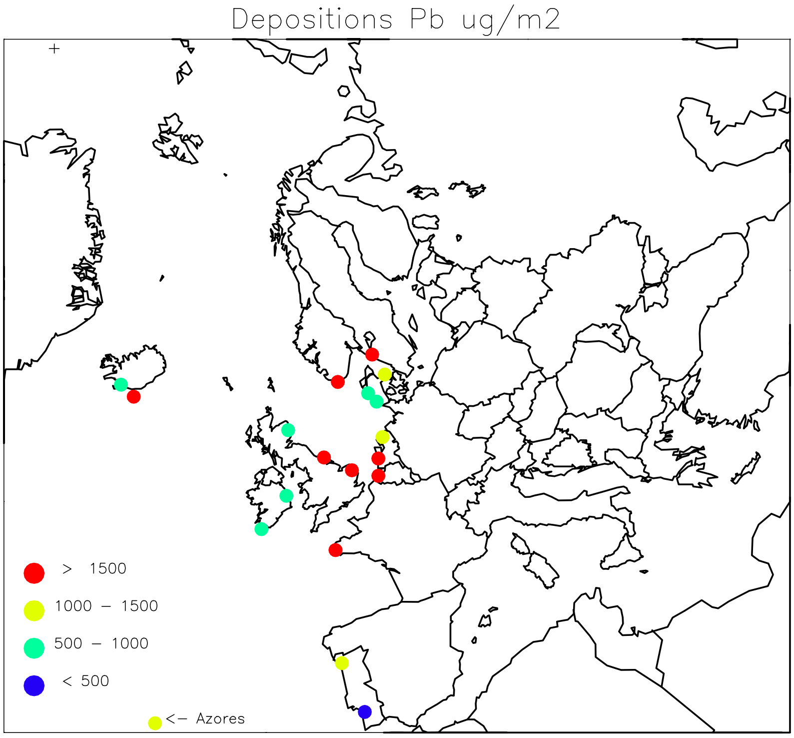


Figure 4.4: Estimated deposition of lead in precipitation, 1999. Units: µg Pb $m^{-2}yr^{-1}$.

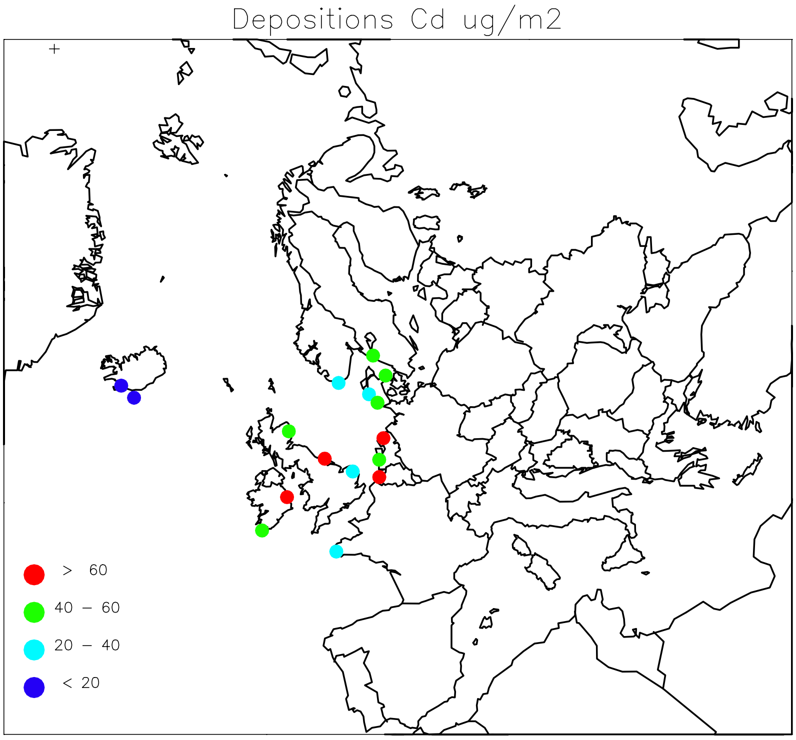


Figure 4.5: Estimated deposition of cadmium in precipitation, 1999. Units: µg Cd $m^{-2}yr^{-1}$.

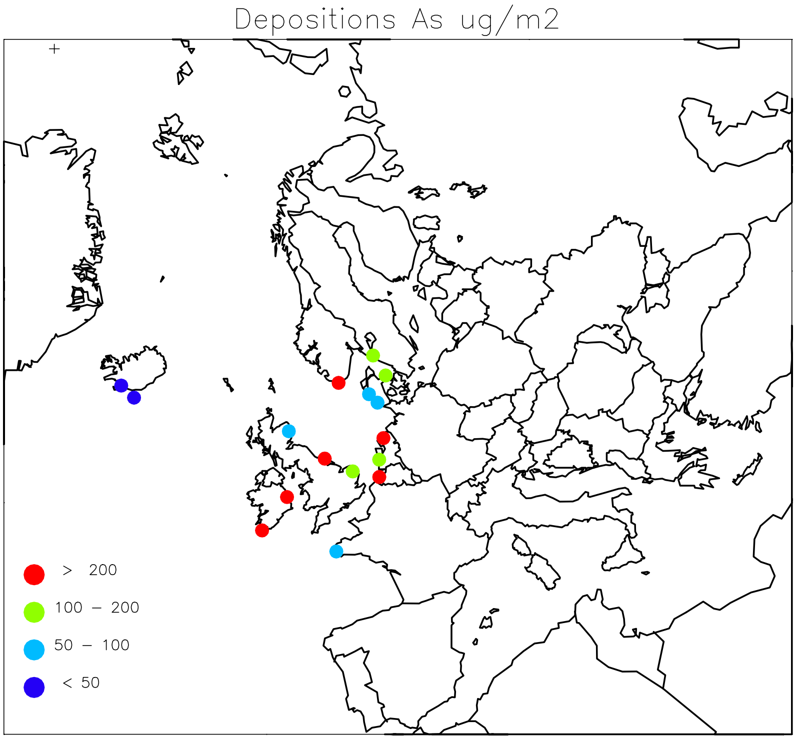


Figure 4.6: Estimated deposition of arsenic in precipitation, 1999. Units: µg As $m^{-2}yr^{-1}$.

Table 4.3: Mean precipitation weighted concentrations of metals in precipitation, 1999.

		As	**Cd**	**Cr**	**Cu**	**Hg**	**Ni**	**Pb**	**Zn**	**precip.**
		µg/l	µg/l	µg/l	µg/l	*ng/l*	µg/l	µg/l	µg/l	*mm*
BE0004	Knokke	0.24	0.20	3.25	4.31	30.0	2.96	4.33	24.5	841
NL0009	Kollumerwaard	0.32[1]	0.14	0.21[1]	1.76		0.35	1.63	10.0	856
NL0091	De Zilk	0.22[1]	0.05	0.21[1]	1.48	14.4	0.37	2.67	6.2	876
DK0008	Anholt	0.19	0.05	0.21	1.19		0.32	1.59	12.8	798
DK0031	Ulborg	0.08	0.03	0.09	0.56		0.22	0.89	6.9	1063
DE0001	Westerland	0.11	0.06	0.14	2.20		0.92	1.22	16.7	812
SE0002	Rörvik					6.84				867
SE0097	Gårdsjön	0.10[1]	0.05	0.24			0.21	1.63	11.6	1097
NO0099	Lista	0.22	0.03	0.20	1.73	9.82	0.36	1.60	7.4	1273
IS0002	Irafoss	0.04[1]	0.01[1]	0.12[1]	1.39		0.24[1]	1.37	12.1	1862*
IS0090	Reykjavik	0.05[1]	0.01[1]	0.38[1]	2.29		0.92[1]	0.74	10.9	793*
GB0014	High Muffles	0.24	0.07	0.20	1.37		0.32	2.42	5.1	866
GB0090	East Ruston	0.13	0.05	0.31	1.36		0.35	1.96	5.7	798
GB0091	Banchory	0.10	0.06	0.16	0.89		0.31[1]	0.90	3.3	868
IE0001	Valentia	0.34[1]	0.03[1]	0.26[1]	0.75	50.0[1]	0.28[1]	0.30[1]	15.0	1776
IE0002	Turlough Hill	0.25[1]	0.04[1]	0.26[1]	0.86	50.0[1]	0.31[1]	0.55	4.4	1744
FR0090	Porspoder	0.09	0.02	0.16	0.92		0.30	1.86	2.5	1086
PT0003	V.d.Castelo		0.43		2.56		0.94	0.75	14.8	1496
PT0004	Monte Velho		0.47		1.34		1.06	0.68	12.7	560
PT0010	A.d.Heroismo		0.65		1.94		2.25	1.05	60.2	951

[1] Many or all values BDL (see Appendix A). Calculations following CAMP principles.

* Annual precipitation. 10 months monitoring plus 2 months Official Rain Gauge.

Table 4.4: Estimated annual wet depositions of priority metals, 1999.

		As	**Cd**	**Cr**	**Cu**	**Hg**	**Ni**	**Pb**	**Zn**
		µg/m^2	*µg/m^2*	*µg/m^2*	*mg/m^2*	*µg/m^2*	*mg/m^2*	*mg/m^2*	*mg/m^2*
BE0004	Knokke	202	168	2733	3.62	25.2	2.49	3.64	20.6
NL0009	Kollumerwaard	274[1]	120	180[1]	1.51		0.30	1.40	8.6
NL0091	De Zilk	193[1]	44	184[1]	1.30	12.6	0.32	2.34	5.4
DK0008	Anholt	152	40	168	0.95		0.26	1.27	10.2
DK0031	Ulborg	85	32	96	0.60		0.23	0.95	7.3
DE0001	Westerland	89	49	114	1.79		0.75	0.99	13.6
SE0002	Rörvik					5.9			
SE0097	Gårdsjön	110[1]	55	263			0.23	1.79	12.7
NO0099	Lista	280	38	255	2.20	12.5	0.46	2.04	9.4
IS0002	Irafoss	48[1]	19[1]	223[1]	2.57		0.45[1]	2.53	22.5
IS0090	Reykjavik	40[1]	8[1]	301[1]	1.86		0.55	0.61	8.7
GB0014	High Muffles	208	61	173	1.19		0.28	2.10	4.4
GB0090	East Ruston	104	40	247	1.09		0.28	1.56	4.6
GB0091	Banchory	87	52	139	0.77		<0.27	0.78	2.8
IE0001	Valentia	604[1]	53[1]	461[1]	1.33	89[1]	0.50[1]	0.53[1]	26.7
IE0002	Turlough Hill	436[1]	70[1]	453[1]	1.50	89[1]	0.54[1]	0.96[1]	7.6
FR0090	Porspoder	98	22	174	1.00		0.33	2.02	2.7
PT0003	V.d.Castelo		643		3.83		1.41	1.12	22.2
PT0004	Monte Velho		263		0.75		0.59	0.38	7.1
PT0010	A.d.Heroismo		609		1.83		2.14	0.99	56.7

[1] Many or all values BDL (see Appendix A). Calculations following CAMP principles.

Table 4.5: Observed mean annual air concentrations of metals, 1999.

		As *ng/m^3*	Cd *ng/m^3*	Cr *ng/m^3*	Cu *ng/m^3*	Hg *pg/m^3*	Ni *ng/m^3*	Pb *ng/m^3*	Zn *ng/m^3*
BE0004	Knokke		<2		24.0		12.9	23.3	36.8
NL0009	Kollumerwaard	0.68	0.21					10.56	31.7
DK0008	Anholt	0.41	0.1	0.39	1.00		1.54	4.77	9.46
DK0031	Ulborg	0.42	0.16	0.40	1.07		1.08	5.11	11.3
DE0001	Westerland	0.55	0.18		1.84		1.06	5.25	
NO0099	Lista	0.26	0.06	1.52	0.73		0.57	2.21	
NO0042	Zeppelin	0.08	0.02	0.13	0.28		0.14	0.50	1.39
IS0091	Storhofdi	0.08	0.21	7.18	1.15	0.53*	11.56	1.03	17.0
GB0014	High Muffles	0.68	0.13	0.16	4.86		0.64	9.86	43.1
GB0090	East Ruston	1.08	0.26	0.74	3.51		0.64	18.4	19.5
GB0091	Banchory	0.23	0.06	0.8	1.08		0.09	2.13	13.3

* Only the particulate fraction, not total airborne elemental mercury.

Table 4.6: Example comparison of estimates with different methods and laboratories.

	Arsenic *µg /m^2*	Copper *mg /m^2*	Lead *mg /m^2*
Bulk-Antwerp	202	3.62	3.64
Wet-only-Ghent	2491	20.3	19.94

4.3 Organic compounds

Finally, in Tables 4.7–4.12 the annual average values for organic compounds reported to CAMP are listed. More results are anticipated in the near future from different countries. With restricted data it is more difficult to identify factors of relevance in interpreting data and developing monitoring efforts. Nevertheless quite strong differences in reported concentrations of some organic compounds between sites suggests either marked gradients, or differences in techniques which may be beneficial to evaluate. Concentrations of organic compounds like of metals frequently are below the detection limits. Comments given with respect to the treatment of metal data are also valid for the organics.

Table 4.7: Annual mean precipitation weighted concentrations of PCB's in precipitation, 1999.

		PCB's										precip.
		28 *ng/l*	31 *ng/l*	52 *ng/l*	101 *ng/l*	105 *ng/l*	118 *ng/l*	138 *ng/l*	153 *ng/l*	156 *ng/l*	180 *ng/l*	*mm*
IS0091	Storhofdi	0.092	0.091	0.029	0.019	0.004	0.022	0.025	0.025	0.003	0.014	1502[2]
IE0002	Turlough Hill			1.35[1]	1.58[1]		1.44[1]	1.44[1]	1.49[1]		1.35[1]	1743

[1] All values BDL. High detection limit. See Appendix A.

[2] Official Rain Gauge data. Organics sampler measured 713 mm.

Table 4.8: Estimated annual wet depositions of PCB's, 1999.

		PCB's									
		28	**31**	**52**	**101**	**105**	**118**	**138**	**153**	**156**	**180**
		ng/m^2	*ng/m^2*	*ng/m^2*	*ng/m^2*	*ng/m^2*	*ng/m^2*	*ng/m^2*	*ng/m^2*	*ng/m^2*	*ng/m^2*
IS0091	Storhofdi	138	136	43	30	8	34	39	39	6	24
IE0002	Turlough Hill			2343	2753		2509	2597	2597		2353

Many values BDL. IE0002 Detection limit high. See Appendix A.

Table 4.9: Observed mean annual air concentrations of PCB's, 1999.

		PCB's									
		28	**31**	**52**	**101**	**105**	**118**	**138**	**153**	**156**	**180**
		pg/m^3	*pg/m^3*	*pg/m^3*	*pg/m^3*	*pg/m^3*	*pg/m^3*	*pg/m^3*	*pg/m^3*	*pg/m^3*	*pg/m^3*
IS0091	Storhofdi	3.52	1.74	0.85	0.27	0.03	0.1	0.04	0.07		0.05

Table 4.10: Annual mean precipitation weighted concentrations of organohalogens in precipitation, 1999.

		γ-HCH	**α-HCH**	**β-HCH**	**aldrin**	**dieldrin**	**endrin**	**ppDDD**	**ppDDE**	**ppDDT**	**heptachl**	**HCB**	**precip**
		ng/l	*ng/l*	*ng/l*	*ng/l*	*ng/l*	*ng/l*	*ng/l*	*ng/l*	*ng/l*	*ng/l*	*ng/l*	*mm*
BE0004	Knokke	21.	7.6		9.5	3.8	10.4	6.6	4.7	5.2	6.3		841
NL0091	De Zilk	14.09											949
IS0091	Storhofdi	0.12	0.24	0.01		0.03		0.020	0.028	0.003		0.02	1502
IE0002	Turlough Hill	5.21	1.4		1.35	2.1	2.15	1.35	1.35	1.35	1.4		1743
NO0099	Lista	3.7											

Many values BDL. Detection limits often high. See Appendix A.

Table 4.11: Estimated annual wet depositions of organohalogens, 1999.

		γ-HCH	**α-HCH**	**β-HCH**	**aldrin**	**dieldrin**	**endrin**	**ppDDD**	**ppDDE**	**ppDDT**	**heptachl**	**HCB**
		μg/m^2	*μg/m^2*	*μg/m^2*	*μg/m^2*	*μg/m^2*	*μg/m^2*	*μg/m^2*	*μg/m^2*	*μg/m^2*	*μg/m^2*	*μg/m^2*
BE0004	Knokke	18	5		8	3	9	6	4	4	5	
NL0091	De Zilk	13										
IS0091	Storhofdi	0.2	0.4	<0.1		<0.1		<0.1	<0.1	<0.1		<0.1
IE0002	Turlough Hill	9			2	4	4	2	2	2		
NO0099	Lista	5										

Table 4.12: Observed mean annual air concentrations of organohalogens, 1999.

		γ-HCH	**α-HCH**	**β-HCH**	**aldrin**	**endrin**	**ppDDE**	**ppDDT**	**opDDT**	**HCB**
		pg/m3	pg/m3	pg/m3	pg/m3	pg/m3	pg/m3	pg/m3	pg/m3	pg/m3
NO0099	Lista	36								
IS0091	Storhofdi	3.99	9.75	0.41	1.32	0.005	0.09	0.03	0.04	5.96

5 Summary

This report contains the results of monitoring undertaken for CAMP during 1999. The programme calls for Mandatory Monitoring of a range of nutrients, heavy metals and organic compounds in precipitation and air, and encourages participation in a Voluntary Monitoring of additional compounds. Monitoring should be conducted at monitoring stations located in proximity to the coast. Most stations do meet the ten kilometre objective. The furthest station from the coast is located some 26 kilometres inland.

Participation in the Mandatory programme for components in precipitation is reasonable. Some environmental toxins, e.g. γ-HCH and mercury receive less attention than other compounds. Monitoring of airborne compounds is at a similar level of compliance. Rather less attention is given to the Voluntary programme, notably the precipitation element in which organic substances feature. Some data is anticipated in the near future after national processing, but will still mean that observations are only reported from a single site.

