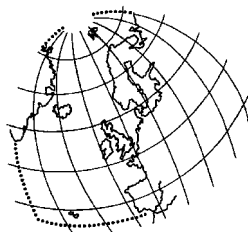


Assessment and Monitoring Series

Comprehensive Atmospheric Monitoring Programme (CAMP)

Observations from N.E. Atlantic Coastal Stations in
2000



OSPAR Commission
2002

The Convention for the Protection of the Marine Environment of the North-East Atlantic (the “OSPAR Convention”) was opened for signature at the Ministerial Meeting of the former Oslo and Paris Commissions in Paris on 22 September 1992. The Convention entered into force on 25 March 1998. It has been ratified by Belgium, Denmark, Finland, France, Germany, Iceland, Ireland, Luxembourg, Netherlands, Norway, Portugal, Sweden, Switzerland and the United Kingdom and approved by the European Community and Spain.

La Convention pour la protection du milieu marin de l'Atlantique du Nord-Est, dite Convention OSPAR, a été ouverte à la signature à la réunion ministérielle des anciennes Commissions d'Oslo et de Paris, à Paris le 22 septembre 1992. La Convention est entrée en vigueur le 25 mars 1998. La Convention a été ratifiée par l'Allemagne, la Belgique, le Danemark, la Finlande, la France, l'Irlande, l'Islande, le Luxembourg, la Norvège, les Pays-Bas, le Portugal, le Royaume-Uni de Grande Bretagne et d'Irlande du Nord, la Suède et la Suisse et approuvée par la Communauté européenne et l'Espagne.

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ISBN 1-904426-06-9

NILU OR 12/2002
MARCH 2002

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

COMPREHENSIVE ATMOSPHERIC MONITORING PROGRAMME



**Observations from
N.E. Atlantic Coastal Stations in 2000**

Working Group on Inputs to the Marine Environment (INPUT)

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



NILU: OR 12/2001

NILU: OR12/2002
REFERENCE: O-97146
DATE: MARCH 2002
ISBN: 82-425-1343-0

Observations from N.E. Atlantic Coastal Stations in 2000

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Cover photograph:

Sunrise over the Irish Sea from Cloghy Beach, Co. Down, Northern Ireland, Autumn 1993.

Executive Summary

This report contains the results of monitoring undertaken for CAMP during 2000. 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.

A larger number of stations have reported than in previous years. All countries submitted data. Participation in the Mandatory programme for components in precipitation is reasonable. However, some toxins, e.g. γ -HCH and mercury, are not widely monitored. Consideration may be given to increased monitoring of these components. 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.

Metal and organic concentrations frequently are frequently below the detection limits of analytical devices. In some cases detection limits are unusually high. Side-by-side samples analysed at different laboratories yield large differences in estimates. Similarly, there are clear differences in the estimates provided by different countries which may well reflect factors other than differences in environmental occurrences.