Whilst equivalence in monitoring periods between countries is reasonable, there are some clear exceptions. A number of countries do recommence their monitoring periods at the start of each month thus allowing true monthly values to be reported or derived. However, a number do not do this, and some have long monitoring periods straddling months. This can make comparability less straightforward.

Reporting practices also vary between countries. Whilst some aggregate all samples in each month prior to analysis, others aggregate the results of several shorter samples, whilst others report raw short-period data. There is a reasonable prospect that data handling will be different as a consequence of this.

Metal and organic concentrations frequently are below the detection limits of analytical devices and in some cases detection limits are unusually high; this calls for strict rules when aggregating such data. Procedures may be worked out in co-operation with HELCOM and EMEP.

Differences in techniques and laboratories may be worth some evaluation. Example review of side-by-side samples analysed at different laboratories yielded tenfold differences in estimates. Similarly, there are quite clear differences in the estimates provided by different countries which may not only reflect differences in environmental occurrence.

Appendix A

Observed monthly mean concentrations in precipitation and in air at CAMP coastal monitoring stations, 1999

Appendix is divided by country, and thereafter by station. Each station heading contains observations of both precipitation and airborne concentrations during 1999. The following countries and stations which reported data for 1999 are listed.

Belgium	BE0003, BE0004, BE0011, BE0013
Denmark	DK0008, DK0031
France	FR0090
Germany	DE0001
Iceland	IS0002, IS0090, IS0091
Ireland	IE0001, IE0002
Netherlands	NL0009, NL0091
Norway	NO0042, NO0099, NO0001
Portugal	PT0003, PT0004, PT0010
Sweden	SE0002, SE0097, SE0098
United Kingdom	UK0014, UK0090, UK0091

Belgium

BE0003R – Brugge
Concentrations in precipitation

	From:	To:	**prec.** **mm**	**NH_4-N** **mg/l**	**NO_3-N** **mg/l**
January	4.01	29.01	39.6	0.21	0.65
February	29.01	26.02	42.0	0.43	0.82
March	26.02	2.04	54.0	0.55	0.99
April	2.04	30.04	52.7	0.24	1.02
May	30.04	29.05	12.8	0.78	1.02
June	29.05	2.07	80.3	0.91	0.68
July	2.07	30.07	11.1	1.16	1.16
August	30.07	3.09	92.3	0.51	0.45
September	3.09	1.10	74.4	0.63	0.42
October	1.10	29.10	100.7	0.02	0.25
November	29.10	28.11	18.2	0.63	0.41
December	28.11	3.01	111.1	0.11	0.24

BE0004R – Knokke
Concentrations in precipitation

Bulk Sampler														
	From:	To:	Precip. mm	**As** µg/l	flag	**Cd** µg/l	flag	**Cu** µg/l	flag	**Pb** µg/l	flag	**Zn** µg/l	flag
January	12.01	10.02	37.3	0.24	780	0.88		2.0	780	5.65		663.1	
February	10.02	10.03	68.5	0.24	780	4.17		2.0	780	3.46		484.6	
March	10.03	7.04	35.4	0.24	780	0.17		2.0	780	4.65		339.9	
April	7.04	4.05	52.2	0.24	780	0.29	653	28.2	653	6.76	653	50.51	653
May	4.05	2.06	37.7	0.24	780	0.30	654	321.2	654	8.37	654	84.48	654
June	2.06	30.06	69.0	0.24	780	0.25		26.4		6.36		45.40	
July	30.06	28.07	22.8	0.24	780	0.03	780	9.5		2.06		7.04	
August	28.07	25.08	123.3	0.24	780	0.07		2.0	780	2.98		2.15	
September	25.08	22.09	27.8	0.24	780	0.11		2.0	780	4.81		127.5	
October	22.09	20.10	133.0		999		999		999		999		
November	20.1	19.11	39.5	0.24	780	0.08		2.0	780	5.20		18.68	654
December	19.11	17.12	103.0	0.24	780	0.03	780	2.0	780	2.60	653	8.29	
December	17.12	14.01	86.9	0.24	780	0.05	654	2.0	780	1.43	654	2.15	

Concentrations in precipitation

Wet-Only sampler																				
	From:	To:	Precip. mm	**As** µg/l	flag	**Cd** µg/l	flag	**Cr** µg/l	flag	**Cu** µg/l	flag	**Pb** µg/l	flag	**Hg** ng/l	flag	**Ni** µg/l	flag	**Zn** µg/l	flag
January	12.01	10.02	37.3	2.3	780	0.12	780	1.6		93.6		0.7	780	0.04		2.0	780	23.8	
February	10.02	10.03	68.5	2.6	780	0.12	780	4.4		1.9	780	27.9		0.04		3.7		40.8	
March	10.03	7.04	35.4	2.3	780	0.11		3.3		1.7	780	44.1		0.04		4.0		55.9	
April	7.04	4.05	52.2	2.6	780	0.16	653	1.1	653	1.9	780	0.7	780	0.04	653	2.0	780	34.0	653
May	4.05	2.06	37.7	2.5	780	0.45	654	4.4	654	4.4	654	0.7	780	0.03	654	1.9	780	76.0	654
June	2.06	30.06	69.0	2.5	780	0.26		2.9		3.8		28.6		0.03		1.9		33.3	
July	30.06	28.07	22.8	3.4	780	0.03		3.4	780	5.6	780	46.1		0.03	780	3.2	780	26.5	
August	28.07	25.08	123.3	3.4	780	0.12		3.4	780	5.6	780	17.1		0.03		3.2	780	10.6	
September	25.08	22.09	27.8	3.4	780	1.10		3.4	780	5.6	780	47.2		0.03	780	3.7		25.6	
October	22.09	22.10	133.0	3.3	780	0.11	780	3.4	780	10.8		13.7		0.03	780	3.1	780	7.1	
November	22.10	19.11	39.5	3.4	780	0.93	654	3.4	780	5.5	780	33.1	654	0.03	780	3.2	780	39.8	654
December	19.11	17.12	103.0	3.4	780	0.24		3.4	780	5.5	780	33.1		0.03	780	3.2	780	11.2	
December	17.12	14.01	86.9	1.3	780	0.70	780	1.6		9.4		25.0		0.01	780	11.0		53.0	

Concentrations in precipitation

Wet Only sampler																					
	From:	To:	Precip.	Aldrin		α-HCH		γ-HCH		dieldrin		endrin		Heptachlor		pp-DDD		ppDDE		ppDDT	
			mm	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag
January	12.01	10.02	37.3	5	780	5	780		999	5	780	5	780	5	780	5	780	5	780	5	780
February	10.02	10.03	68.5		999		999	9		5	780	5	780	5	780	5	780	5	780	5	780
March	10.03	7.04	35.4	5	780		999	59		5	780	5	780	5	780	5	780	5	780	5	780
April	7.04	4.05	52.2	10	780	6	780	39	653	3	780	11	780	6	780	6	780	4	780	4	780
May	4.05	2.06	37.7		999		999	76	654	3	780	11	780	6	780	6	780	4	780	4	780
June	2.06	30.06	69.0	10	780	7	780	32		3	780	12	780	6	780	7	780	4	780	5	780
July	30.06	28.07	22.8		999		999		999		999		999		999		999		999		999
August	28.07	25.08	123.3	10	780	7	780		999	3	780	12	780	6	780	7	780	4	780	5	780
September	25.08	22.09	27.8	16	780	12	780	12		5	780	20	780	11	780	11	780	8	780	8	780
October	22.09	20.10	133.0	10	780	7	780		999	3	780	12	780	6	780	7	780	4	780	5	780
November	20.10	19.11	39.5	12	780	10	780	17	654	4	780	16	780	8	780	10	780	5	780	6	780
December	19.11	17.12	103.0	12	780	10	780	8	653	3	780	15	780	8	780	8	780	5	780	6	780
December	17.12	14.01	86.9	2	780	1	780	9		1	780	2	780	1	780	1	780	1	780	1	780

Concentrations in air

	From:	To:	Cd		Cu		Ni		Pb		Zn	
			ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag
January	1.01	1.02	2	781	22		13		22		41	
February	1.02	1.03	2	781	22		15		30		46	
March	1.03	1.04	2	781	26		16		29		65	
April	1.04	1.05	2	781	21		14		20	780	53	
May	1.05	1.06	2	781	20		15		20	780	29	
June	1.06	1.07	2	781	23		12		20	780	13	
July	1.07	1.08	2	781	22		12		20	780	18	
August	1.08	1.09	2	781	22		12		20	780	17	
September	1.09	1.10	2	781	22		10		28		56	
October	1.10	1.11	2	781	24		13		22		42	
November	1.11	1.12	2	781	26		13		28		45	
December	1.12	1.01	2	781	38		10		20	780	16	

BE0011 – Moerkerke
Concentrations in air

	From:	To:	NO_2-N µg/m^3	NO-N µg/m^3
January	1.01	1.02	7.91	1.87
February	1.02	1.03	7.61	2.80
March	1.03	1.04	8.83	2.33
April	1.04	1.05	6.09	0.93
May	1.05	1.06	6.39	1.40
June	1.06	1.07	4.57	0.47
July	1.07	1.08	5.17	0.93
August	1.08	1.09	5.48	0.93
September	1.09	1.10	6.39	1.40
October	1.10	1.11	7.30	2.80
November	1.11	1.12	7.61	3.27
December	1.12	1.01	6.09	1.40

BE0013 –Houtem
Concentrations in air

	From:	To:	NO_2-N µg/m^3	NO-N µg/m^3
January	1.01	1.02	5.48	0.93
February	1.02	1.03	6.09	1.87
March	1.03	1.04	6.39	1.40
April	1.04	1.05	4.26	0.93
May	1.05	1.06	5.17	0.93
June	1.06	1.07	3.65	0.47
July	1.07	1.08	4.26	0.47
August	1.08	1.09	3.96	0.47
September	1.09	1.10	4.57	0.93
October	1.10	1.11	4.57	2.33
November	1.11	1.12	5.48	0.93
December	1.12	1.01	4.26	0.93

Denmark

DK0008 – Anholt

Concentrations in precipitation

Month	From:	To:	Precip. mm HM	As µg/l	flag	Cd µg/l	flag	Cr µg/l	flag	Cu µg/l	flag	Pb µg/l	flag	Ni µg/l	flag	Zn µg/l	flag
January	1.01	31.01	51.9		999	0.05			999	1.42		1.65		0.33		6	
February	31.01	28.02	32.6		999	0.05		0.55		2.82		2.21		0.51		18	
March	28.02	31.03	70.4		999	0.07		0.27		1.75		3.28		0.46		9	
April	31.03	30.04	39.2	0.08		0.04		0.23			999	2.88		0.32		12	
May	30.04	31.05	48.3	0.15		0.07		0.40			999	3.93		0.54		26	
June	31.05	30.06	99.3	0.03		0.03		0.12			999	1.29			999	10	
July	30.06	31.07	45.2	0.33		0.09		0.32		3.29		2.73		0.49		21	
August	31.07	31.08	166.3	0.15		0.03		0.13		1.22		0.67		0.32		9	
September	31.08	30.09	58.0	0.76		0.09		0.41		2.05		2.67		0.47		13	
October	30.09	31.10	35.7	0.38		0.06		0.26		1.03		1.62		0.33		12	
November	31.10	30.11	7.0	0.82		0.17		0.43		2.21		3.80		1.03		38	
December	30.11	31.12	105.7	0.25		0.03		0.17		0.35		0.68		0.13		8	

Month	From:	To:	Precip. mm	NH_4-N mg/l	flag	NO_3-N mg/l	flag
January	1.01	1.02	52.4	0.39		0.74	
February	1.02	1.03	32.7	0.38		0.69	
March	1.03	29.03	95.7	0.74		0.82	
April	29.03	30.04	63.3	0.49		0.51	
May	30.04	31.05	73.8	0.22		0.48	
June	31.05	30.06	66.0	0.24		0.38	
July	30.06	31.07	77.8	0.43		0.39	
August	31.07	31.08	99.7	0.18		0.18	
September	31.08	30.09	91.2	0.78		0.74	
October	30.09	31.10	17.7	0.60		0.90	
November	31.10	30.11	90.5	0.28		0.48	
December	30.11	31.12	37.1	0.24		0.45	

Concentrations in air

	From:	To:	As ng/m^3	Cd ng/m^3	flag	Cr ng/m^3	Cu ng/m^3	Fe ng/m^3	Ni ng/m^3	Pb ng/m^3	Zn ng/m^3
January	1.01	31.01	0.49	0.10	780	0.28	1.16	38.3	1.40	7.77	10.8
February	31.01	28.02	0.26	0.10	780	0.55	0.62	23.1	1.44	1.64	6.1
March	28.02	31.03	0.75	0.12	780	0.35	1.52	59.7	2.12	6.56	13.5
April	31.03	30.04	0.44	0.11	780	0.35	1.31	77.0	2.35	5.10	11.5
May	30.04	31.05	0.30	0.16	780	0.32	1.70	118.0	1.67	3.82	10.0
June	31.05	30.06	0.25	0.07	780	0.46	0.41	42.8	1.10	3.16	6.2
July	30.06	31.07	0.25	0.09	780	0.38	0.29	85.6	2.01	2.56	6.2
August	31.07	31.08	0.25	0.18	780	0.49	-0.05	66.8	1.41	2.43	4.8
September	31.08	30.09	0.49	0.17	780	1.14	1.74	166.8	2.12	8.31	14.3
October	30.09	31.10	0.51				0.99	27.9	0.70	4.64	8.7
November	31.10	30.11	0.70	0.20	780	0.32	1.50	50.0	1.31	7.60	15.0
December	30.11	31.12	0.23	0.11	780	0.21	0.70	18.4	0.76	3.26	5.9

	From:	To:	NH_3 µg N/m^3	NH_3+NH_4 µg N/m^3	HNO_3+NO_3 µg N/m^3
January	1.01	31.01	0.03	1.16	0.85
February	31.01	28.02	0.05	1.10	0.86
March	28.02	31.03	0.12	2.19	1.16
April	31.03	30.04	0.18	2.37	1.38
May	30.04	31.05	0.13	1.28	0.83
June	31.05	30.06	0.11	1.29	0.73
July	30.06	31.07	0.21	1.09	0.66
August	31.07	31.08	0.22	1.03	0.69
September	31.08	30.09	0.27	1.94	1.16
October	30.09	31.10	0.10	0.92	0.49
November	31.10	30.11	0.09	1.45	0.98
December	30.11	31.12	0.06	0.61	0.50

DK0031 – Ulborg
Concentrations in precipitation

Month	From:	To:	precip mm HM	As µg/l	flag	Cd µg/l	flag	Cr µg/l	flag	Cu µg/l	flag	Pb µg/l	flag	Ni µg/l	flag	Zn µg/l	flag
January	1.01	31.01	79.6		999	0.09		0.16		1.28		1.18		0.35		6	
February	31.01	28.02	70.0		999	0.02		0		0		1.00		0.23		9	
March	28.02	31.03	92.1		999	0.04			999	0.92		1.34		0.27		6	
April	31.03	30.04	50.0	0.05		0.03		0.05			999	1.42		0.20		7	
May	30.04	31.05	24.6	0.17		0.06		0.41			999	2.40		0.58		11	
June	31.05	30.06	183.3	0.02		0.02		0.06			999	0.75		0.18		4	
July	30.06	31.07	56.3	0.14		0.05		0.17		0.94		1.05		0.26		17	
August	31.07	31.08	81.3	0.11		0.03		0.15		0.81		0.78		0.24		5	
September	31.08	30.09	120.5	0.14		0.03		0.13		0.58		0.96		0.16		5	
October	30.09	31.10	119.9	0.06		0.02		0.04		0.19		0.42		0.13		5	
November	31.10	30.11	56.7	0.11		0.04			999	0.59		0.85		0.26		15	
December	30.11	31.12	129.2	0.05		0.01		0.06		0.18		0.47		0.18		7	

Concentrations in air

	From:	To:	**As** ng/m^3	**Cd** ng/m^3	**Cr** ng/m^3	**Cu** ng/m^3	**Fe** ng/m^3	**Ni** ng/m^3	**Pb** ng/m^3	**Zn** ng/m^3
January	1.01	31.01	0.35	0.17	0.12	1.09	38.0	0.989	7.19	11.6
February	31.01	28.02	0.20	0.11	1.23	0.57	24.1	0.761	2.90	6.6
March	28.02	31.03	0.44	0.24	0.76	1.55	56.0	1.435	6.62	14.0
April	31.03	30.04	0.46	0.19	0.23	1.08	106.1	1.766	5.16	11.9
May	30.04	31.05	0.33	0.13	0.09	1.21	126.3	1.389	4.12	9.8
June	31.05	30.06	0.20	0.08	0.31	0.72	43.5	1.126	2.54	5.0
July	30.06	31.07	0.25	0.14	0.67	0.87	85.6	1.626	3.00	10.1
August	31.07	31.08	0.26	0.05	0.32	0.57	71.0	0.697	2.20	6.0
September	31.08	30.09	0.52	0.25	0.62	1.75	144.5	1.216	6.66	13.9
October	30.09	31.10	0.40	0.23	0.28	1.19	42.8	0.547	5.19	10.2
November	31.10	30.11	0.44	0.14	0.29	1.40	49.7	0.91	5.88	12.5
December	30.11	31.12	1.24	0.14	-0.02	0.79	19.5	0.44	9.45	23.5

			NH_3+NH_4 $\mu g\ N/m^3$	**HNO_3+NO_3** $\mu g\ N/m^3$
January	1.01	31.01	1.29	0.80
February	31.01	28.02	1.04	0.74
March	28.02	31.03	2.81	1.56
April	31.03	30.04	2.94	1.34
May	30.04	31.05	2.37	0.85
June	31.05	30.06	1.09	0.52
July	30.06	31.07	1.71	0.61
August	31.07	31.08	1.51	0.50
September	31.08	30.09	2.31	0.90
October	30.09	31.10	1.33	0.54
November	31.10	30.11	1.78	0.94
December	30.11	31.12	0.70	0.39

France

FR0090R – Porspoder
Concentrations in precipitation

	Precip. mm	**As** µg/l	**Cd** µg/l	**Cr** µg/l	**Cu** µg/l	**Pb** µg/l	**Ni** µg/l	**Zn** µg/l	**NH_4-N** mg/l	**NO_3-N** mg/l
January	157.0	0.26	0.02	0.17	0.83	1.13	0.39	1.73	0.26	0.18
February	67.0	0.17	0.01	0.13	0.92	1.02	0.31	1.78	0.23	0.35
March	47.0	0.16	0.02	0.19	1.49	1.55	0.36	3.11	0.14	0.51
April	109.0	0.05	0.01	0.10	0.49	0.57	0.26	1.57	0.02	0.14
May	38.0	0.11	0.07	0.19	3.03	10.71	0.55	15.68	2.09	1.01
June	24.0	0.14	0.03	0.27	1.87	3.57	0.73	4.90	0.13	0.48
July	9.0	0.43	0.04	0.30	1.60	3.00	0.70	5.90	0.27	0.99
August	155.0	0.04	0.02	0.11	0.98	1.63	0.32	1.70	0.29	0.24
September	126.0	0.02	0.01	0.09	0.52	1.00	0.23	1.22	0.03	0.06
October	87.0	0.04	0.03	0.06	0.90	0.66	0.46	1.99	0.27	0.14
November	55.5	0.10	0.04	0.43	1.05	4.66	0.32	5.85	0.32	1.18
December	213.0	0.03	0.01	0.19	0.74	2.02	0.10	1.38	0.02	0.17

Germany

DE0001R – Westerland-1
Concentrations in air

	From:	To:	NO_2-N µg/m^3	flag
January	1.01	1.02	3.4	
February	1.02	1.03	2.5	
March	1.03	1.04	2.9	
april	1.04	1.05	2.1	
May	1.05	1.06	1.6	
June	1.06	1.07	1.3	
July	1.07	1.08	1.4	
August	1.08	1.09		999
September	1.09	1.10	2.0	
October	1.10	1.11	1.9	
November	1.11	1.12	2.9	
December	1.12	1.01	2.2	

DE0041R – Westerland-2 Tinnum
Concentrations in precipitation

	From:	To:	Precip. mm	**As** **µg/l**	flag	**Cd** **µg/l**	flag	**Cr** **µg/l**	flag	**Cu** **µg/l**	flag	**Pb** **µg/l**	flag	**Hg** **ng/l**	flag	**Ni** **µg/l**	flag	**Zn** **µg/l**	flag
January	1.01	1.02	74.0	0.11		0.07		0.18		1.35		1.98		15.9		1.14		24.2	
February	1.02	1.03	30.3	0.19		0.11		0.21		2.21		1.59		13.1		0.92		23.3	
March	1.03	1.04	43.9	0.08		0.07		0.12		1.10		1.02		6.7		0.63		20.8	
April	1.04	1.05	70.2	0.11		0.06		0.10		3.07		1.72		13.4		1.39		21.9	
May	1.05	1.06	13.2	0.17		0.08		0.19		3.31		2.22		9.3		1.53		34.1	
June	1.06	1.07	56.9	0.07		0.05		0.17		1.55		0.87		35.3		0.67		19.9	
July	1.07	1.08	101.1	0.11		0.07		0.13		1.43		1.37			999	1.12		13.5	
August	1.08	1.09	66.5	0.08		0.05		0.11		1.91		0.63		10.6		1.23		20.9	
September	1.09	1.10	85.6	0.10		0.05		0.15		1.19		1.17		7.1		0.52		17.6	
October	1.10	1.11	154.6	0.12		0.04		0.14		2.28		1.10		7.2		0.46		9.1	
November	1.11	1.12	65.0	0.16		0.09		0.15		3.62		1.02		6.4		1.48		12.1	
December	1.12	1.01	50.5		699	0.03			699	5.23		0.65		6.7			699	11.2	

	From:	To:	precip mm	**NH_4-N** mg N/l	flag	**NO_3-N** mgN/l	flag
January	1.01	1.02	74.0	0.43		0.76	
February	1.02	1.03	30.3	0.28		0.53	
March	1.03	1.04	43.9	0.67		0.58	
April	1.04	1.05	70.2	0.75		0.94	
May	1.05	1.06	13.2	0.87		0.83	
June	1.06	1.07	56.9	0.47		0.48	
July	1.07	1.08	101.1	0.69		0.59	
August	1.08	1.09	66.5	0.48		0.41	
September	1.09	1.10	85.6	0.36		0.44	
October	1.10	1.11	154.6	0.14		0.34	
November	1.11	1.12	65.0	0.67		0.37	
December	1.12	1.01	50.5	0.67		0.29	

Concentrations in air

	From:	To:	**As**		**Cd**		**Cu**		**Ni**		**Pb**		**NO_3-N**		**NH_4-N**	
			ng/m^3	flag	**ng/m^3**	flag	**ng/m^3**	flag	**ng/m^3**	flag	**ng/m^3**	flag	**µg/m^3**	flag	**µg/m^3**	flag
January	1.01	1.02	0.46		0.36		1.92		1.30		8.45		0.65		0.25	
February	1.02	1.03	0.24		0.27		1.15		0.57		4.79		0.49		0.26	
March	1.03	1.04	0.70		0.21		2.55		1.62		7.83		0.41		0.73	
April	1.04	1.05	0.59		0.16		1.75		1.58		5.92		0.52		0.62	
May	1.05	1.06	0.33		0.10		1.36		1.33		4.17		0.51		0.23	
June	1.06	1.07	0.17		0.04		0.64		0.55		2.26		0.31		0.13	
July	1.07	1.08	0.30		0.07		1.16		1.29		2.92		0.26		0.19	
August	1.08	1.09	0.34		0.08		1.39		1.07		3.04		0.20		0.14	
September	1.09	1.10	0.96		0.35		2.82		1.55		9.61		0.40		0.82	
October	1.10	1.11	0.56		0.20		1.49		0.46		4.81		0.35		0.28	
November	1.11	1.12	0.57		0.16		2.20		1.01		5.73		0.45		0.42	
December	1.12	1.01	1.34		0.12		3.60		0.36		3.43		0.28		0.30	

Iceland

IS0002 – Irafoss
Concentrations in precipitation

Month	From:	To:	Precip. mm HM	As µg/l	flag	Cd µg/l	flag	Cr µg/l	flag	Cu µg/l	flag	Pb µg/l	flag	Ni µg/l	flag	Zn µg/l	flag
January	1.01	1.02															
February	1.02	1.03															
March	1.03	1.04															
April	1.04	1.05															
May	1.05	1.06	270.6	0.06		0.01	781	0.05	781	2.93		4.03		0.33		7.87	
June	1.06	1.07	72.3	0.06		0.01	781	0.06	781	1.17		1.19		0.10		7.21	
July	1.07	1.08	126.4	0.03	781	0.01	781	0.06	781	0.81		0.55		0.21		5.10	
August	1.08	1.09	112.9	0.03	781	0.01	781	0.05	781	1.20		0.74		0.36		5.26	
September	1.09	1.10	122.0	0.03	781	0.02		0.05	781	1.06		0.73		0.15		6.09	
October	1.10	1.11	229.3	0.03	781	0.01		0.40		1.11		0.43		0.40		12.0	
November	1.11	1.12	154.9	0.05		0.01	781	0.05	781	0.55		0.43		0.05		6.84	
December	1.12	1.01	112.7	0.03	781	0.02		0.05	781	0.77		0.57		0.06		41.9	

Month	From:	To:	Precip. mm HM	flag	Fe µg/l	flag	Al µg/l	flag	V µg/l	flag	Mn µg/l	flag	Precip. mm	NH_4-N mg/l	flag	NO_3-N mg/l	flag
January	1.01	1.02															
February	1.02	1.03															
March	1.03	1.04															
April	1.04	1.05															
May	1.05	1.06	270.6		38.6		43.5		0.14		1.65		277.4	0.17		0.09	
June	1.06	1.07	72.3		106		98.8		0.27		3.73		177.4	0.15		0.07	
July	1.07	1.08	126.4		319		193		0.58		7.05		148.5	0.07		0.09	
August	1.08	1.09	112.9		77.8		81.2		0.22		2.86		110.2	0.06		0.09	
September	1.09	1.10	122.0		84.5		65.2		0.23		1.89		102.3	0.02		0.05	
October	1.10	1.11	229.3		395		211		0.83		7.07		209.8	0.01		0.04	
November	1.11	1.12	154.9		31.3		52.0		0.23		2.71		224.7	0.14		0.10	
December	1.12	1.01	112.7		39.1		25.8		0.15		0.92		110.3	0.13		0.03	

IS0090 – Reykjavik
Concentrations in precipitation

Month	From:	To:	precip mm HM	As µg/l	flag	Cd µg/l	flag	Cr µg/l	flag	Cu µg/l	flag	Pb µg/l	flag	Ni µg/l	flag	Zn µg/l	flag
January	1.01	1.02															
February	1.02	1.03															
March	1.03	1.04	14.8	0.12		0.02		0.76		6.83		0.85		2.68		18.3	
April	1.04	1.05	28.4	0.15		0.02		1.18		6.71		1.45		9.09		23.0	
May	1.05	1.06	95.3	0.06		0.01		0.30		2.41		0.78		1.15		7.66	
June	1.06	1.07	73.3	0.10		0.01	781	0.05	781	1.25		0.62		0.47		10.1	
July	1.07	1.08	66.1	0.03	781	0.01	781	0.28		1.06		0.59		0.34		5.76	
August	1.08	1.09	63.8	0.04	781	0.01		0.12		1.43		0.81		0.37		7.27	
September	1.09	1,10	66.5	0.03	781	0.01	781	0.28		1.74		0.61		0.13		5.64	
October	1,10	1.11	104.4	0.03	781	0.01	781	0.45		1.46		0.32		0.31		23.5	
November	1.11	1.12	55.1	0.05		0.01		0.73		3.16		0.68		0.32		9.79	
December	1.12	1.01	36.9	0.03	781	0.01		0.61		4.64		1.91		0.21		2.89	

Month	From:	To:	Precip mm HM	flag	Fe µg/l	flag	Al µg/l	flag	V µg/l	flag	Mn µg/l	flag	Precip. mm N	NH_4-N mg/l	flag	NO_3-N mg/l	flag
January	1.01	1.02															
February	1.02	1.03															
March	1.03	1.04	14.8		695		588		0.50		16.9		8.6	1.27		0.39	
April	1.04	1.05	28.4		677		647		0.65		16.89		9.4	1.03		0.19	
May	1.05	1.06	95.3		303		249		0.53		8.66		62.7	0.35		0.15	
June	1.06	1.07	73.3		42.8		62.4		0.10		2.04		67.3	0.31		0.17	
July	1.07	1.08	66.1		108		81.4		0.33		3.63		71.5	0.11		0.08	
August	1.08	1.09	63.8		102		120		0.30		2.50		67.0	0.24		0.14	
September	1.09	1,10	66.5		142		172		0.50		2.64		68.6	0.31		0.11	
October	1,10	1.11	104.4		91.2		98.6		0.37		1.78		106.5	0.10		0.05	
November	1.11	1.12	55.1		290		286		0.89		7.40		59.7	0.18		0.12	
December	1.12	1.01	36.9		160		216		0.59		3.03		38.6	0.52		0.09	

IS0091R – Storhofdi
Concentrations in precipitation

	prec.	a-HCH	b-HCH	g-HCH	dieldrin	cis_CD	HCB	op_DDT	pp_DDT	pp_DDE	pp_DDD	trans_NO
	mm	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l
January	74.8	0.204	0.019	0.042	0.056	0.014	0.018	0.016	0.032	0.013	0.030	0.010
February	52.3	0.221	0.006	0.001	0.052	0.009	0.011	0.011	0.024	0.012	0.003	0.004
March	24.0	0.300	0.000	0.025	0.058	0.005	0.021	0.000	0.034	0.004	0.006	0.000
April	48.6	0.192	0.000	0.082	0.048	0.012	0.014	0.000	0.003	0.003	0.000	0.002
May	49.9	0.199	0.000	0.266	0.056	0.000	0.031	0.000	0.094	0.282	0.141	0.000
June	74.2	0.189	0.000	0.115	0.030	0.005	0.011	0.000	0.000	0.016	0.015	0.003
July	47.1	0.228	0.003	0.222	0.001	0.004	0.013	0.001	0.002	0.005	0.001	0.002
August	59.5	0.292	0.003	0.134	0.003	0.003	0.013	0.001	0.001	0.003	0.002	0.001
September	77.7	0.325	0.011	0.172	0.001	0.003	0.016	0.000	0.001	0.002	0.003	0.001
October	76.5	0.242	0.007	0.161	0.010	0.004	0.017	0.000	0.002	0.003	0.009	0.003
November	61.3	0.314	0.010	0.114	0.039	0.004	0.029	0.000	0.000	0.002	0.008	0.003
December	62.3	0.223	0.003	0.076	0.045	0.014	0.017	0.001	0.006	0.008	0.012	0.004

All BDC except a-HCH, HCB, g-HCH from May, ppDDT until April, dieldrin until July.

	prec.	PCB_101	PCB_105	PCB_118	PCB_138	PCB_153	PCB_156	PCB_180	PCB_28	PCB_31	PCB_52
	mm	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l	ng/l
January	74.8	0.054	0.000	0.053	0.079	0.073	0.006	0.043	0.051	0.053	0.030
February	52.3	0.019	0.003	0.026	0.017	0.017	0.003	0.008	0.122	0.127	0.054
March	24.0	0.029	0.000	0.038	0.033	0.033	0.000	0.025	0.069	0.110	0.042
April	48.6	0.026	0.000	0.034	0.024	0.024	0.000	0.008	0.079	0.102	0.051
May	49.9	0.043	0.000	0.065	0.069	0.088	0.002	0.031	0.079	0.080	0.038
June	74.2	0.009	0.000	0.011	0.003	0.005	0.001	0.003	0.054	0.059	0.013
July	47.1	0.010	0.008	0.010	0.020	0.018	0.001	0.018	0.033	0.029	0.015
August	59.5	0.019	0.009	0.018	0.032	0.027	0.001	0.024	0.136	0.131	0.018
September	77.7	0.010	0.003	0.004	0.007	0.008	0.000	0.002	0.098	0.093	0.011
October	76.5	0.002	0.004	0.003	0.000	0.001	0.003	0.001	0.026	0.027	0.004
November	61.3	0.004	0.003	0.009	0.018	0.017	0.003	0.016	0.101	0.094	0.007
December	62.3	0.016	0.014	0.017	0.012	0.012	0.009	0.005	0.097	0.084	0.010

Much BDC except 101-138 until September.

Concentrations in air

	FROM:	TO:	Pb	Cd	Cu	Zn	Cr	Ni	Fe	Mn	V	As	Al	Hg	NO_3-N
			ng/m^3	ng/m^3	ng/m^3	ng/m^3	ng/m^3	ng/m^3	µg/m^3	ng/m^3	ng/m^3	ng/m^3	µg/m^3	pg/m^3	µg/m3
January	1.01.	1.02.	0.80	0.07	1.54	21.7	3.88	3.62	0.95	14.9	4.18	0.11	0.53	0.78	0.02
February	1.02.	1.03.	0.71	0.12	0.70	21.9	2.98	2.71	0.13	2.42	0.78	0.05	0.11	0.92	0.02
March	1.03.	1.04.	0.51	0.03	0.68	17.9	4.11	3.26	0.35	4.92	2.37	0.07	0.14	0.78	0.03
April	1.04.	1.05.	1.66	0.11	1.16	14.1	9.16	5.78	0.46	9.34	1.85	0.36	0.24	0.79	0.07
May	1.05.	1.06.	1.09	0.24	1.09	14.8	9.87	6.35	0.67	8.28	1.99	0.10	0.28	0.41	0.12
June	1.06.	1.07.	1.76	0.56	2.01	43.6	9.34	70.1	0.21	9.74	0.62	0.05	0.17	0.78	0.06
July	1.07.	1.08.	0.66	0.03	0.98	13.1	6.18	4.20	0.14	2.16	0.41	0.04	0.07	0.49	0.05
August	1.08.	1.09.	0.42	0.01	0.54	6.07	8.79	4.85	0.11	1.60	0.28	0.04	0.04	0.24	0.05
September	1.09.	1.10.	0.77	0.03	0.65	7.45	10.4	8.08	0.16	2.42	0.43	0.06	0.06	0.31	0.05
October	1.10.	1.11.	0.49	0.02	0.83	4.62	7.24	6.09	0.44	8.28	1.60	0.07	0.25	0.23	0.06
November	1.11.	1.12.	0.47	0.13	0.46	6.16	6.43	5.11	0.09	1.51	0.30	0.03	0.03	0.19	0.03
December	1.12.	1.01.	2.68	1.01	2.76	26.8	7.98	14.12	0.11	4.09	0.32	0.03	0.10	0.49	0.03

Ireland

IE0001R – Valentia Observatory
Concentrations in precipitation

	From:	To:	Precip. mm	As µg/l	flag	Cd µg/l	flag	Cr µg/l	flag	Cu µg/l	flag	Pb µg/l	flag	Hg µg/l	flag	Ni µg/l	flag	Zn µg/l	flag
January	1.01	1.02	200.4	0.5	781	0.05	781	0.5	781	0.5	781	0.5	781	100	781	1.0	781	6.0	
February	1.02	1.03	82.7		999		999		999		999		999	100	999		999		999
March	1.03	1.04	143.9	0.6	0	0.07		0.5	781	0.8		0.6		100	781	0.5	781	11.3	
April	1.04	1.05	158.9	0.5	781	0.05	781	0.5	781	0.6		0.5	781	100	781	0.5	781	10.1	
May	1.05	1.06	53.0	0.5	781	0.05	781	0.5	781	2.0		0.9		100	781	0.5	781	16.4	
June	1.06	1.07	52.2	0.6		0.05	781	0.6		1.1		0.5	781	100	781	0.5	781	11.7	
July	1.07	1.08	84.5	0.6		0.05	781	0.5	781	1.3		0.5	781	100	781	0.5	781	7.9	
August	1.08	1.09	166.7	0.6		0.05	781	0.5	781	1.1		0.5	781	100	781	0.5	781	8.3	
September	1.09	1.10	290.4	0.5	781	0.05	781	0.5	781	0.6		0.5	781	100	781	0.5	781	7.2	
October	1.10	1.11	101.4	0.5	781	0.05	781	0.5	781	0.5	781	0.5	781	100	781	0.5	781	5.4	
November	1.11	1.12	137.6	0.5	781	0.05	781	0.5	781	1.4		0.5	781	100	781	0.5	781	23.3	
December	1.12	1.01	304.4	0.5	781	0.05	781	0.5	781	0.5		0.5	781	100	781	0.5	781	38.0	