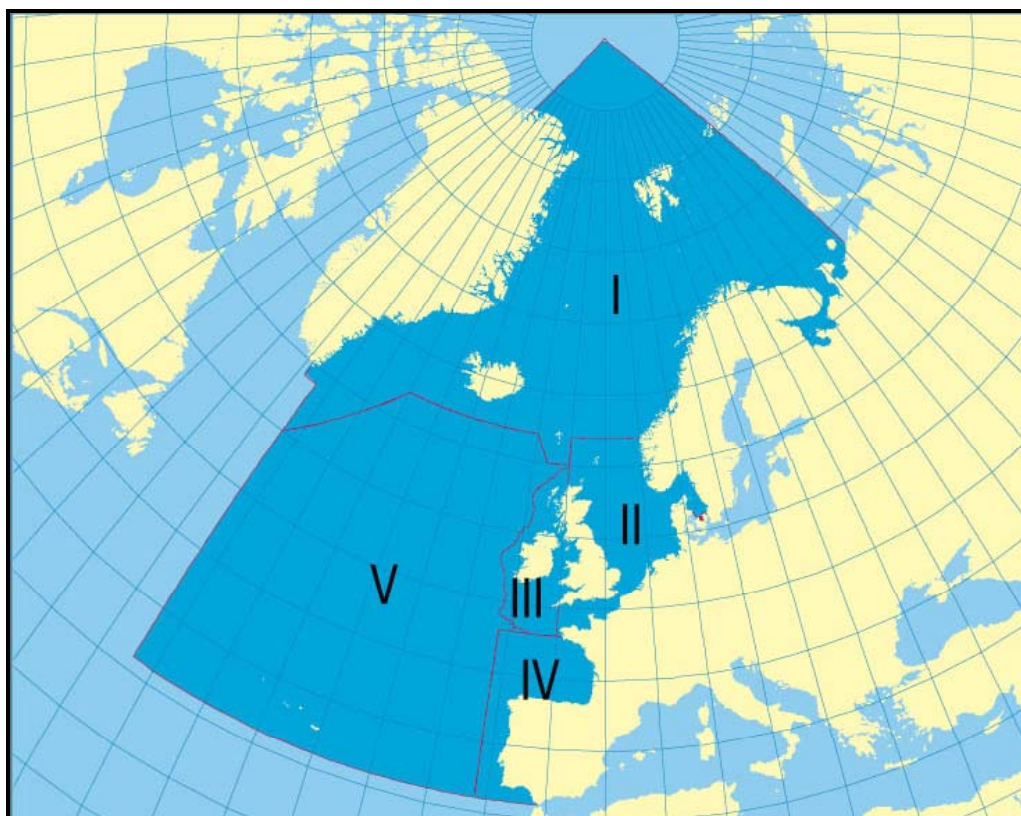
The geographical, temporal and component coverage of the air quality programme has improved in recent years, and together with good effort by Contracting Parties in reviewing historical data submissions, the air database is now capable of allowing temporal and spatial assessments of pollutant supply.

Observations from N.E. Atlantic Coastal Stations in 2000

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 2000.

The monitoring regime proposed by CAMP is summarised in chapter two listing 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.



*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 2000, listing the stations reporting, their individual monitoring regimes, and the components they have reported. This provides an overview of the implementation of CAMP recommendations. Actual observations are summarised (annual mean

values) in chapter four. The monthly mean wet depositions and air concentrations values themselves from each station for 2000 are provided in Appendix A. These are values aggregated from reported concentrations in air and precipitation. Reported time periods are often shorter. The monthly values have been previously forwarded to country data originators for review in accordance with the revised CAMP time schedule (June 2001 - See Appendix B). Finally, Appendix C 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, fluoranthene, 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, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(a)pyrene, benzo(ghi)perylene, indeno(1,2,3-cd)pyrene, NO |

^{a)} total ammonium ($\text{NH}_3 + \text{NH}_4^+$) and total nitrate ($\text{HNO}_3 + \text{NO}_3^-$) 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^- , 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 NO₂ 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.