	From:	To:	Precip. mm	Mn µg/l	flag	V µg/l	flag	Al µg/l	flag
January	1.01	1.02	200.4	0.5	781	10.0	781	18.1	
February	1.02	1.03	82.7		999		999		999
March	1.03	1.04	143.9	1.4		1.3		29.8	
April	1.04	1.05	158.9	1.8		1.0		20.0	
May	1.05	1.06	53.0	5.2		1.3		70.7	
June	1.06	1.07	52.2	3.5		1.2		69.3	
July	1.07	1.08	84.5	3.4		1.2		26.4	
August	1.08	1.09	166.7	2.0		1.1		18.5	
September	1.09	1.10	290.4	0.8		1.0		6.9	
October	1.10	1.11	101.4	0.6		0.5	781	23.5	
November	1.11	1.12	137.6	0.6		0.5	781	8.5	
December	1.12	1.01	304.4	0.9		0.5	781	8.3	

IE0002R – Turlough Hill
Concentrations in precipitation

	From:	To:	Precip. mm	As µg/l	flag	Cd µg/l	flag	Cr µg/l	flag	Cu µg/l	flag	Pb µg/l	flag	Hg µg/l	flag	Ni µg/l	flag	Zn µg/l	flag
January	1.01	1.02	198.0	0.5	781	0.05	781	0.5	781	0.5	781	0.5	781	100	781	1.0	781	2.6	
February	1.02	1.03	106.2		999		999		999		999		999		999		999		999
March	1.03	1.04	72.8		999		999		999		999		999		999		999		999
April	1.04	1.05	195.2	0.5	781	0.05	781	0.5	781	1.0		0.7		100	781	0.5	781	4.8	
May	1.05	1.06	119.2	0.5	781	0.07		0.5	781	1.1		1.0		100	781	0.5	781	6.2	
June	1.06	1.07	55.6	0.6		0.05	781	0.5	781	1.3		0.9		100	781	0.5	781	4.7	
July	1.07	1.08	36.8	0.6		0.09		0.5		1.7		1.1		100	781	0.6		5.7	
August	1.08	1.09	107.8	0.6		0.13		0.5	781	1.4		1.4		100	781	0.5		7.3	
September	1.09	1.10	263.0	0.5	781	0.05	781	0.5	781	0.7		0.5	781	100	781	0.5	781	4.1	
October	1.10	1.11	155.3	0.5	781	0.06		0.5	781	0.8		0.9		100	781	0.5	781	5.7	
November	1.11	1.12	164.0	0.5	781	0.05	781	0.5	781	0.5		0.5	781	100	781	0.5	781	2.8	
December	1.12	1.01	269.8	0.5	781	0.05	781	0.5	781	1.1		0.5	781	100	781	0.5	781	3.6	

	From:	To:	Precip. mm	NH_4-N mg/l	flag	NO_3-N mg/l	flag	Mn µg/l	flag	V µg/l	flag	Al µg/l	flag
January	1.01	1.02	198.0	0.17		0.05		2.7		10.0	781	12.4	
February	1.02	1.03	106.2	0.58		0.13			999		999		999
March	1.03	1.04	72.8	0.36		0.16			999		999		999
April	1.04	1.05	195.2	0.36		0.17		1.4		1.1		11.3	
May	1.05	1.06	119.2	0.35		0.23		3.3		1.3		30.1	
June	1.06	1.07	55.6	0.74		0.27		2.4		1.4		43.5	
July	1.07	1.08	36.8	0.61		0.34		3.4		1.4		51.6	
August	1.08	1.09	107.8	0.48		0.44		5.1		1.5		34.5	
September	1.09	1.10	263.0	0.10		0.09		1.3		1.1		12.7	
October	1.10	1.11	155.3	0.58		0.53		2.2		0.5		27.5	
November	1.11	1.12	164.0	0.14		0.13		0.8		0.5	781	11.5	
December	1.12	1.01	269.8	0.12		0.08		0.7		0.5	781	9.6	

	From:	To:	Precip.	**γ-HCH**		**α-HCH**		**PCB52**		**PCB101**		**PCB118**		**PCB138**		**PCB153**		**PCB180**	
			mm	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag
January	1.01	1.02	198.0	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781
February	1.02	1.03	106.2	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781
March	1.03	1.04	72.8	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781
April	1.04	1.05	195.2	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781
May	1.05	1.06	119.2	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781
June	1.06	1.07	55.6	3	781	3	781	3	781	3	781	3	781	3	781	3	781	3	781
July	1.07	1.08	36.8	3	781	3	781	3	781	3	781	3	781	3	781	3	781	3	781
August	1.08	1.09	107.8	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781
September	1.09	1.10	263.0	51	781	10	781	10	781	10	781	10	781	10	781	10	781	10	781
October	1.10	1.11	155.3	5	781	5	781	1	781	1	781	1	781	1	781	1	781	1	781
November	1.11	1.12	164.0	7	781	1	781	1	781	6	781	3	781	4	781	4	781	1	781
December	1.12	1.01	269.8	5	781	2	781	1	781	1	781	1	781	1	781	1	781	1	781

	From:	To:	Precip.	**ppDDD**		**opDDD**		**ppDDT**		**opDDT**		**ppDDE**		**Aldrin**		**Dieldrin**		**Endrin**		**hepta-chlor**		**hepta-chlor-epoxide**	
			mm	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag	ng/l	flag
January	1.01	1.02	198.0	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781
February	1.02	1.03	106.2	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781
March	1.03	1.04	72.8	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781
April	1.04	1.05	195.2	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781
May	1.05	1.06	119.2	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781
June	1.06	1.07	55.6	3	781	3	781	3	781	3	781	3	781	3	781	3	781	3	781	3	781	3	781
July	1.07	1.08	36.8	3	781	3	781	3	781	3	781	3	781	3	781	3	781	3	781	3	781	3	781
August	1.08	1.09	107.8	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781	2	781
September	1.09	1.10	263.0	10	781	10	781	10	781	10	781	10	781	10	781	20	781	20	781	10	781	10	781
October	1.10	1.11	155.3	1	781	1	781	1	781	1	781	1	781	1	781	1	781	2	781	1	781	1	781
November	1.11	1.12	164.0	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781
December	1.12	1.01	269.8	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781	1	781

Netherlands

NL0009R – Kollumerwaard
Concentrations in precipitation

Approximate Month	From:	To:	Precip. mm HM	flag	As µg/l	flag	Cd µg/l	flag	Cr µg/l	flag	Cu µg/l	flag	Pb µg/l	flag	Ni µg/l	flag	Zn µg/l	flag
January	23.12	18.01	67.1		0.45	781	0.41		0.42	781	1.32		1.10		0.55		22.2	
February	18.01	17.02	43.8		0.45	781	0.32		0.42	781	0.98		1.56		0.41	781	15.8	
March	17.02	17.03	54.3		0.45	781	0.07		0.42	781	1.72		1.19		0.41	781	7.2	
April	17.03	14.04	61.1		0.45	781	0.09		0.42	781	1.68		1.95		0.42		8.0	
	14.04	12.05	34.3		0.45	781	0.13		0.42	781	2.37		1.96		0.41	781	13.3	
May	12.05	9.06	52.7		0.68		0.07		0.42	781	1.85		1.85		0.41	781	8.6	
June	9.06	7.07	52.4		0.45	781	0.06		0.42	781	1.56		1.47		0.41	781	7.5	
July	7.07	4.08	13.5		0.45	781	0.14		0.42	781	7.66		2.06		0.41	781	10.0	
August	4.08	1.09	77.0		0.45	781	0.07		0.42	781	1.25		1.25		0.41	781	5.0	
September	1.09	29.09	47.9		0.51		0.18		0.42	781	5.15		2.32		0.83		11.9	
October	29.09	27.10	79.7		0.51		0.10		0.42	781	0.78		2.24		0.54		7.7	
November	27.10	24.11	67.5		0.45	781	0.11		0.42	781	0.64		1.24		0.41	781	6.2	
December	24.11	22.12		999		999		999		999		999		999		999		999

Approximate Month	From:	To:	Precip. mm N	NH_4-N mg/l	flag	NO_3-N mg/l	flag
January	23.12	18.01	75.9	0.64		0.42	
February	18.01	17.02	44.1	0.80		0.46	
March	17.02	17.03	58.4	0.92		0.52	
April	17.03	14.04	63.5		999		999
	14.04	12.05	35.6	1.62		0.77	
May	12.05	9.06	57.3		999		999
June	9.06	7.07	55.2	1.09		0.50	
July	7.07	4.08	14.2	0.94		0.45	
August	4.08	1.09	81.6	1.13		0.48	
September	1.09	29.09	51.9	1.05		0.57	
October	29.09	27.10	86.4	0.59		0.36	
November	27.10	24.11	68.8	0.36		0.29	
December	24.11	22.12	163.0	0.85		0.44	

Concentrations in air

	From:	To:	As ng/m^3	Cd ng/m^3	Pb ng/m^3	Zn ng/m^3	NH_4-N µg/m^3	NO_3-N µg/m^3
January	31.12	31.01	0.43	0.18	9.11	27.2	0.95	0.79
February	31.01	28.02	0.49	0.16	9.99	27.1	1.31	0.94
March	28.02	31.03	0.73	0.21	10.82	34.2	1.78	1.34
April	31.03	30.04	0.81	0.28	12.49	32.7	1.93	1.23
May	30.04	31.05	0.63	0.18	7.98	34.7	1.19	0.75
June	31.05	30.06	0.33	0.10	5.37	23.5	0.84	0.47
July	30.06	31.07	0.63	0.18	9.24	38.9	1.38	0.64
August	31.07	31.08	0.68	0.19	9.08	37.0	1.07	0.66
September	31.08	30.09	1.58	0.41	21.73	46.2	2.15	1.26
October	30.09	31.10	0.69	0.19	8.75	23.0	1.02	0.70
November	31.10	30.11	0.76	0.29	12.67	32.4	0.97	0.67
December	30.11	31.12	0.37	0.15	9.44	23.2	0.63	0.41

NL0091R – De Zilk
Concentrations in precipitation

Approximate Month	From:	To:	Precip mm HM	As µg/l	flag	Cd µg/l	flag	Cr µg/l	flag	Cu µg/l	flag	Pb µg/l	flag	Ni µg/l	flag	Zn µg/l	flag
January	23.12	18.01	76.2	0.45	781	0.09		0.42	781	1.11		1.73		0.63		4.3	
February	18.01	17.02	43.1	0.45	781	0.07		0.42	781	1.36		2.98		0.47		5.9	
March	17.02	17.03	79.4	0.45	781	0.03	781	0.42	781	0.93		2.23		0.41	781	6.4	
April	17.03	14.04	69.6	0.45	781	0.04		0.42	781	2.25		2.75		0.41	781	6.7	
	14.04	12.05	33.8	0.45	781	0.15		0.42	781	3.42		5.59		0.57		20.9	
May	12.05	9.06	67.5	0.45	781	0.07		0.42	781	2.21		4.28		0.75		10.3	
June	9.06	7.07	73.5	0.45	781	0.03	781	0.42	781	0.88		2.26		0.41	781	5.0	
July	7.07	4.08	14.0	0.45	781	0.04		0.42	781	3.06		2.53		0.43		7.3	
August	4.08	1.09	106.0	0.45	781	0.03	781	0.42	781	0.98		2.20		0.45		4.6	
September	1.09	29.09	62.7	0.45	781	0.06		0.42	781	1.25		2.97		0.41	781	5.8	
October	29.09	27.10	140.1	0.45	781	0.03		0.42	781	0.93		1.40		0.41	781	3.3	781
November	27.10	24.11	92.8	0.45	781	0.10		0.42	781	2.28		4.02		0.42		8.6	
December	24.11	22.12	92.6		999		999		999		999		999		999		999

Approximate Month	From:	To:	Precip. mm HCH	γ-HCH ng/l	flag	Precip. mm N	NH_4-N mg/l	flag	NO_3-N mg/l	flag		Precip mm Hg	Hg ng/l
January	23.12	18.01	79.3	10		77.4	0.38		0.32		**Jan**	64	8.2
February	18.01	17.02	49.3	10		45.8	0.35		0.54		**Feb**	16	10.0
March	17.02	17.03	84.6	10		79.9	0.52		0.45		**Mar**	80	10.0
April	17.03	14.04	73.1	40		68.7	0.98		0.74		**Apr**	46	14.0
	14.04	12.05	35.9	60		32.7	2.04		1.48		**May**	26	22.0
May	12.05	9.06	68.2	30		67.1	0.88		0.81		**Jun**	86	13.0
June	9.06	7.07	74.8	10		72.8	0.60		0.48		**Jul**	38	17.0
July	7.07	4.08	16.5	10		14.0	0.74		0.71		**Aug**	94	13.0
August	4.08	1.09	106.2	10		104.3		999		999	**Sep**	58	15.0
September	1.09	29.09	65.8	10		61.4	0.63		0.44		**Oct**	75	3.8
October	29.09	27.10	141.6	10	781	138.9	0.27		0.30		**Nov**	87	8.6
November	27.10	24.11	96.7	10		93.3	0.25		0.33		**Dec**	121	7.1
December	24.11	22.12	95.8	10	781	92.3	0.27		0.35				

Concentrations in air

	From:	To:	NH_4-N µg/m^3	NO_3-N µg/m^3
January	31.12	31.01	0.81	0.60
February	31.01	28.02	1.35	0.89
March	28.02	31.03	1.41	1.01
April	31.03	30.04	1.00	0.66
May	30.04	31.05	1.15	0.74
June	31.05	30.06	0.69	0.38
July	30.06	31.07	1.02	0.48
August	31.07	31.08	1.09	0.52
September	31.08	30.09	0.89	0.49
October	30.09	31.10	1.00	0.59
November	31.10	30.11	0.74	0.48
December	30.11	31.12	0.40	0.27

Norway

NO0057R – Ny Ålesund
Concentrations in precipitation

	From:	To:	Precip. mm	**NH_4-N mg/l**	**NO_3-N mg/l**
January	1.01	1.02	27.3	0.05	0.16
February	1.02	1.03	0.0		
March	1.03	1.04	19.8	0.14	0.12
april	1.04	1.05	11.0	0.12	0.07
May	1.05	1.06	17.7	0.26	0.21
June	1.06	1.07	24.7	1.07	0.94
July	1.07	1.08	19.2	0.20	0.15
August	1.08	1.09	11.3	0.06	0.10
September	1.09	1.10	39.7	0.05	0.05
October	1.10	1.11	21.4	0.04	0.04
November	1.11	1.12	28.3	0.18	0.05
December	1.12	1.01	6.4	0.10	0.13

NO0042R – Zeppelin mountain
Concentrations in air

	From:	To:	**As** ng/m^3	**Cd** ng/m^3	**Cr** ng/m^3	**Cu** ng/m^3	**Pb** ng/m^3	**Ni** ng/m^3	**Zn** ng/m^3	**V** ng/m^3	**Co** ng/m^3	**Mn** ng/m^3
January	1.01	1.02	0.17	0.04	0.34	0.23	0.79	0.14	2.35	0.23	0.12	0.46
February	1.02	1.03	0.27	0.03	0.44	0.38	1.07	0.27	3.53	0.58	0.06	1.43
March	1.03	1.04	0.08	0.02	0.04	0.29	0.50	0.17	1.23	0.25	0.09	0.30
April	1.04	1.05	0.17	0.05	0.08	0.40	0.90	0.20	3.75	0.18	0.11	0.62
May	1.05	1.06	0.04	0.02	0.05	0.44	0.38	0.12	1.88	0.06	0.06	0.22
June	1.06	1.07	0.01	0.01	0.03	0.15	0.10	0.09	0.63	0.02	0.03	0.06
July	1.07	1.08	0.01	0.00	0.03	0.07	0.03	0.09	0.37	0.06	0.03	0.24
August	1.08	1.09	0.01	0.00	0.04	0.08	0.04	0.12	0.32	0.11	0.03	0.18
September	1.09	1.10	0.01	0.00	0.07	0.10	0.05	0.07	0.32	0.05	0.02	0.53
October	1.10	1.11	0.00	0.00	0.30	0.04	0.04	0.09	0.10	0.02	0.03	0.10
November	1.11	1.12	0.06	0.01	0.05	0.42	0.30	0.12	0.75	0.09	0.03	0.47
December	1.12	1.01	0.15	0.03	0.07	0.73	0.88	0.17	1.49	0.19	0.03	0.56

	From:	To:	**NH_3+NH_4-N** µg/m^3	**HNO_3+NO_3-N** µg/m^3
January	1.01	1.02	0.11	0.04
February	1.02	1.03	0.15	0.03
March	1.03	1.04	0.33	0.03
April	1.04	1.05	0.18	0.03
May	1.05	1.06	0.20	0.05
June	1.06	1.07	0.16	0.03
July	1.07	1.08	0.39	0.06
August	1.08	1.09	0.30	0.03
September	1.09	1.10	0.21	0.02
October	1.10	1.11	0.08	0.02
November	1.11	1.12	0.06	0.02
December	1.12	1.01	0.10	0.03

NO0099R – Lista
Concentrations in precipitation

	From:	To:	Precip.	As		Cd		Cr		Cu		Pb		Hg		Ni		Zn	
			mm HM	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	ng/l	flag	µg/l	flag	µg/l	flag
January	1.01	1.02	114.0	0.07		0.02		0.10		0.41		0.83		8.80		0.13		3.94	
February	1.02	1.03	109.3	0.10		0.01		0.14		0.60		1.12		8.10		0.11		7.42	
March	1.03	1.04	170.6	0.10		0.02		0.11		0.36		1.58		9.10		0.11		3.13	
April	1.04	1.05	71.8	0.15		0.01		0.17		0.54		1.23		11.80		0.20		5.45	
May	1.05	1.06	46.4	0.18		0.15		0.14		2.38		2.02		17.50		0.39		6.36	
June	1.06	1.07	147.6	0.10		0.01		0.10		0.66		0.76			999	0.11		2.21	
July	1.07	1.08	62.9	0.10		0.01		0.28		2.28		1.23		8.50		1.29		6.88	
August	1.08	1.09	71.1	0.19		0.02		0.10		4.36		4.55		14.10		1.29		15.72	
September	1.09	1.10	86.5	0.21		0.04		0.16		2.07		2.41		14.30		0.40		10.12	
October	1.10	1.11	156.3	0.18		0.03		0.13		0.72		1.43		6.50		0.21		5.93	
November	1.11	1.12	70.2	0.78		0.08		0.30		4.10		2.09		14.10		0.65		13.84	
December	1.12	1.01	153.7	0.56		0.03		0.61		4.84		1.75		6.10		0.53		14.63	

	From:	To:	Precip.	V		Co		g-HCH		Precip.	NH_4-N		NO_3-N	
			mm	µg/l	flag	µg/l	flag	ng/l	flag	mm N	mg N/l	flag	mg N/l	flag
January	1.01	1.02	114.0	0.49		0.02		2.70		122.7	0.39		0.72	
February	1.02	1.03	109.3	0.38		0.02		1.80		115.1	0.30		0.49	
March	1.03	1.04	170.6	0.57		0.02		17.40		157.8	0.64		0.71	
April	1.04	1.05	71.8	0.36		0.04		6.00		67.0	0.55		0.42	
May	1.05	1.06	46.4	0.52		0.06		17.30		46.9	0.88		0.98	
June	1.06	1.07	147.6	0.28		0.01		9.40		172.9	0.83		0.79	
July	1.07	1.08	62.9	0.62		0.06		2.80		64.2	0.55		0.67	
August	1.08	1.09	71.1	0.56		0.01		2.30		73.0	0.37		0.94	
September	1.09	1.10	86.5	0.62		0.06		4.70		92.7	0.29		0.75	
October	1.10	1.11	156.3	0.71		0.03		1.60		165.0	0.54		0.47	
November	1.11	1.12	70.2	1.46		0.07		2.60		54.8	1.10		1.10	
December	1.12	1.01	153.7	1.20		0.06		2.10		141.1	0.31		0.44	

Concentrations in air

	From:	To:	As	Cd	Cr	Cu	Pb	Ni	V	γ-HCH
			ng/m^3	ng/m^3	ng/m^3	ng/m^3	ng/m^3	ng/m^3	ng/m^3	pg/m^3
January	1.01	1.02	0.26	0.08	0.92	0.68	1.25	0.56	0.57	7.2
February	1.02	1.03	0.22	0.05	1.29	0.44	1.72	0.42	0.75	7.5
March	1.03	1.04	0.35	0.12	1.46	0.77	3.44	0.79	1.61	23.1
April	1.04	1.05	0.25	0.09	1.43	0.82	2.64	0.54	1.09	41.7
May	1.05	1.06	0.19	0.05	1.45	0.59	2.18	0.54	1.03	28.1
June	1.06	1.07	0.22	0.05	1.27	0.42	2.58	0.45	1.02	75.9
July	1.07	1.08	0.11	0.03	1.15	0.29	1.59	0.35	0.76	47.8
August	1.08	1.09	0.22	0.04	1.56	0.58	1.69	0.64	1.31	48.5
September	1.09	1.10	0.43	0.10	1.54	1.27	4.23	1.08	2.15	55.4
October	1.10	1.11	0.28	0.04	1.41	0.75	1.72	0.45	0.61	23.6
November	1.11	1.12	0.41	0.06	2.13	1.50	2.17	0.52	0.70	33.9
December	1.12	1.01	0.18	0.04	2.66	0.61	1.32	0.47	0.54	13.3

NO0001R – Birkenes
Concentrations in air

	From:	To:	HNO_3+NO_3 µg N/m^3	NH_3+NH_4 µg N/m^3	NO_2-N µg N/m^3
January	1.01	1.02	0.30	0.22	0.82
February	1.02	1.03	0.18	0.14	0.46
March	1.03	1.04	0.52	0.23	0.75
April	1.04	1.05	0.61	0.25	0.36
May	1.05	1.06	0.54	0.18	0.46
June	1.06	1.07	0.60	0.21	0.39
July	1.07	1.08	1.16	0.15	0.40
August	1.08	1.09	0.48	0.20	0.38
September	1.09	1.10	0.78	0.31	0.56
October	1.10	1.11	0.47	0.15	0.54
November	1.11	1.12	0.34	0.26	0.64
December	1.12	1.01	0.15	0.10	0.50

Portugal

PT0003R – Viana do Castelo
Concentrations in precipitation

	From:	To:	Precip.	Cd		Cu	Pb		Ni		Zn	Mn	NH_4-N	NO_3-N
			mm	µg/l	flag	µg/l	µg/l	flag	µg/l	flag	µg/l	µg/l	mg/l	mg/l
January	1.01	1.02	128.0	0.43	780	2.67	1.59		1.63		24.2	5.15	0.16	0.25
February	1.02	1.03	27.5	0.43	780	2.39	0.65	780	0.78	780	28.6	3.54	0.27	0.19
March	1.03	1.04	112.6	0.52		1.94	0.65	780	0.87		15.1	3.35	0.31	0.14
April	1.04	1.05	140.7	0.43	780	2.37	0.65	780	0.78	780	25.5	2.25	0.12	0.17
May	1.05	1.06	96.2	0.43	780	2.16	0.88		1.47		12.5	2.38	0.22	0.26
June	1.06	1.07	14.7	0.59		2.72	0.65	780	1.51		23.2	3.43	0.20	0.26
July	1.07	1.08	15.9	0.43	780	3.19	0.65	780	0.78	780	60.4	6.88	0.37	0.27
August	1.08	1.09	85.4	0.43	780	3.87	0.65	780	1.53		12.9	2.72	0.14	0.15
September	1.09	1.10	359.6	0.43	780	2.46	0.65	780	0.78	780	7.4	2.91	0.12	0.04
October	1.10	1.11	217.3	0.43	780	2.22	0.78		0.78	780	7.2	2.24	0.10	0.04
November	1.11	1.12	84.1	0.43	780	2.54	0.87		0.78	780	19.7	3.47	0.11	0.18
December	1.12	1.01	213.8	0.43	780	3.10	0.65	780	0.78	780	17.8	2.47	0.07	0.13

Flags not given as daily data submitted

PT0004R – Monte Velho
Concentrations in precipitation

	From:	To:	Precip.	Cd		Cu		Pb		Ni		Zn		Mn		NH_4-N	NO_3-N
			mm	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	mg/l	mg/l
January	1.01	1.02	63.5	0.61		0.79		0.55	780	1.06		19.86		5.01		0.04	0.13
February	1.02	1.03	10.9	0.87		2.08		0.65	780	0.78	780	27.34		2.90		1.41	0.71
March	1.03	1.04	87.4	0.43	780	0.71		0.65	780	0.78	780	10.76		1.49		0.09	0.07
April	1.04	1.05	25.3	0.43	780	2.71		0.65	780	2.02		20.47		5.05		1.24	0.24
May	1.05	1.06	63.5	0.55		1.85		0.69		2.25		13.47		3.25		0.27	0.27
June	1.06	1.07	0.0		999		999		999		999		999		999		
July	1.07	1.08	0.0		999		999		999		999		999		999		
August	1.08	1.09	13.2	0.43	780	2.43		0.65	780	2.09		14.00		1.08		0.02	0.16
September	1.09	1.10	86.4	0.43	780	1.50		0.65	780	0.78	780	22.00		6.53		0.33	0.22
October	1.10	1.11	123.3	0.43	780	1.37		0.65	780	0.78	780	5.71		2.66		0.20	0.09
November	1.11	1.12	42.6	0.43	780	0.93		1.13		0.78	780	6.33		8.39		0.15	0.18
December	1.12	1.01	43.9	0.43	780	1.36		0.65	780	0.78	780	4.19		1.08		0.02	0.08

PT0010R – Angra do Heroismo
Concentrations in precipitation

	From:	To:	Precip.	Cd		Cu		Pb		Ni		Zn		Mn		NH_4-N		NO_3-N	
			mm	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	ng/l	flag	mg/l	flag	mg/l	flag
January	28.12	26.01	112.3	0.87		1.95		0.65	780	7.02		99.61		5.84		0.05		0.17	
February	26.01	23.02	28.3	0.43	780	3.30		0.65	780	11.32		150.97		13.71		0.25		0.20	
March	23.02	23.03	54.9	0.43	780	1.23		1.12		2.35		32.90		2.61		0.04		0.20	
April	23.03	27.04	56.9	0.43	780	1.05		1.14		4.36		12.44		6.21		0.04		0.32	
May	27.04	25.05	85.9	1.04		1.08		0.81		1.73		12.24		3.84		0.02		0.24	
June	25.05	29.06	57.5	2.40		2.19		0.70		2.44		16.38		3.65		0.02		0.28	
July	29.06	27.07	13.6	0.66		4.52		6.16		5.41		53.36		12.78		0.04		0.59	
August	27.07	24.08	71.7	0.43	780	1.98		1.23		1.33		18.18		2.61		0.05		0.15	
September	24.08	28.09	84.4	0.43	780	3.25		1.91		0.78	780	19.43		4.37		0.02		0.08	
October	28.09	26.10	53.3	0.43	780	1.38		1.14		0.78	780	16.48		3.87		0.08		0.08	
November	26.10	23.11	148.7	0.43	780	1.70		0.73		0.78	780	91.40		13.06		0.10		0.14	
December	23.11	28.12	183.4	0.43	780	2.38		0.65	780	0.78	780	124.94		25.48		0.02		0.14	

Sweden

SE0002R – Rørvik

Concentrations in precipitation

	From:	To:	Precip.	Hg		Precip.	NH_4-N	NO_3-N
			mm	ng/l	flag	mm	mg/l	mg/l
January	1.01	1.02	47	7.3		69.8	0.41	0.64
February	1.02	1.03	49	8.9		58.3	0.32	0.44
March	1.03	31.03	41	11.4		63.5	1.54	1.29
april	31.03	30.04	81	9		54.3	0.50	0.39
May	30.04	31.05	30	18.7		35.5	0.66	0.51
June	31.05	30.06	109	11.1		146.7	0.38	0.40
July	30.06	31.07	40	12.7		62.7	0.42	0.40
August	31.07	31.08	110	6.4		121.4	0.34	0.33
September	31.08	30.09	108	9.1		68.2	0.57	0.62
October	30.09	31.01	68	6.8		87.3	0.38	0.41
November	31.01	30.11	9	13.8		12.0	0.94	1.25
December	30.11	30.12	Lost		890	87.6	0.17	0.31

Concentrations in air

	HNO_3+NO_3	NH_3+NH_4	NO_2
	µg N/m^3	µg N/m^3	µg N/m^3
January	0.66	0.75	2.63
February	0.74	0.66	2.36
March	0.92	1.55	1.91
April	2.23	2.85	1.62
May	0.48	0.63	1.21
June	0.58	0.82	0.93
July	0.45	0.72	1.02
August	0.37	0.60	0.96
September	0.75	1.35	1.18
October	0.40	0.67	1.19
November	0.75	1.11	2.42
December	0.21	0.16	1.52

SE0097R – Gårdsjøn

Concentrations in precipitation

	From:	To:	Precip.	As		Cd		Cr		Pb		Ni		Zn	
			mm	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag
January	4.01	28.01	199	0.10	781	0.07		0.15		1.08		0.19		3.94	
February	28.01	2.03	40	0.10	781	0.03		0.36		1.42		0.34		5.82	
March	2.03	30.03	172	0.10	781	0.11		0.39		2.91		0.45		8.88	
April	30.03	2.05	34	0.10	781	0.05		0.25		2.63		0.06		15.47	
May	2.05	31.05	97	0.10	781	0.01		0.20		1.16		0.08		13.42	
June	31.05	1.07	83	0.11		0.05		0.36		1.60		0.29		16.30	
July	1.07	1.08	119	0.10	781	0.03		0.17		1.43		0.09		10.92	
August	1.08	30.08	60	0.10	781	0.03		0.23		2.41		0.05	781	24.28	
September	30.08	29.09	105	0.11		0.04		0.29		1.75		0.22		26.06	
October	29.09	2.11	97	0.10	781	0.03		0.18		0.99		0.13		12.68	
November	2.11	6.12	Lost		999		999		999		999		999		999
December	6.12	6.01	91	0.08		0.01		0.16		1.01		0.17		2.98	

	From:	To:	Precip. mm	NO_3-N mg/l	NH_4-N mg/l
January	4.01	28.01	161	0.47	0.31
February	28.01	2.03	60	0.57	0.40
March	2.03	30.03	131	0.81	0.93
April	30.03	2.05	126	0.32	0.39
May	2.05	31.05	106	0.41	0.66
June	31.05	1.07	170	0.42	0.38
July	1.07	1.08	62	0.56	0.77
August	1.08	30.08	87	0.39	0.39
September	30.08	29.09	78	0.36	0.41
October	29.09	2.11	124	0.33	0.27
November	2.11	6.12	25	1.27	0.18
December	6.12	6.01	274	0.28	0.19

SE0098R – Svartedalen
Concentrations in precipitation

	From:	To:	Precip. mm	flag	NH_4-N mg/l	flag	NO_3-N mg/l	flag
January	5.01	29.01	166		0.09		0.25	
February	29.01	2.03	132		0.57		0.75	
March	2.03	30.03	122		1.39		1.11	
April	30.03	13.05	166		0.47		0.35	
May	13.05	2.06	50		1.23		0.89	
June	2.06	29.06	165		0.47		0.51	
July	29.06	1.80		999		999		999
August	3.08	31.08	109		0.46		0.43	
September	31.08	30.09	118		0.49		0.48	
October	30.09	31.10	108		0.28		0.32	
November	31.10	2.12		999		999		999
December	2.12	6.01	269		0.24		0.36	

United Kingdom

GB0014R – High Muffles
Concentrations in precipitation

	From:	To:	Precip.	As		Cd		Cr		Cu		Pb		Ni		Zn	
			mm	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag
January	30.12	3.02	84.7	0.25		0.06		0.09		1.90		2.8		0.26		4.7	
February	3.02	3.03	45.9	0.18		0.06		1.00		2.00		2.2		0.37		3.8	
March	3.03	31.03	178.1	0.18		0.08		0.15		1.10		3.1		0.27		4.4	
April	31.03	5.05	71.4	0.13		0.04		0.05		1.90		1.9		0.19		4.3	
May	5.05	2.06	51.3	0.30		0.31		3.50	459	3.50		4.7		1.10		7.6	
June	2.06	30.06	77.1	0.79		0.04		0.003	781	2.90		2.3		0.38		0.8	
July	30.06	3.08	24.6	0.20		0.04		0.20		2.00		2.4		0.46		8.8	
August	3.08	1.09	115.9	0.07		0.03		0.10		0.45		1.0		0.10		24.0	459
September	1.09	29.09	64.5	0.29		0.06		0.20		1.20		3.4		0.36		8.8	
October	29.09	3.11	78.1	0.20		0.08		0.32		0.85		2.2		0.31		5.3	
November	3.11	1.12	76.6	0.20		0.06		0.20		0.78		2.2		0.33		4.6	
December	1.12	1.01	82.8	0.20		0.05		0.20		0.66		1.9		0.20		6.8	

Concentrations in air

	From:	To:	As		Cd		Cr		Cu		Pb		Ni		Zn	
			ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag
January	30.12	3.02	0.08		0.20		0.04	781	4.80		0.6		0.68		7.7	
February	3.02	3.03	0.51		0.19		0.03		8.82		6.8		2.16		18.0	
March	3.03	31.03	0.70		0.20		0.77		2.59		8.2		0.89		12.3	
April	31.03	5.05	0.68		0.18		0.79		3.18		8.3		0.82		9.3	
May	5.05	2.06	0.55		0.06		0.04	781	2.32		6.3		1.18		27.5	
June	2.06	30.06	0.45		0.04		0.06		3.84		5.3		1.19		49.0	
July	30.06	3.08	0.31		0.11	781	0.04	781	9.15		8.0		0.08	781	30.9	
August	3.08	1.09	0.83		0.12	781	0.04	781	9.13		8.7		0.08	781	30.7	
September	1.09	29.09	0.87		0.13	781	0.04	781	8.71		15.7		0.09	781	95.9	
October	29.09	3.11	0.29		0.10	781	0.04	781	1.46		8.8		21.19	459	208.3	459
November	3.11	1.12	1.37		0.12	781	0.04	781	2.36		21.1		0.08	781	31.5	
December	1.12	1.01	0.87		0.44		0.04	781	1.96		11.3		0.09	781	126.1	

GB0090R – East Ruston
Concentrations in precipitation

	From:	To:	precip	As		Cd		Cr		Cu		Pb	
			mm	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag
January	11.12	18.01	116.0	0.08		0.02		0.06		0.60		1.1	
February	18.01	2.03	83.0	0.12		0.03		0.37		0.84		1.7	
	March/April single sample												
March/April	2.03	28.04	88.5	0.25		0.07		0.32		2.00		2.5	
May	28.04	31.05	31.8	9.40	459	0.15		2.50		2.90		5.1	
June	31.05	28.06	72.2	0.14		0.04		0.16		1.10		1.4	
July	28.06	3.08	65.0	0.10		0.04		0.48		1.60		1.4	
August	3.08	30.08	127.6	0.09		0.03		0.09		0.82		1.5	
September	30.08	12.10	152.0	0.10		0.04		0.10		0.90		1.9	
October	12.10	10.11	48.0	0.25		0.09		0.10		1.30		2.3	
November	10.11	2.12	41.5	0.10		0.04		0.20		1.10		1.0	
December	2.12	11.01	88.0	0.09		0.02		6.10	459	2.40		2.4	