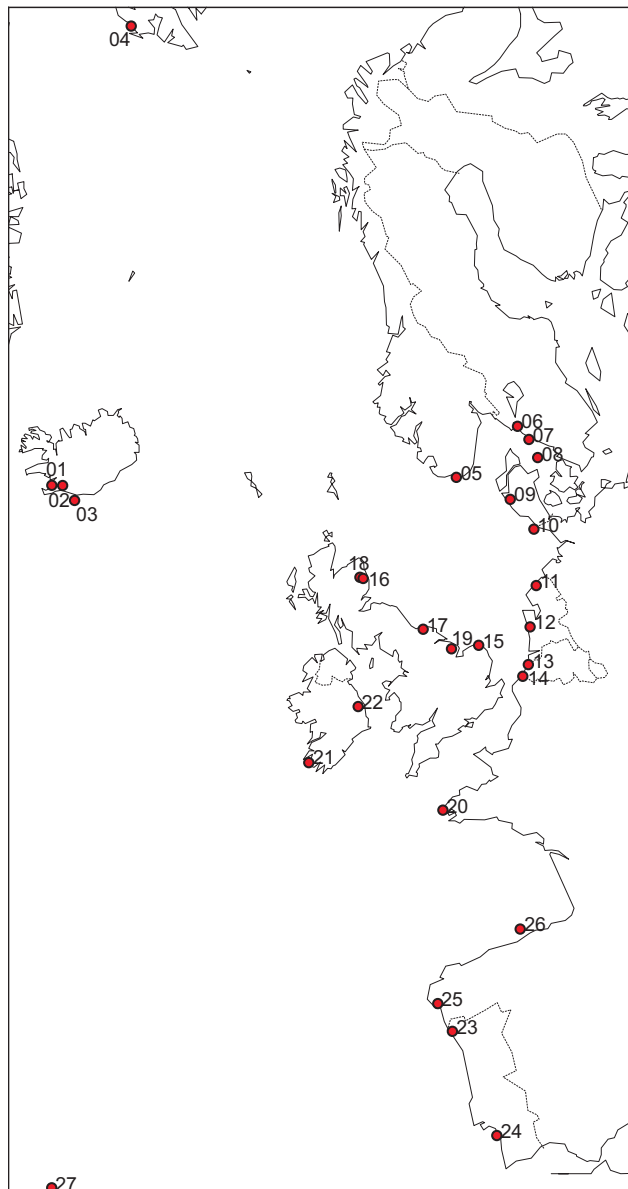
In consequence, all data reported to CAMP should be very carefully identified. As well as station and component identification, all data originators in participating countries are asked to assign unique names to the field instruments, to the methodologies, and to ensure programme labelling. Reporting 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.

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. Details of file formats and flags can be found at www.nilu.no/projects/ccc.

The time schedule for data reporting calls for submission of data by countries to the CAMP Data Manager by 30 September 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 mid November.

3 N.E. Atlantic coastal atmospheric monitoring, 2000



| Region | map no | code | Station name | Region | map no | code | Station name | Region | map no | code | Station name |
|--------|--------|------------------|------------------------|--------|--------|------------------|---------------------|--------|--------|--------|--------------------------------|
| I | 1 | IS0002 | Irafoss | II | 9 | DK0031 | Ulborg | II | 17 | GB0014 | High Muffles |
| | 2 | IS0090 | Reykjavik | | 10 | DE0001 | Westerland | | 18 | GB0091 | Banchory |
| | 3 | IS0091 | Storhofdi | | | DE0041 | Wstlnd Tinnum | | 19 | GB0095 | Driby |
| | 4 | NO0042 NO0057 | Zeppelin Ny-Ålesund | | 11 | NL0009 | Kollumerwaard | II/III | 20 | FR0090 | Porspoder ^(also IV) |
| II | 5 | NO0099 NO0001 | Lista Birkenes | | 12 | NL0091 | De Zilk | | III | 21 | IE0001 |
| | 6 | SE0002 | Rorvik | | 13 | BE0003 | Brugge | 22 | | IE0002 | Turlough Hill |
| | 7 | SE0097 | Gardsjoen | | | BE0004 | Knokke | IV | 23 | PT0003 | V. d. Castelo |
| | | SE0098 | Svartedalen | | 14 | BE0011 BE0013 | Moerkerke Houtem | | 24 | PT0004 | Monte Velho |
| | 8 | DK0008 | Anholt | | 15 | GB0090 | East Ruston | | 25 | ES0005 | Noia |
| | | | | | 16 | GB0016 | Glen Dye | | 26 | ES0008 | Niembro |
| | | | | | | | | V | 27 | PT0010 | A. d. Heroismo |

Figure 3.1: Stations reporting to CAMP, 2000

Table 3.1: List of coastal stations reporting to CAMP for 2000.

| Country | Station code | Station name | Latitude (deg.min) | Longitude (deg.min) | 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-Tinum | | | | 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 |
| Spain | ES0005R | Noia | 42.44N | 8.55W | 685 | |
| | ES0008R | Niembro | 43.26N | 4.05W | 134 | |
| Sweden | SE0002R | Rørvik | 57.25N | 11.56E | 10 | 0.65 |
| | SE0097R | Gårdsjön | 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 |
| | GB0016R | Glen Dye | 56.58N | 2.25W | 85 | 24 |
| | GB0090R | East Ruston | 52.48N | 1.28E | 5 | 8 |
| | GB0091R | Banchory | 57.05N | 02.32W | 120 | 26.5 |
| | GB0095R | Driby | 53.14N | 0.04E | 47 | 16 |

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 2000. An increased number of stations reported in 2000 than for previous years.

Table 3.2: National submissions of precipitation data for 2000 – 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 | • | • | • | • | • | | • | • | | • | • |

Grey areas in table were not reported.

Furthermore, year 2000 data was reported by all countries virtually within the deadlines. Subsequent validation of aggregated monthly values, however, was only partially achieved within the deadlines. There remain some uncertainties over questions of reporting format, flagging of data and so forth but in general the reporting requirements were met.

Table 3.3: Submissions of air concentration data for 2000 – Mandatory List.

| | NO ₂ | NO ₃ | NH _x |
|----------------|-----------------|-----------------|-----------------|
| Belgium | • | | |
| Denmark | | • | • |
| France | | | |
| Germany | • | • | • |
| Iceland | | • | |
| Ireland | | | |
| Netherlands | • | • | • |
| Norway | • | • | • |
| Portugal | | | |
| Spain | • | • | • |
| Sweden | • | • | • |
| United Kingdom | | | |

Grey areas in table were not reported.

Table 3.4: Submissions of precipitation data for 2000 – 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 | • ⁶ | | | | | | | | | | pesticides |
| Netherlands | | | | | | | | | | | |
| Norway | | | | | | | | | | | |
| Portugal | | | | | | | | | | | |
| Spain | | | | | | | | | | | |
| Sweden | | | | | | | | | | | |
| United Kingdom | | | | | | | | | | | |

Grey area in table were not reported.

PCB Number in superscript indicates number of individual congeners reported. Voluntary list defines 7.

Whilst otherwise largely adhered to, γ -HCH and mercury in precipitation from the mandatory list are not widely monitored by participating countries. Furthermore, the recommended CAMP voluntary monitoring programme for components in precipitation has in general not been closely adhered to.

Table 3.5: Submissions of air concentration data for 2000 – 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 | • | • | • | • | • | | • | • | | | |

Grey areas in table were not reported.

Table 3.6: Sampling regime for components in precipitation.

| Station code | Station name | Nutrients | Heavy Metals | Organics |
|-------------------------------|--|-----------------|-----------------------------------|----------|
| BE0003R BE0004R | Brugge Knokke | W1W | WM BM As,Cd,Pb,Zn <i>plus</i> | WM |
| DK0008R DK0031R | Anholt Ulborg | | BM BM | |
| FR0090R | Porspoder | B2W | B2W | |
| DE0001Rb | Westerland-Tinum | W1W(M) | W1W(M) | |
| ES0005R ES0008R | Noia Niembra | BD BD | | |
| IS0002R IS0090R IS0091R | Irafoss Reykjavik Storhofdi | BW BW | B1W B1W | B2W |
| IE0001R IE0002R | Valentia Observatory Turlough Hill | WD | BM BM | BM |
| NL0009R NL0091R | Kollumerwaard De Zilk | W4W W4W | W4W W4W WW Hg <i>except</i> | B4W |
| NO0057R NO0099R | Ny Alesund Lista | BHW BD | BHW | |
| PT0003R PT0004R PT0010R | Viana do Castelo Monte Velho Angra do Heroismo | BD BD W1W | BD BD W1W | |
| SE0002R SE0097R SE0098R | Rørvik Gårdsjön Svartedalen | WD BM | BM BM | |
| GB0014R GB0090R GB0091R | High Muffles East Ruston Banchory | WD | BM BM 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 Westerland-Tinum | AD HVD | HVM | |
| IS0091R | Storhofdi | HV2W | HV2W | F2W |
| ES0005R | Noia | AD | | |
| ES0008R | Niembra | AD | | |
| NL0009R | Kollumerwaard | FD NO ₃ ,NH ₄ : MnH NO,NO ₂ | FD | |
| NL0091R | De Zilk | FD NO ₃ ,NH ₄ : DH NH ₃ : MnH NO,NO ₂ | | |
| NO0001R | Birkenes | FD | | |
| NO0042R | Zeppelin | FD | FHW | |
| NO0099R | Lista | FD | FHW | |
| SE0002R | Rørvik | FD HNO ₃ +NO ₃ ,NH _x : AD NO ₂ | | |