Concentrations in air

	From:	To:	As		Cd		Cr		Cu		Pb		Ni		Zn	
			ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag
January	11.12	18.01	3.13		0.20		0.47		2.91		8.2		0.69		7.5	
February	18.01	2.03	0.51		0.16		0.82		3.20		1.0		1.05		10.7	
	March/April single sample															
March/April	2.03	28.04	0.81		0.24		0.66		2.91		12.8		1.82		15.0	
May	28.04	31.05	0.36		0.19		0.39		1.26		6.9		1.84		18.1	
June	31.05	28.06	0.39		0.07		0.10	781	1.45		8.1		1.45		10.6	
July	28.06	3.08	0.79		0.09	781	0.03	781	4.11		15.0		0.06	781	29.3	
August	3.08	30.08	0.89		0.12	781	3.49		3.84		17.5		0.08	781	22.1	
September	30.08	12.10	1.62		0.48	781	1.90		5.47		28.5		0.05	781	28.5	
October	12.10	10.11	1.93		0.36		0.04	781	5.36		32.1		0.07	781	2.4	
November	10.11	2.12	1.86		0.47		0.05	781	3.21		27.4		0.09	781	32.5	
December	2.12	11.01	1.68		0.80		0.03	781	4.27		34.7		0.05	781	25.6	

GB0091R – Banchory
Concentrations in precipitation

	From:	To:	precip	As		Cd		Cr		Cu		Pb		Ni		Zn	
			mm	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag	µg/l	flag
January	31.12	27.01	48.6	0.06		0.03		0.34		5.4		0.76		0.14		2.4	
February	27.01	5.03	70.4	0.08		0.04		0.18		1.1		1.10		0.17		2.1	
March	5.03	1.04	31.9	0.09		0.04		1.80	459	1.2		0.79		0.94		1.9	
April	1.04	30.04	70.0	0.07		0.05		0.15		0.6		1.10		0.14		3.1	
May	30.04	4.06	55.5	0.26		0.10		0.003	781	3.4		3.00		0.71		4.6	
June	4.06	2.07	82.8	0.62	459	0.03		0.003	781	29.0	459	0.57		0.65		0.8	
July	2.07	30.07	52.3	0.07		0.04		0.06		0.9		0.74		0.20		2.7	
August	30.07	31.08	42.9	0.09		0.04		0.10		1.0		0.86		0.20		5.3	
September	31.08	1.10	133.0	0.20		0.05		0.10		0.6		1.50		0.20		4.1	
October	1.10	2.11	133.0	0.05		0.12		0.41		0.7		0.32		0.20		3.9	
November	2.11	6.12	80.9	0.05		0.10		0.41		0.7		0.31		0.30		3.6	
December	6.12	7.01	115.6	0.03		0.02		0.02		0.3		0.40		0.20		15.0	459

Concentrations in air

	From:	To:	As		Cd		Cr		Cu		Pb		Ni		Zn	
			ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag	ng/m^3	flag
January	31.12	27.01	0.18		0.13		0.36		1.32		1.20		0.10	781	5.10	
February	27.01	5.03		999		999		999		999		999		999		999
March	5.03	1.04	0.10		0.11		0.41		0.98		1.86		0.10	781	2.63	
April	1.04	30.04	0.12		0.13		1.03		0.92		1.70		0.10	781	3.40	
May	30.04	4.06	0.10		0.03				0.77		1.93		0.51		10.7	
June	4.06	2.07	0.83		0.03				0.51		0.25		0.05			999
July	2.07	30.07	0.30		0.15	781	0.99		3.43		2.29		0.10	781	14.9	
August	30.07	31.08	0.27		0.14	781	0.05		1.85		2.62		0.10	781	22.6	
September	31.08	1.10	0.22		0.16	781	2.18		0.27		2.34		0.10	781	14.2	
October	1.10	2.11	0.16		0.12	781	0.04		2.20		4.48		0.10	781	32.6	
November	2.11	6.12	0.37		0.14	781	3.25		0.47		2.32		0.10	781	22.8	
December	6.12	7.01	0.30		0.11	781	10.39	459	0.52		3.60		0.10	781	23.0	

Appendix B

Principles for the Comprehensive Atmospheric Monitoring Programme (CAMP)

1. Objectives

The main objectives of the CAMP are to monitor the concentrations of selected contaminants in precipitation and air and their depositions in order:

- to assess, as accurately as appropriate, the atmospheric input of the selected contaminants to the maritime area and regions thereof on an annual basis;
- to determine long-term trends in atmospheric inputs;
- for their use in relation to modelling activities, specifically to validate atmospheric transport models used for assessments of atmospheric inputs to maritime area.

2. The network[1]

Each Contracting Party bordering the maritime area (EU excluded) should have at least one monitoring station on the coast and/or offshore to be included in the joint monitoring programme. Contracting Parties which border more than one OSPAR Region should have at least one monitoring station at the coast and/or offshore within each. The station should be a so-called *background station*, that is, a station which is not directly influenced by local sources. The station should be located not more than 10 km from the coastline. At the station simultaneous measurements of the chemical composition of air and precipitation are to be performed.

3. Chemical composition of precipitation

3.1. Components to be measured[2]

The following contaminants are to be measured on a mandatory basis in precipitation:

• heavy metals:	arsenic cadmium chromium copper lead mercury nickel zinc
• persistent organic contaminants:	γ-HCH[3] (lindane)
• nutrients:	ammonium (NH_4^+) nitrate (NO_3^-)

---

[1] Contracting Parties should take into account developments within the framework of other international organisations (particularly AMAP, EMEP, HELCOM and WMO).

[2] Not all contaminants included in the Joint Assessment and Monitoring Programme (JAMP) are mentioned here as mandatory or voluntary components. Reasons are either because the atmospheric pathways are negligible (e.g. oil, TBT) or because routine monitoring methods are extremely expensive or not yet fully developed (e.g. furans, dioxins). However, when information is available, for example during a measuring campaign, Contracting Parties are strongly encouraged to submit these data to the data base manager.

[3] In view of the low concentrations, the monitoring of α-HCH is no longer mandatory. When γ-HCH is not measured as a separate component, it should be clearly stated in the data reports that total HCH has been measured.

The following contaminants should be measured on a voluntary basis in precipitation:

• persistent organic contaminants:	the PCB-congeners 28, 52, 101, 118, 138, 153 and 180[4] the following PAHs: phenanthrene, anthracene, fluoranthene, pyrene, benzo[*a*]anthracene, chrysene, benzo[*a*]pyrene, benzo[*ghi*]perylene, indeno[*1,2,3-cd*]pyrene

For quality assurance purposes Contracting Parties are encouraged to report pH, electrical conductivity and the concentrations in precipitation of the major ions (Na^+, K^+, Ca^{2+}, Mg^{2+}, SO_4^{2-}, Cl^-, NH_4^+, NO_3^-, HCO_3^-).

3.2. Sampling and analysing methods[5]

For CAMP the use of wet-only samplers is recommended. The use of bulk collectors is acceptable when on a regular basis, an intercomparison of results of wet-only and bulk samplers actually in use in the network takes place. Samplers should be designed for sampling during all seasons and climatic conditions. Formation of ice in funnel or bottle must be avoided; at stations where high temperatures are expected in the summer, cooling of the samples might be needed. The size of funnel and bottles should be adapted to the length of the sampling period and expected precipitation amount.

Each individual sampler must be identified with a short, unique name[6], for bulk precipitation samplers, the bucket stand is named and the bucket itself is a nameless consumable. All measurements must be related to a field sampler or instrument identified in this manner. Official precipitation amounts should be reported where available (see paragraph 3.4). In addition, the precipitation amount measured in each individual sampler must be reported.

There are several methods for analysing of heavy metals (excluding mercury) in precipitation and in aerosol filters. Direct methods without extraction of the filters are instrumental neutron activation analysis (INAA), particle induced X-ray emission (PIXE) and X-ray fluorescence. Methods for analysing heavy metals in precipitation and dissolved particles from filters are atomic absorption spectroscopy (AAS) with flame- or electrothermal atomisation, inductively coupled plasma optical emission spectroscopy (ICP-OES) and inductively coupled plasma mass spectroscopy (ICP-MS). The latter method (ICP-MS) has been recommended at an EMEP workshop (Moscow, September 1996) as the analytical reference method for the heavy metals As, Cd, Cr, Cu, Ni, Pb, and Zn.

---

[4] Although atmospheric input is estimated to be the most important input route to the maritime system it is judged not appropriate to recommend the mandatory monitoring of PCBs taking into account that PCBs were due to be phased out in all Contracting Parties. In this regard it is proposed that it is more appropriate to recommend targeted monitoring activities in areas expected to have relatively high PCB loads.

[5] See for an overview of sampling and analysing methods currently in use within Europe the report and proceedings of the workshop on the assessment of EMEP activities concerning Heavy Metals and Persistent Organic Pollutants and their further development, Moscow, Russian Federation, 24-26 September 1996; Report 117, Volumes I and II, World Meteorological Organisation, Global Atmospheric Watch, Geneva, Switzerland.

[6] For more details, see chapter 6.1.

In designing a sampling methodology the JAMP guidelines for the Sampling and Analysis of Mercury in Air and Precipitation and the JAMP Guidance Note on Sampling and Analysis of PCBs in Air and Precipitation should be taken into account[7].

In general terms the detection limits of the measured contaminants should be well below the ambient levels by a factor of 10.

3.3. Sampling frequency

Sampling periods from one week to one month are acceptable. It is recommended however, that samples should be taken on a weekly basis in order to reduce the risk of (bio)chemical change in samples and/or the accidental contamination of samples (e.g. via bird droppings). When the samples are stored in a safe way (e.g. frozen) two or more samples can be combined before analysis to longer, regular intervals (e.g. monthly or 4-weekly averaged samples).

If weekly sampling is used and if a week includes two adjacent months, the measured data should be allocated to the month which comprises the largest number of days in the week in question. It is recommended , however, to have two sampling periods for a week that crosses a month boundary, even if one of these is only a one-day sample. It is recommended that samples are always changed at a fixed time (e.g. at 8.00 am (UT)) on every Tuesday and on the first of every month.

3.4. Precipitation amount

For the evaluation of the chemical composition of precipitation and for the estimation of wet deposition fluxes correct data on precipitation amounts is needed. Common practice has shown that the efficiency of chemical samplers for sampling of precipitation may differ considerably even for identical samplers; this results in different “observed” precipitation amounts (and therefore wet deposition fluxes). Parallel to the chemical measurements a standard rain gauge should be used according to WMO recommendations for measuring the precipitation amount. Alternatively, the results of a nearby located meteorological station which is shown to be representative for the CAMP-location may be used.

4. Chemical composition of ambient air and aerosol

4.1. Components to be measured

The following contaminants are to be measured on a mandatory basis in air:

- nutrients:	in gaseous phase: NO_2, HNO_3, and NH_3 in aerosol phase[8]: ammonium (NH_4^+) and nitrate (NO_3^-)

The following contaminants should be carried out on a voluntary basis in air:

- heavy metals:	arsenic cadmium chromium copper lead mercury

---

[7] Secretariat Note: these JAMP Guidelines are available from the OSPAR Secretariat on request.

[8] As an alternative total nitrate (sum of gaseous HNO_3 and particulate NO_3) and total ammonium (sum of gaseous NH_3 and particulate NH_4) can be measured.

	nickel zinc
• nutrients:	NO
• persistent organic contaminants:	γ-HCH (lindane) the PCB-congeners 28, 52, 101, 118, 138, 153 and 180 the following PAHs: phenanthrene, anthracene, fluoranthene, pyrene, benzo[a]anthracene, chrysene, benzo[a]pyrene, benzo[ghi]perylene, indeno[1,2,3-cd]pyrene

4.2. Sampling and analysing methods[9]

High volume samplers or medium volume samplers equipped with cellulose fibre filters or membrane filters are currently in use for collection of aerosol. The recommended analytical method for As, Cd, Cr, Cu, Ni, Pb, and Zn is ICP-MS; other analytical methods are mentioned in section 3.2.

In designing a sampling methodology the JAMP Guidelines for Sampling and Analysis of Mercury in Air and Precipitation[10] and the JAMP Guidance Note on Sampling and Analysis of PCBs in Air and Precipitation[11] should be taken into account.

In general terms the detection limits of the measured contaminants should be well below the ambient levels by a factor of 10.

Knowledge of the particle size distribution is desirable for estimating dry deposition fluxes; size distribution forms an essential input parameter in transport/deposition models. Size distributions of heavy metal particles have been extensively studied with the help of cascade impactors. For routine monitoring cascade impactors are too expensive; a separation into two classes (cut-off at 2.5 μm) is possible using commercially available samplers.

4.3. Sampling frequency

For heavy metals and POP in gas and aerosol phase a sampling period of 24h is recommended. When only a limited number of samples can be taken within a given time period (e.g. due to budgetary constraints) it is suggested to take one 24h sample every five or six days[12]. In this strategy the number of samples to be analysed is limited to 70 or 60 annually; in this way, seasonal changes might be detectable and a reliable yearly averaged concentration will be obtained. In monitoring pesticides a higher frequency during the application period might be necessary.

---

[9] See for an overview of sampling and analysing methods currently in use within Europe the report and proceedings of the workshop on the assessment of EMEP activities concerning Heavy Metals and Persistent Organic Pollutants and their further development, Moscow, Russian Federation, 24-26 September 1996; Report 117, Volumes I and II, World Meteorological Organisation, Global Atmospheric Watch, Geneva, Switzerland.

[10] Adopted by ASMO 1997; final version (23 February 1998) circulated to Contracting Parties on 24 February 1998.

[11] Adopted by ASMO 1997; final version (23 February 1998) circulated to Contracting Parties on 24 February 1998.

[12] A sampling frequency of once per week should be avoided as this might introduce a systematic error. There is, for example, a clear difference in NO_x concentrations during the weekend and during working days. For heavy metals and POP such systematic differences can not be excluded a priori.

With respect to the nitrogen species, the gaseous compounds NO and NO_2 should be measured on a continuous base (aggregated to hourly averages before reporting); for the other N-compounds sampling period/frequency should not be less than 24h-average samples on a daily base.

5. Quality assurance

The low ambient concentrations of trace elements will easily cause wrong measurements if strict precautions are not taken to prevent contamination and other sources of errors. Quality assurance (QA) is therefore recognised as an essential component in air quality monitoring. Until now a quality assurance and quality control programme for the CAMP network has not been developed. It is strongly recommended to develop such a programme in close co-operation with other international monitoring networks (in particular, HELCOM, AMAP and EMEP)[13]. It is unlikely that full QA procedures will be established in the short term in all laboratories participating in CAMP. Nevertheless a minimum requirement, to ensure that comparable quality data is produced, must be established. This minimum program should include the following points:

- requirements on documentation of procedures for sampling and analysis;
- a training programme for the persons involved in the various tasks of the monitoring procedure;
- regular of analytical intercalibrations of prepared samples;
- field intercalibrations of sampling and analyses;
- implementation of an audit program where stations are visited by experts.

It is essential that all participating organisations agree a programme to introduce QA procedures (at least the minimum set given above) and make a commitment to their strict adherence.

6. Reporting Procedures

In accordance with the OSPAR/NILU Data Management Contract, Annex 1, as presented to INPUT(1) 1998 (cf. INPUT(1) 98/3/Info.1)[14], Contracting Parties should submit, on a yearly base, CAMP data to the database manager (NILU, Kjeller, Norway) using a reporting format and according to the time schedule attached at Appendix 1. To allow data exchange and QA co-operation with EMEP, EMEP naming conventions should be used for organisation codes, station codes, field instrument references and sampling method references. In cases where the monitoring of components on the voluntary list is not performed, it would be useful if the Contracting Parties concerned could provide a short justification for not including these measurements in their national monitoring programmes.

Contracting Parties have to provide the database manager with one contact point (institutes and contact person) which is responsible for the monitoring activities on CAMP stations and which can serve as contact point for the exchange of information concerning

---

[13] See e.g. the conclusions and draft recommendations of the EMEP-WMO workshop on data analysis, validation and reporting, Usti nad Labem (Czech Republic), 27-30 April 1997, UN-ECE.EB.AIR/GE.1/1997/7.
One recommendation of the workshop may need special attention: results from various field intercomparisons of heavy metal deposition showed large differences between deposition even from identical samplers close to each other. A strong reduction in uncertainties can be realised by parallel measurements with at least two identical samplers at one site. When two or more samplers are installed, procedures for detecting outliers and for reporting the measurements (e.g. is the averaged or median value reported) have to be defined.

[14] Secretariat Note: details available from the OSPAR Secretariat on request.

monitoring data, atmospheric inputs of contaminants to the maritime area, methods of analysis of atmospheric contaminants and possible intercalibration activities.

6.1. Additional requirements on information of monitoring stations[15]

For a proper evaluation of the monitoring results the following (meta) information on the station should be supplied to the database manager:

- station name and station code;
- organisation responsible for operation of the station and name of contact person;
- co-ordinates; clearly indicate whether co-ordinates are given in degrees-minutes-seconds or in degrees and decimal units;
- altitude: height of the station above sea level (m);
- start date: date on which the station became operational;
- description of station environment: describe the siting of the station (e.g. located in a nature area, an agricultural area mainly with intensive cattle breeding);
- description of main emission sources: describe the nearest pollution sources (e.g. nearest city is Leyden (150,000 inhabitants, 15 km in southern direction);
- meteorological parameters measured at the station in addition to air contaminants;
- prevailing meteorological conditions (e.g. wind rose).

For each component the following information on the measurement configuration is needed:

- component;
- for automatic devices: name/type/version of monitor and measurement technique;
- for manual or semi-automatic devices: name/type of equipment to obtain sample, analytical principle used;
- calibration method, frequency of calibration;
- integration time of results;
- height of sampling point above surface;
- length of sampling line;
- whether the sampling line is heated;
- start/end date of configuration.

An organisation is defined as the operator of a station and the owner of a field instrument. The organisation code has the form NL01L (the last L declares that this organisation is a laboratory, and it is laboratory 1 in the Netherlands). Station number 3 in the Netherlands will have the code NL0003R (4 digit number, + the code R for regional background station). The organisation may have bulk samplers operated at several stations. We need to relate the sampler to the organisation with a reference like NL01L_bu1. A reference in this context is always constructed by the organisation code, an underscore character, and a name (the name only needs to be unique within the organisation that creates it, the

---

[15] A preliminary list of requested items is presented here. Contents, units and formats will be specified in detail by the data base manager in the call for meta-information and monitoring data.

reference will then be unique world-wide). Also method references are created in the same manner.