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 2000. 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 of the CAMP 1999 report 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. This new data is included here. Associated air concentration data is presented in Table 4.2 (mean annual values).

Table 4.1: Reduced and oxidised nitrogen supply per station, year 2000: Mean precipitation weighted concentrations (mg N l^{-1}), and estimated annual wet depositions (mg N m^{-2}).

| Area | Station code | Location | concentrations | | precip mm | depositions | |
|--------|--------------|---------------|----------------------------------|----------------------------------|--------------|------------------------------------|------------------------------------|
| | | | NH_4 mg N/l | NO_3 mg N/l | | NH_4 mg N/m^2 | NO_3 mg N/m^2 |
| I | IS0002 | Irafoss | 0.08 | 0.04 | 1769 | 140 | 72 |
| I | IS0090 | Reykjavik | 0.25 | 0.07 | 675 | 169 | 49 |
| I | NO0057 | Ny Alesund | 0.10 | 0.08 | 421 (11) | 42 | 32 |
| II | NO0001 | Birkenes | 0.32 | 0.43 | 2327 | 739 | 994 |
| II | NO0099 | Lista | 0.46 | 0.62 | 1494 | 694 | 926 |
| II | SE0002 | Roervik | 0.23 | 0.33 | 886 | 203 | 295 |
| II | SE0098 | Svartedalen | 0.59 | 0.56 | 1135 (10) | 675 | 634 |
| II | DK0008 | Anholt | 0.45 | 0.60 | 703 | 314 | 422 |
| II | DE0001 | Westerland | 0.58 | 0.62 | 630 | 385 | 411 |
| II | NL0009 | Kollumerwaard | 0.90 | 0.51 | 625 | 565 | 321 |
| II | NL0091 | De Zilk | 0.52 | 0.44 | 1000 (11) | 515 | 443 |
| II | BE0003 | Brugge | 0.80 | 0.48 | 812 | 651 | 389 |
| II | GB0014 | High Muffles | 0.50 | 0.50 | 1153 | 581 | 511 |
| II | GB0016 | Glen Dye | 0.33 | 0.36 | 1237 | 409 | 445 |
| II | GB0095 | Driby | 0.54 | 0.48 | 619 | 333 | 299 |
| II/III | FR0090 | Porspoder | 0.24 | 0.31 | 1322 | 318 | 408 |
| III | IE0002 | Turlough Hill | 0.21 | 0.12 | 1907 (10) | 409 | 228 |
| IV | ES0008 | Niembro | 0.27 | 0.42 | 655 | 178 | 273 |
| IV | PT0003 | V.d.Castelo | 0.12 | 0.11 | 1891 | 223 | 205 |
| IV | PT0004 | Monte Velho | 0.11 | 0.13 | 574 | 65 | 72 |
| V | PT0010 | A.d.Heroismo | 0.06 | 0.19 | 919 | 59 | 182 |

text under table: numbers in (brackets) indicate number of months where less than 12.