7. Calculation of long-term averaged concentrations

7.1 Precipitation

The yearly averaged concentration in precipitation, $\overline{C}$, should be estimated by precipitation amount weighted averaging of the concentrations for each of the sampling periods:

$$\overline{C} = \frac{\sum_{i=1}^{N} P_i C_i}{\sum_{i=1}^{N} P_i} \qquad [1]$$

where N is the number of sampling periods in one year, P_i is the precipitation amount and C_i is the reported concentration in period i.

When the concentration in a period (or part of a period) is below the measurement limit of detection (DL), the value may be reported:

1. as the observed value or computed average with the flag 0.000, if an insignificant number of input elements are non-numeric (less than 25% missing or below the detection limit). For non-continuous instruments or samplers the value must be positive and above the detection limit, for continuous monitors the value may be below the noise level or may be negative (close to zero).
2. as an estimate with the flag 0.780 if a significant number of input elements (between 25% and 50%) are missing or below the detection limit. The estimate may be negative for continuous monitors, it may be below the detection limit (but positive) for non-continuous instruments.
3. as BDL (below detection limit), where the flag is 0.781 and the value contains the detection limit (no valid numerical value is available in this case). This can also be used for aggregates where 50% or more of the input elements are missing or BDL.
4. as missing with the flag 0.999 if 50% or more of the input elements are missing or BDL (the data originator, knowing his instrument, method and the typical variations in the signal, must decide whether missing or BDL is the most correct result).

It is recommended to report the actual measured value (method 1) with a clear indication of the DL (e.g. in parentheses). When the measurement technique does not permits this, the measurements should be flagged as *below detection limit*. In the framework of EMEP and HELCOM a reporting format including instructions for exception flagging (e.g. missing data, data below detection limit) has been adopted by these organisations[16]. It is recommended to follow similar procedures in reporting CAMP data.

When data coverage is less then 75% no reliable yearly average concentration can be calculated. During evaluation of data coverage concentrations below detection limit should be seen as *missing data.* In the evaluating of averages, the actual observed values

---

[16] See Krognes T, Gunstrøm T.Ø. and Schaug J. (1995) Air Quality databases at NILU. EBAS version 1.01. Report TR3/95, NILU, Kjeller, Norway.

are used for data below detection limit; when only a flag *below detection limit* is reported, a value of 50% of the reported detection limit[17] is used in the averaging procedure, eq [1].

7.2 Ambient air and aerosol

The monthly averaged concentration in air or aerosol, $\overline{C}_m$, is estimated by numerical averaging of the concentrations for each of the sampling periods:

$$\overline{C}_m = \frac{1}{N}\sum_{i=1}^{N} C_i \qquad [2]$$

where N is the number of sampling periods in one month, and C_i is the concentration in period i.

When the concentration in a period is below the measurement limit of detection (DL), the actual measured value should be reported with a clear indication of the DL (e.g. in parentheses), see the discussion above on precipitation data. When the measurement technique does not permits this, the measurements should be flagged as *below detection limit*.

When data coverage is less then 50% no reliable monthly average concentration can be calculated. During evaluation of data coverage concentrations below detection limit should be seen as *missing data.* In the evaluating of averages, the actual observed values are used for data below detection limit; when only a flag *below detection limit* is reported, a value of 50% of the reported detection limit is used in the averaging procedure, eq [2]. A yearly averaged concentration is obtained by averaging the monthly concentrations; at least nine monthly values (75%) should be available.

8. Methodology for assessment of atmospheric inputs

The atmospheric input is a mass of a contaminant carried to the maritime area via the atmosphere. Total deposition consists of the sum of wet and net dry deposition; for (semi)-volatile compounds the net dry deposition term includes the mass which has re-volatilised from the sea surface[18].

Although the location of CAMP monitoring stations has been carefully selected and measurements are not directly influenced by inland sources, the atmospheric input to the marine area can not be calculated directly from the (land-based) measurements. For several reasons deposition estimates based on averaging the deposition flux over all monitoring stations will be in error:

- As sources of contaminants are mainly land-based one can expect that the concentrations in the more remote parts of the Convention waters will be lower than at coastal stations; the use of coastal data might lead to an overestimation of atmospheric inputs.
- For (semi)-volatile POP the dry deposition estimates based on ambient data will not include the effect of re-volatilisation.

---

[17] In earlier discussions on this point in the former ATMOS working group, a factor of 2/3 has been introduced. In agreement with the procedures of EMEP and HELCOM here a factor of 1/2 is recommended.

[18] Note that the net dry deposition term might be negative. This might be the case when some material which entered the maritime system by other pathways (e.g. wet deposition, riverine input, direct dumping) re-volatises.

- It is generally assumed that precipitation amounts at open sea are lower than at nearby land areas; the use of coastal precipitation data might lead to an overestimation of atmospheric inputs. Precipitation rates at coastal stations are extremely variable; for example, coastal stations in the United Kingdom have generally less precipitation than the stations in Norway, most probably due to orographic effects. To take this into account, and to correct for the smaller precipitation amount at open sea, a method which allows variable amounts of precipitation to be used based on 70% of the median values for coastal stations has been proposed for estimation of inputs to the North Sea.
- The CAMP monitoring stations are not regularly spaced along the coast line of the maritime area. For example, for the North Sea an averaging of deposition fluxes measured at coastal stations may over-estimate the atmospheric input due to the relatively higher network density in the southern, more polluted part of the North Sea. Other interpolation methods e.g. by inverse distance weighting, may overcome this problem but any concentration gradients from land to sea due to removal processes or due to dilution (the first point discussed above) is still not accounted for.

Since in the CAMP-network measurements are available on a monthly or 4-weekly basis only, it is not possible to separate on-shore and off-shore winds and estimate direction dependent concentrations. However, it is possible to apply a bulk gradient correction factor for each station derived from calculation with an atmospheric transport model. These *dispersion factors f(i)* are defined as the ratio of the modelled deposition flux at station *i* to the modelled deposition flux at the Convention Waters as a whole or sub-regions of it. This model-based dispersion factor can now be applied to extrapolate the measured deposition at the coastal station to the whole North Sea area and/or its sub-regions; total deposition is calculated by:

$$d_{(wet+dry)} = A\frac{\sum_{i=1}^{i=n_w} C_w(i)\, pa_{land}\ f_w(i)}{n_w} + A\frac{\sum_{i=1}^{i=n_a} C_a(i)\, v_d\ t\ f_a(i)}{n_a} \qquad [3]$$

where A is the total area of the North Sea (525,000 km^2) and/or sub-regions, n_w the number of stations with wet deposition measurements, n_a the number of stations with air concentrations measurements, v_d is the dry deposition velocity, t is the length of the period considered (here one year = 365*24*3600 s), $C_w(i)$ the weighted mean concentration in precipitation, pa_{land} is the precipitation amount and $C_a(i)$ the mean concentration in air at station *i*. $f_w(i)$ and $f_a(i)$ represent the dispersion factors for wet and dry deposition, respectively as calculated by the RIVM/TREND model As discussed above it is suggested to take for pa_{land} the median precipitation value of all the stations rather than using station specific precipitation amounts.

This procedure described above is the so-called Method 3a, more details can be found in Oslo and Paris Commissions (1994) Calculation of Atmospheric inputs of contaminants to the North Sea, 1987-1992.

9. Changes in methodology

If in future surveys there are significant changes of methodology of sampling or analysis, these should be reported to the Secretariat by Contracting Parties, together with any re-assessment of previously reported data.

Time schedule and data reporting format

Time schedule

Data measured in one calendar year should be reported in the next year according to the following time schedule:

1st April	Call for metadata issued from NILU (regarding both historic and new metadata), with instructions and supporting software as indicated in section 6.
1st June	Participants submit metadata via internet or on diskette, in specified formats.
31st August	Participants submit data via internet or on diskette, in specified formats. Transfer files shall have been checked with software supplied from NILU.
30th September	Draft report submitted from NILU, based on data submissions that have passed the formatting and consistency checks.
30th October	Participants submit completed/corrected data and metadata via internet or on diskette.
30th November	NILU submits final data report. This will probably also serve as output to the participants for the final validation of the data.

Data reporting format

Data reporting format of data deliverance is in accordance with the terms of the OSPAR/NILU CAMP Data Management Contract.

Appendix C

Description of NASA/Ames files

The NASA/Ames 1001 format has been extensively adopted around the world after its development by NASA. Here, a brief guide is given to the structure and information required in the form it is used by NILU. Accompanying this 4-page description is a list of components on page 65, a list of instrument code names on page 66, a list of data flags on page 67 and an example completed NASA/Ames file on page 69.

For stationary monitoring points the file format consists usually of 40 line initial lines containing qualifying information - metadata - followed by one line for each data point, defined as follows:

Line no.	variable	value	comment
1	NLHEAD	40 1001	Number of header and metadata lines before the data (40), plus NASA/Ames version no. (1001).
2	ONAME	e.g. Barrett Kevin	Name of data originator, i.e. person responsible for providing data, surname first, max. 132 characters.
3	ORG	e.g. NO01L, NILU, Box 100, N-2027, Kjeller, Norway	Registered organisation or laboratory code with O or L suffix to which data originator is affiliated (contact NILU for new institutions), separated by a comma from name, address, telephone, etc.
4	SNAME	e.g. Hjellbrekke Anne-Gunn	Person submitting/posting data file to database, surname first, max. 132 characters. May be the same as line 2, or can be another operator.
5	MNAME	e.g. CAMP(insert) EMEP(insert)	Mission/project name. If more than one project is to use the data, these are separated by spaces. An action must be specified, in this case “insert”. This is used for new datasets. If a dataset is being updated, rather than entered for the first time the action is “update”.
6	IVOL NVOL	1 1	Used to manage data. Always set to 1 1.
7	DATE RDATE	e.g. 1999 01 01 2000 04 01	DATE is the starting date for data file in YYYY MM DD, with year, month and day each separated by a space. Normally set to 1st January when 1 year of data is included, 1st January or 1st July when 6 months of data are included, or 1st month when 1 month of data is included. RDATE is latest date of data revisions or corrections
8	DX(1)	e.g. 1	Time units between data points for regular time series data, units as defined in line 9, XNAME. For example, for daily data points when XNAME is given as “days from file reference point”, DX = 1 For hourly data when XNAME is given as “days”, DX = fractional Julian day, i.e. 0.041667 (1/24). For hourly data when XNAME is defined as “hours from file reference point”, DX = 1 For irregular time series data, e.g. monthly data where the number of days varies, DX = 0
9	XNAME(1)	e.g. days from file reference point	Description of the units and start time of each data point.
10	NV	e.g. 3	Number of variables/columns of data <u>in addition</u> to the start time, i.e. no. dependent variables. For fixed monitoring points this will typically be 3 - in addition to start time there is end time, data value and data flag. Other cases could include multiple

			mast measurements with further columns for heights.
11	VSCAL(n), n=1,NV	e.g. 1 1 1	Variable scalar(n), the factor by which each of the dependent elements must be multiplied to convert to correct units. Always use 1 for each.
12	VMISS(n), n=1,NV	e.g. 999 9999.9 9.999	The missing data label for each data element. Created by filling all digits in data format with 9. Number of decimals will vary according to resolution of reported data. The VMISS values will be entered in the data columns when data points are missing. This does not apply to the flag column for which a valid flag can always be assigned.
13	VNAME(n) n=1,NV	e.g. end_time, Julian date counted from the file reference point	Variable name and description for each of the dependent variables, each listed on a separate line with max 132 characters. start-time is the independent variable, and is NOT declared. end_time, is the first dependent variable and must be defined with units. value is the second dependent variable (3rd column) and must be labelled with units. Units will change with component. numflag is the third dependent variable, and has no units. A list of flags is available on www.nilu.no/projects/ccc/flags.html, copied below.
(14)		e.g. value, mm	
(15)		e.g. numflag, no unit, max 3 flags(of 3 digits each) coded into decimals	
16	NSCOML	e.g. 0	Number of special comment lines for data set. Special circumstances concerning this particular data file. If no comments then NSCOML = 0
	[SCOM(n), n=1,NSCOML]		Comment lines. If NSCOML = 0, no comment lines will be given, and NNCOML will follow NSCOML.
17	NNCOML	23	Number of normal comment lines to follow from here, before the data components. In the CAMP format 23 lines now follow before the data set.
18	Data definition:	EBAS_1	Does not vary.
19	Set type code:	e.g. TI	Here TI means time series, irregular. Thepossible set type codes are: TI: Irregular time series (variable increment in time, fixed position) TU: Uniform time series (constant increment in time, fixed position) SU: Spatial Uniform time series (constant increment in time, changing position with constant or variable increments) SI: Spatial Irregular time series (variable increment in time, changing position with constant or variable increments) PO: Position-related snapshot (point samples in varying positions at common time point) AR: Area-related snapshot (averages for named areas at common time point) GR: Grid-related snapshot (averages for indexed grid squares at common time point) GS: Grid-related snapshot (averages for indexed boxes in a 3-D grid at common time point) CO: Column data (LIDAR, sun-spectrometers, etc)

20	Regime:	IMG	Represents Imission, ground level/lower troposphere. Alternatives refer to emissions or model results. In CAMP, Regime is always IMG.
21	Station code:	e.g. NO0001R	Station code consists of the nation code, station sequence number, and station type code. In this example we have: Norwegian station 0001, Regional background. Possible station suffixes are: R regional background G global background U urban I industrial Contact NILU if a new station is to be used.
22	Platform code:	e.g. NO0001S	Introduced in CAMP/HELCOM/EMEP/AMAP to distinguish between Stationary or Mobile platforms at a station. Consists of nation code, sequence number and suffix S or M
23	Startdate:	e.g. 19990101	Indicates the start date for data, the variable DATE given previously in line 7, but without spaces, i.e. YYYYMMDD.
24	Timeref:	e.g. 08_00	Indicates the time of sample changes, Format is hour_minute.
25	Revision date:	e.g. 20000401	Indicates latest data revision date, the variable RDATE given previously in line 7, but without spaces, i.e. YYYYMMDD.
26	Component:	e.g. precipitation_amount	component name. Select from list on CAMP2000A CD, and repeated below, and spell exactly.
27	Unit:	e.g. mm	unit for component, matrix and regime. Select from list (CAMP2000A CD and below).
28	Matrix:	e.g. precip	choice between: precip air aerosol air+aerosol Component/matrix list below clarifies options.
29	Period code:	e.g. 1y	Reporting period. Choices are: 1mo: 1 month 6mo: 6 months 1y: 1 year (12 months)
30	Resolution code:	e.g. 1mo	Resolution of reported data. Choices are: 1h : 1 hour resolution 1d: 1 day resolution 1w: 1 week resolution 2w: 2 week resolution 4w: 4 week resolution 1mo: 1 month resolution
31	Laboratory code:	e.g. NO01L	The laboratory which produced measurement results. Consists of nation code, sequence number, and the suffix L. Contact NILU for new laboratories.
32	Instrument type:	e.g. bulk_sampler	Instrument type. Select from list on CAMP2000A CD and repeated below.
33	Instrument name:	e.g. BS14	Assign short name which is unique in the organisation, and including numbers or letters that may be incremented as new instruments are acquired. Do not alter a name, or re-use names from earlier instruments taken out of service in the

			organisation. Do not include organisation code or instrument type. The example BS14 may indicate “bulk sampler, 14”.
34	Method ref:	e.g. NO01L_precip1a	Add a unique, short, name for each method description, to the end of the organisation code in line 3.
35	Ext. lab. code:	e.g. NA	Use if external laboratory undertakes analysis. Otherwise use NA (not applicable)
36	Ext. meth. ref:	NA	Use if external laboratory undertakes analysis. Otherwise use NA (not applicable)
37	Add. qualifier	e.g. 1d	Insert sampling resolution, if different from reported Resolution Code, line 30.
38	File name:	e.g. TI.IMG.NO0001R.NO0001S.19990101.2000.04.01.precipitation_amount.precip.1y.1mo	Indicates location, dates, component and time resolution
39	File name ext:	e.g. .NO01L.bulk_sampler.BS14.NO01L_precip1a.NA.NA.1d	Indicates laboratory and methods. Both File name and File name ext. are constructed from the metadata elements as shown.
40		Start_time end_time value numflag	Title line of data set. Independent variable listed first (start_time) followed by the dependent variables VNAME in line 13.

Component/Matrix List: (new components are added regularly. Please contact for any not listed here).