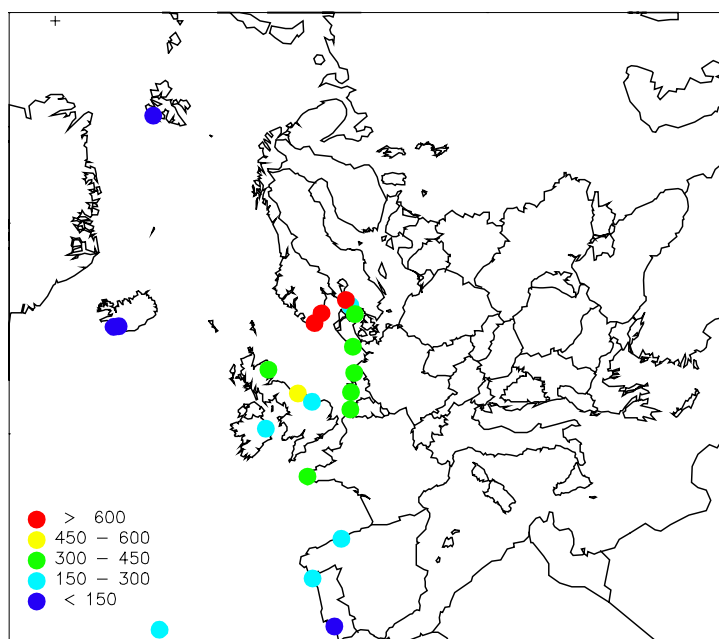


Figure 4.1: Estimated deposition of oxidised nitrogen in precipitation, 2000.
Units: $\text{mg N m}^{-2} \text{ yr}^{-1}$.

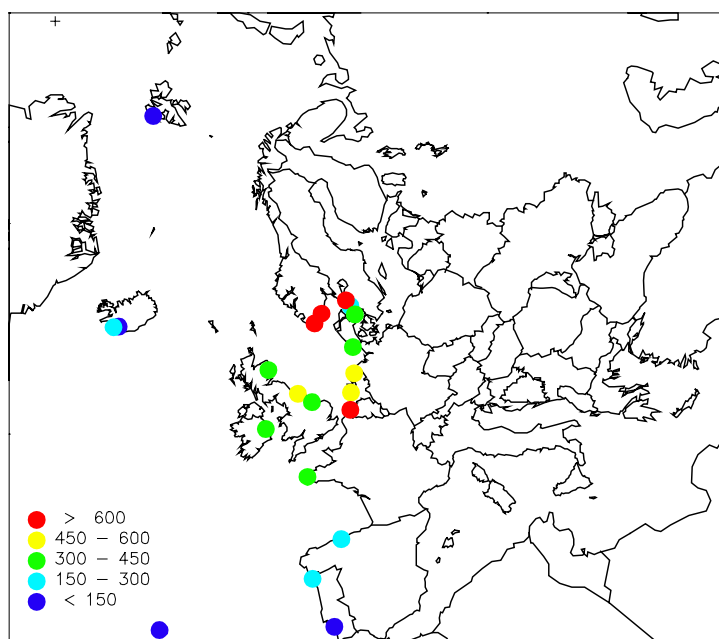


Figure 4.2: Estimated deposition of reduced nitrogen in precipitation, 2000.
Units: $\text{mg N m}^{-2} \text{ yr}^{-1}$.

Table 4.2: Observed annual mean air concentrations of reduced and oxidised nitrogen, 2000.
Units: $\mu\text{g N m}^{-3}$.

| | | NH_3 | NH_4 | NH_x | NO_3 | HNO_3+NO_3 | NO | NO_2 |
|-----------|---------------|---------------------|---------------------|---------------------|---------------------|----------------------------|---------------------|---------------------------------|
| | | $\mu\text{g N/m}^3$ | $\mu\text{g N/m}^3$ | $\mu\text{g N/m}^3$ | $\mu\text{g N/m}^3$ | $\mu\text{g N/m}^3$ | $\mu\text{g N/m}^3$ | $\mu\text{g N/m}^3$ |
| IS0091 | Storhofdi | | | | 0.04 | | | |
| NO0042 | Zeppelin | | | 0.10 | | 0.03 | | |
| NO0001 | Birkenes | | | 0.43 | | 0.20 | | 0.57 |
| SE0002 | Roervik | | | 0.87 | | 0.63 | | 1.48 |
| DK0031 | Ulborg | | | 1.40 | | 0.66 | | |
| DE0001 | Westerland | | 0.51 | | 0.74 | | | 2.16 |
| NL0009 | Kollumerwaard | | 0.87 | | 0.54 | | 0.73 | 3.71 |
| NL0091 | De Zilk | 0.69 | 1.30 | | 0.75 | | 2.23 | 6.20 |
| BE0011 | Moerkerke | | | | | | 1.98 | 5.99 |
| BE0013 | Houtem | | | | | | 1.13 | 1.98 |
| ES0005(6) | Noia | | 0,31 | 0.09 | | 0,42 | | 2.69: abs.sol. 1.47: monitor |
| ES0008 | Niembro | | 0.48 | 2.53 | | 0.52 | | 2.64: abs.sol. 2.14: monitor |

text under table: numbers in (brackets) indicate number of months where less than 12.

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.

The CAMP principles propose side-by-side comparisons bulk and wet-only samplers where bulk samplers are used. 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. The only case of this being followed systematically is at BE0007. 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. The difference in estimates can be large. Monthly deposition estimate for each of these can be found in Appendix A. Following review at INPUT 2001, Belgium decided to undertake CAMP analysis at the Antwerp laboratory in future. This data will be available from year 2001.

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 followed CAMP principles, i.e. represents estimates where provided or otherwise 50% of the detection limit. 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.

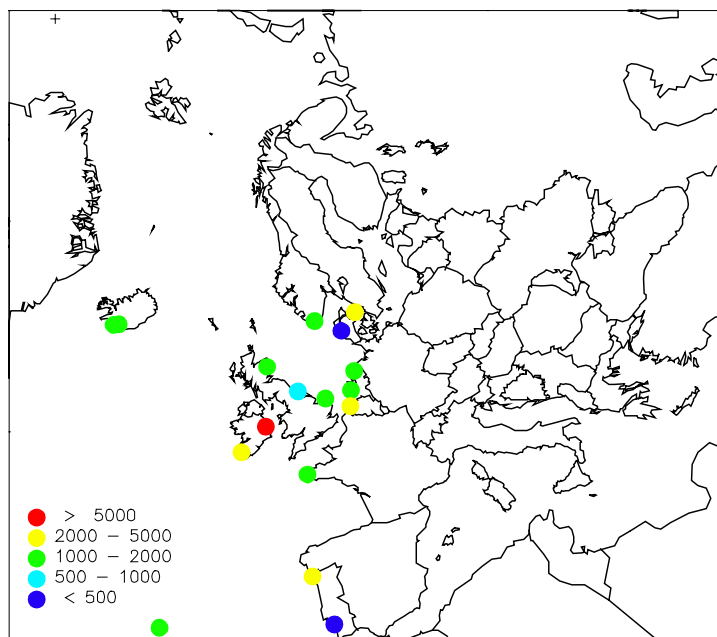


Figure 4.3: Estimated deposition of copper in precipitation, 2000.
Units: $\mu\text{g Cu m}^{-2}\text{yr}^{-1}$.