MATRIX	COMPONENT	UNIT
aerosol	acidity	ne H/m3
aerosol	aluminium	ng/m3
aerosol	ammonium	ug N/m3
aerosol	arsenic	ng/m3
aerosol	black_carbon	ug/m3
aerosol	cadmium	ng/m3
aerosol	calcium	ug/m3
aerosol	chloride	ug/m3
aerosol	chromium	ng/m3
aerosol	cobalt	ng/m3
aerosol	copper	ng/m3
aerosol	lead	ng/m3
aerosol	magnesium	ug/m3
aerosol	manganese	ng/m3
aerosol	mercury	pg/m3
aerosol	nickel	ng/m3
aerosol	nitrate	ug N/m3
aerosol	potassium	ug/m3
aerosol	selenium	ng/m3
aerosol	sodium	ug/m3
aerosol	sulphate_total	ug S/m3
aerosol	susp_part_matter	ug/m3
aerosol	vanadium	ng/m3
aerosol	zinc	ng/m3
air	CFC_11	pptv
air	CFC_113	pptv
air	CFC_12	pptv
air	HCFC_123	pptv
air	HCFC_22	pptv
air	N2butanone	ug/m3
air	N2butenal	ug/m3
air	N2methylbenzencarbaldehyde	ug/m3
air	N2methylpentane	pptv
air	N2methylpropenal	ug/m3
air	N2oxopropanal	ug/m3
air	N2propenal	ug/m3
air	N3buten2one	ug/m3
air	N3methylbenzencarbaldehyde	ug/m3
air	N3methylpentane	pptv
air	N4methylbenzencarbaldehyde	ug/m3
air	NOx	ug N/m3
air	NOy	ug N/m3
air	PAN	ug N/m3
air	acryloniyrile	ug/m3
air	ammonia	ug N/m3
air	benzene	pptv
air	benzenecarbaldehyde	ug/m3
air	butadiene	pptv
air	butanales	ug/m3
air	butane	pptv
air	butenes	pptv
air	carbondioxide	ppmv
air	carbontetrachloride	pptv
air	cyclohexane	pptv
air	dichloromethane	ug/m3
air	dinitrogenoxide	ppbv
air	ethanal	ug/m3
air	ethane	pptv
air	ethanedial	ug/m3
air	ethene	pptv
air	ethylbenzene	pptv
air	ethyne	pptv
air	halon_1211	pptv
air	halon_1301	pptv
air	heptane	pptv
air	hexanal	ug/m3
air	hexane	pptv
air	isobutane	pptv
air	isoheptane	pptv
air	isooctane	pptv
air	isopentane	pptv
air	isoprene	pptv
air	methanal	ug/m3
air	methane	ppbv
air	methylchloroform	pptv
air	mpxylene	pptv
air	neohexane	pptv
air	neopentane	pptv
air	nitric_acid	ug N/m3
air	nitrogen_dioxide	ug N/m3
air	nitrogenmonoxide	ug N/m3
air	octane	pptv
air	oxylene	pptv
air	ozone	ug/m3
air	pentanal	ug/m3
air	pentane	pptv
air	pentenes	pptv
air	phenyletanone	ug/m3
air	propanal	ug/m3
air	propane	pptv
air	propanone	ug/m3
air	propene	pptv
air	styrene	ug/m3
air	sulphur_dioxide	ug S/m3
air	tetrachloroethylene	ug/m3
air	toluene	pptv
air	trichloroethylene	ug/m3
air+aerosol	HCB	pg/m3
air+aerosol	N1methylnaphtalene	ng/m3
air+aerosol	N1methylphenanthrene	ng/m3
air+aerosol	N2methylanthracene	ng/m3
air+aerosol	N2methylnaphtalene	ng/m3
air+aerosol	N2methylphenanthrene	ng/m3
air+aerosol	PCB_101	pg/m3
air+aerosol	PCB_105	pg/m3
air+aerosol	PCB_118	pg/m3
air+aerosol	PCB_138	pg/m3
air+aerosol	PCB_153	pg/m3
air+aerosol	PCB_156	pg/m3
air+aerosol	PCB_180	pg/m3
air+aerosol	PCB_28	pg/m3
air+aerosol	PCB_31	pg/m3
air+aerosol	PCB_52	pg/m3
air+aerosol	acenaphtene	ng/m3
air+aerosol	acenaphtylene	ng/m3
air+aerosol	alpha_HCH	pg/m3
air+aerosol	anthanthrene	ng/m3
air+aerosol	anthracene	ng/m3
air+aerosol	benz_a_anthracene	ng/m3
air+aerosol	benzo_a_fluoranthene	ng/m3
air+aerosol	benzo_a_fluorene	ng/m3
air+aerosol	benzo_a_pyrene	ng/m3
air+aerosol	benzo_b_fluoranthene	ng/m3
air+aerosol	benzo_b_fluorene	ng/m3
air+aerosol	benzo_bjk_fluoranthenes	ng/m3
air+aerosol	benzo_e_pyrene	ng/m3
air+aerosol	benzo_ghi_fluoranthene	ng/m3
air+aerosol	benzo_ghi_perylene	ng/m3
air+aerosol	benzo_k_fluoranthene	ng/m3
air+aerosol	beta_HCH	pg/m3
air+aerosol	biphenyl	ng/m3
air+aerosol	chrysene_triphenylene	ng/m3
air+aerosol	cis_CD	pg/m3
air+aerosol	cis_NO	pg/m3
air+aerosol	coronene	ng/m3
air+aerosol	cyklopenta_cd_pyrene	ng/m3
air+aerosol	dibenzo_ac_ah_anthracenes	ng/m3
air+aerosol	dibenzofuran	ng/m3
air+aerosol	dibenzothiophene	ng/m3
air+aerosol	dieldrin	ng/m3
air+aerosol	fluoranthene	ng/m3
air+aerosol	fluorene	ng/m3
air+aerosol	gamma_HCH	pg/m3
air+aerosol	inden_123cd_pyrene	ng/m3
air+aerosol	mercury	ng/m3
air+aerosol	naphtalene	ng/m3
air+aerosol	op_DDD	pg/m3
air+aerosol	op_DDE	pg/m3
air+aerosol	op_DDT	pg/m3
air+aerosol	perylene	ng/m3
air+aerosol	phenanthrene	ng/m3
air+aerosol	pp_DDD	pg/m3
air+aerosol	pp_DDE	pg/m3
air+aerosol	pp_DDT	pg/m3
air+aerosol	pyrene	ng/m3
air+aerosol	retene	ng/m3
air+aerosol	sum_ammonia_and_ammonium	ug N/m3
air+aerosol	sum_nitric_acid_and_nitrate	ug N/m3
air+aerosol	sum_sulph_diox_sulphate	ug S/m3
air+aerosol	trans_CD	pg/m3
air+aerosol	trans_NO	pg/m3
precip	HCB	ng/l
precip	PCB_101	ng/l
precip	PCB_118	ng/l
precip	PCB_128	ng/l
precip	PCB_138	ng/l
precip	PCB_149	ng/l
precip	PCB_153	ng/l
precip	PCB_177	ng/l
precip	PCB_18	ng/l
precip	PCB_180	ng/l
precip	PCB_26	ng/l
precip	PCB_28	ng/l
precip	PCB_44	ng/l
precip	PCB_52	ng/l
precip	acidity	ue H/l
precip	aldrin	ng/l
precip	alpha_HCH	ng/l
precip	aluminium	ug/l
precip	ammonium	mg N/l
precip	anthracene	ng/l
precip	arsenic	ug/l
precip	benz_a_anthracene	ng/l
precip	benzo_a_pyrene	ng/l
precip	benzo_b_fluoranthene	ng/l
precip	benzo_ghi_fluoranthene	ng/l
precip	benzo_ghi_perylene	ng/l
precip	benzo_k_fluoranthene	ng/l
precip	beta_HCH	ng/l
precip	cadmium	ug/l
precip	calcium	mg/l
precip	chloride	mg/l
precip	chromium	ug/l
precip	chrysene	ng/l
precip	cobalt	ug/l
precip	conductivity	uS/cm
precip	copper	ug/l
precip	dibenzo_ah_anthracene	ng/l
precip	dieldrin	ng/l
precip	endrin	ng/l
precip	fluoranthene	ng/l
precip	gamma_HCH	ng/l
precip	heptachlor	ng/l
precip	inden_123cd_pyrene	ng/l
precip	iron	ug/l
precip	lead	ug/l
precip	magnesium	mg/l
precip	manganese	ug/l
precip	mercury	ng/l
precip	nickel	ug/l
precip	nitrate	mg N/l
precip	op_DDD	ng/l
precip	op_DDE	ng/l
precip	op_DDT	ng/l
precip	pH	pH units
precip	phenanthrene	ng/l
precip	potassium	mg/l
precip	pp_DDD	ng/l
precip	pp_DDE	ng/l
precip	pp_DDT	ng/l
precip	precipitation_amount	mm
precip	precipitation_amount_off	mm
precip	pyrene	ng/l
precip	sodium	mg/l
precip	sulphate_corrected	mg S/l
precip	sulphate_total	mg S/l
precip	sum_PCB	ng/l
precip	vanadium	ug/l
precip	zinc	ug/l

List of Instrument type code names, for line 32 of NASA/Ames files.

Instrument Group	Instrument Type name Use in line 32 of metadata
air_monitor	UK
air_monitor	chemiluminesc
air_monitor	doas
air_monitor	ir_abs
air_monitor	lidar
air_monitor	online_gc
air_monitor	teom
air_monitor	uv_abs
air_monitor	uv_fluoresc
air_sampler	UK
air_sampler	abs_solution
air_sampler	abs_tube
air_sampler	ads_tube
air_sampler	ann_denuder
air_sampler	filter_1pack
air_sampler	filter_2pack
air_sampler	filter_3pack
air_sampler	filter_abs_solution
air_sampler	high_vol_sampler
air_sampler	impactor
air_sampler	passive_sampler
air_sampler	steel_canister
air_sampler	tub_denuder
precip_sampler	UK
precip_sampler	bulk_sampler
precip_sampler	icecore_sampler
precip_sampler	snowpack_sampler
precip_sampler	wet_only_sampler
precip_sampler	precip_gauge

List of data flags used in the CAMP/HELCOM/AMAPEMEP data base

Flags are sorted according to severity. Flags above 250 indicate an exception that has invalidated or reduced the quality of the data element. These may be assigned at data source or by the data originator. Flags below 250 are assigned by NILU. They indicate that the element is valid, even if it may fail simple validation tests. The value may for example be extreme, but has been tested and found correct. Up to three flags can be assigned to each data element, coded into decimals, e.g. 0.678657568

The flag 100 is used to indicate that a value is valid even if an exception in the 999-250 range has also been flagged. In this case the 100 flag must appear before other flags. In all other cases, the most severe flag should appear first if more than one flag is needed.

Flag	Mnemonic	Description
Group 9: Missing flags		
999	MMU	Missing measurement, unspecified reason
990	MSN	Precipitation not measured due to snow-fall. Needed for historic data, should not be needed for new data
980	MZS	Missing due to calibration or zero/span check
Group 8: Flags for undefined data elements		
899	UUS	Measurement undefined, unspecified reason
890	UNP	Concentration in precipitation undefined, no precipitation
Group 7: Flags used when the value is unknown		
799	MUE	Measurement missing (unspecified reason), data element contains estimated value
784	LPE	Low precipitation, concentration estimated
783	LPU	Low precipitation, concentration unknown
781	BDL	Value below detection limit, data element contains detection limit
780	BDE	Value below detection limit, data element contains estimated value. Also used for aggregates that is uncertain since many input elements were below the detection limit
771	ARL	Value above range, data element contains upper range limit
770	ARE	Value above range, data element contains estimated value
750	ALK	H+ not measured in alkaline sample
701	LAU	Less accurate than usual, unspecified reason. (Used only with old data, for new data see groups 6 and 5)
Group 6: Mechanical problem		
699	LMU	Mechanical problem, unspecified reason
679	LUM	Unspecified meteorological condition
678	LHU	Hurricane
677	LAI	Icing or hoar frost in the intake
659	LSA	Unspecified sampling anomaly
658	LSV	Too small air volume
657	LPO	Precipitation collector overflow. Heavy rain shower (squall)
656	LWB	Wet-only collector failure, operated as bulk collector
655	LMI	Two samples mixed due to late servicing of sampler. Estimated value created by averaging
654	LLS	Sampling period longer than normal, observed values reported
653	LSH	Sampling period shorter than normal, observed values reported
649	LTP	Temporary power fail has affected sampler operation

Group 5: Chemical problem

599	LUC	Unspecified contamination or local influence
593	LNC	Industrial contamination
591	LAC	Agricultural contamination
578	LSS	Large sea salt contribution (ratio between marine and excess sulphate is larger than 2.0)
568	LSC	Sand contamination
567	LIC	Insect contamination
566	LBC	Bird droppings
565	LPC	Pollen and/or leaf contamination
549	LCH	Impure chemicals
540	LSI	Spectral interference in laboratory analysis
532	LHB	Data less accurate than normal due to high field blank value
531	LLR	Low recovery, analysis inaccurate
521	LBA	Bactericide was added to sample for storage under warm climate

Group 4: Extreme or inconsistent values

499	INU	Inconsistent with another unspecified measurement
478	IBA	Inconsistency discovered through ion balance calculations
477	ICO	Inconsistency between measured and estimated conductivity
460	ISC	Contamination suspected
459	EUE	Extreme value, unspecified error
458	EXH	Extremely high value, outside four times standard deviation in a lognormal distribution
457	EXL	Extremely low value, outside four times standard deviation in a lognormal distribution
456	IDO	Invalidated by data originator

Group 2: Exception flags assigned by the database co-ordinator (NILU)

299	CNU	Inconsistent with another unspecified measurement
278	CBA	Inconsistency discovered through ion balance calculations
277	CCO	Inconsistency between measured and estimated conductivity
260	CSC	Contamination suspected
259	CUE	Unspecified error expected
258	CXH	Extremely high value, outside four times standard deviation in a log-normal distribution
257	CXL	Extremely low value, outside four times standard deviation in a log-normal distribution
249	QDT	Apparent typing error corrected
211	QDI	Irregular data checked and accepted by database co-ordinator
210	QDE	Episode data checked and accepted by database co-ordinator

Group 1: Exception flags for accepted, irregular data

147	QOD	Below theoretical detection limit or formal Q/A limit, but a value has been measured and reported
120	QOR	Sample reanalysed with similar results
111	QOI	Irregular data checked and accepted by data originator
110	QOE	Episode data checked and accepted by data originator
100	QOU	Qualified by data originator

Example NASA/Ames file:

This is simply an example, constructed from the explanatory comments above. Most variables should be altered to suit the component, location, time period, etc. in question. The unchanging elements are lines 6, 17, 18, 20 and 36. Some others rarely change, e.g. line 1 and line 35. Others will vary and should certainly be checked carefully for each data submission, as should the data block itself, including start_time and end_time. Similar templates for different time resolutions etc. can be found on the CAMP2000A CD.

```
40  1001
Barrett Kevin
NO01L, NILU, Box 100, N-2027 Kjeller, Norway, Phone +47 63898000, Fax +47 63898050
Hjellbrekke Anne-Gunn
CAMP(insert)  EMEP(insert)
1 1
1999 01 01   2000 04 01
0
Days from the file reference point (start_time)
3
1 1 1
999  9999.9  9.999
end_time, Julian day counted from the file reference point
value, mm
numflag, no unit, max 3 flags (of 3 digits each) coded into decimals
0
23
Data definition:     EBAS_1
Set type code:       TI
Regime:              IMG
Station code:        NO0001R
Platform code:       NO0001S
Startdate:           19990101
Timeref:             08_00
Revision date:       20000401
Component:           precipitation_amount
Unit:                mm
Matrix:              precip
Period code:         1y
Resolution code:     1mo
Laboratory code:     NO01L
Instrument type:     bulk_sampler
Instrument name:     BS14
Method ref:          NO01L_precip1a
Ext. lab. code:      NA
Ext. meth. ref:      NA
Add. qualifier:      1d
File name            TI.IMG.NO0001R.NO0001S.19960101.19970601.precipitation_amount.precip.1y.1mo
File name ext:       .NO01L.bulk_sampler.BS14.NO01L_precip1a.NA.NA.1d
   start_time     end_time     value        numflag
   0              31           0            0
   31             59           67           0
   59             90           24           0
   90             120          47           0
   120            151          39           0
   151            181          9999.9       0.999
   181            212          85           0
   212            243          21           0
   243            273          14           0
   273            304          9999.9       0.678657568
   304            334          34           0
   335            365          21           0
```

Appendix D

Data originators in each country

BELGIUM
Flemish Environmental Agency,
Section Air Immissions,
Kronenburgstraat 42,
2000 ANTWERP, Belgium
jasmine.dumollin@vmm.be

DENMARK
National Environmental Research Institute
Frederiksborgvej 399
DK 4000, ROSKILDE, Denmark
kaare.kemp@dmu.dk

FRANCE
jean-yves.cabon@univ.brest.fr

GERMANY
Umweltbundesaft,
Postbach 33 00 22,
D-14191 BERLIN, Germany
dagmar.kallweit@uba.de
elke.bieber@uba.de

ICELAND
Vedurstofa Islands,
Bustadavegi 9,
150 REYKJAVIK, Iceland
johanna@vedur.is

IRELAND
Environmental Protection Agency,
Pottery Road, DUN LAOGHAIRE,
Co. Dublin, Ireland
b.oleary@epa.ie
c.odonnell@epa.ie

NETHERLANDS
RIVM,
PO Box 1,
3720 BA BILTHOVEN, Netherlands
arien.stolk@rivm.nl

NORWAY
Norwegian Institute for Air Research,
PB 100,
2027 KJELLER, Norway
knut.breivik@nilu.no
torunn.berg@nilu.no
anne-gunn.hjellbrekke@nilu.no

PORTUGAL
Meteorological Institute,
Rua C do Aeroporto de Lisboa,
1700 LISBON, Portugal
amelia.lopes@meteo.pt
renato.carvalho@meteo.pt

SPAIN
pedro.de-pablo@sgca.mma.es
javier.ruza-rguez@sgtcca.mma.es

SWEDEN
Swedish Environmental Reserach Institute
IVL, PB 47086,
S-402 58 GOTHENBURG, Sweden
karin.sjoberg@ivl.se
karin.kindbom@ivl.se
hakan.blomgren@ivl.se

UNITED KINGDOM
AEA Technology,
Culham, ABINGDON,
Oxfordshire, OX14 3TD
keith.playford@aeat.co.uk

CAMP Database
Norwegian Institute for Air Research,
PB 100,
2027 KJELLER, Norway
kevin.barrett@nilu.no
terje.krognes@nilu.no
anne-gunn.hjellbrekke@nilu.no

Appendix E

CAMP Data CD

Norwegian Institute for Air Research (NILU)
P.O. Box 100, N-2027 Kjeller, Norway

REPORT SERIES SCIENTIFIC REPORT	REPORT NO. OR 2/2001	ISBN 82-425-1236-1 ISSN 0807-7207	
DATE	SIGN.	NO. OF PAGES 79	PRICE NOK 120.-
TITLE Observations from Coastal Stations in 1999		PROJECT LEADER Kevin Barrett	
		NILU PROJECT NO. O-97146	
AUTHOR(S) Kevin Barrett		CLASSIFICATION * A	
		CONTRACT REF.	

REPORT PREPARED FOR
OSPAR Commission
Bonn Agreement
New Court
48 Carey Street
London WC2A 2JQ
UNITED KINGDOM

ABSTRACT
This report describes the observations made at monitoring stations in 1999 around the North Sea and North East Atlantic by the CAMP programme. The monitoring programme and stations are described and annual observed values given in summary, supported by actual observed values listed in the Appendix.

NORWEGIAN TITLE

KEYWORDS		
Marine	Atmospheric	Deposition

ABSTRACT (in Norwegian)

** Classification*	*A*	*Unclassified (can be ordered from NILU)*
	B	*Restricted distribution*
	C	*Classified (not to be distributed)*