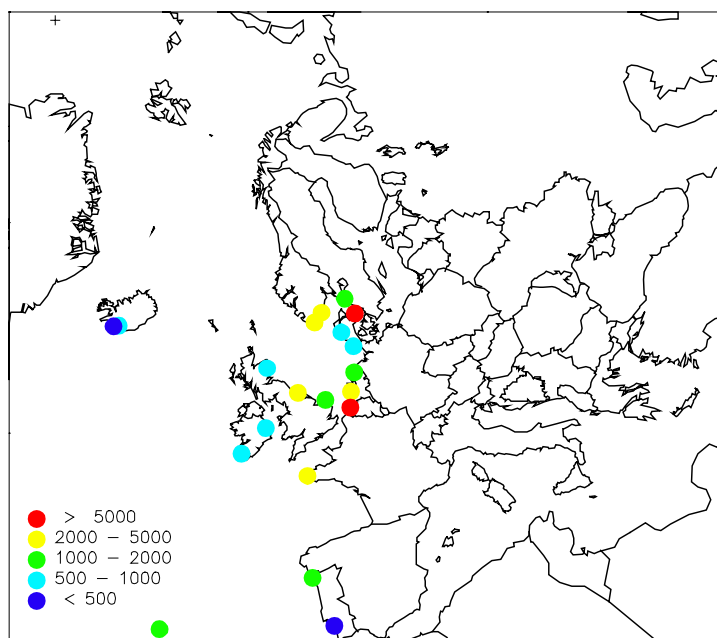


Figure 4.4: Estimated deposition of lead in precipitation, 2000.
Units: $\mu\text{g Pb m}^{-2}\text{yr}^{-1}$.

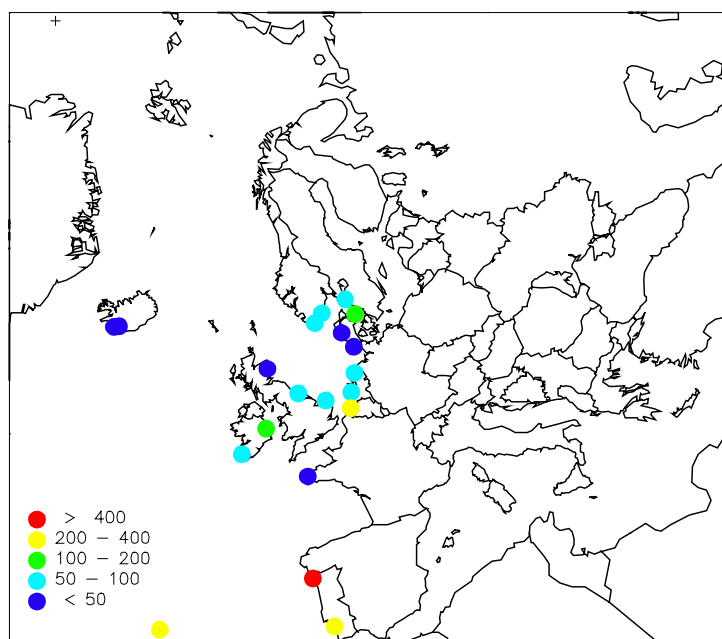


Figure 4.5: Estimated deposition of cadmium in precipitation, 2000.
Units: $\mu\text{g Cd m}^{-2}\text{yr}^{-1}$.

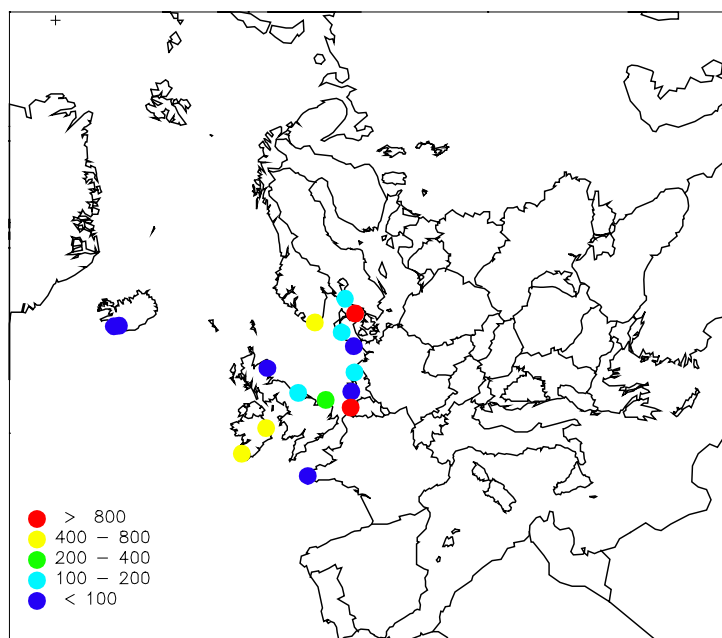


Figure 4.6: Estimated deposition of arsenic in precipitation, 2000.
Units: $\mu\text{g As m}^{-2}\text{yr}^{-1}$.

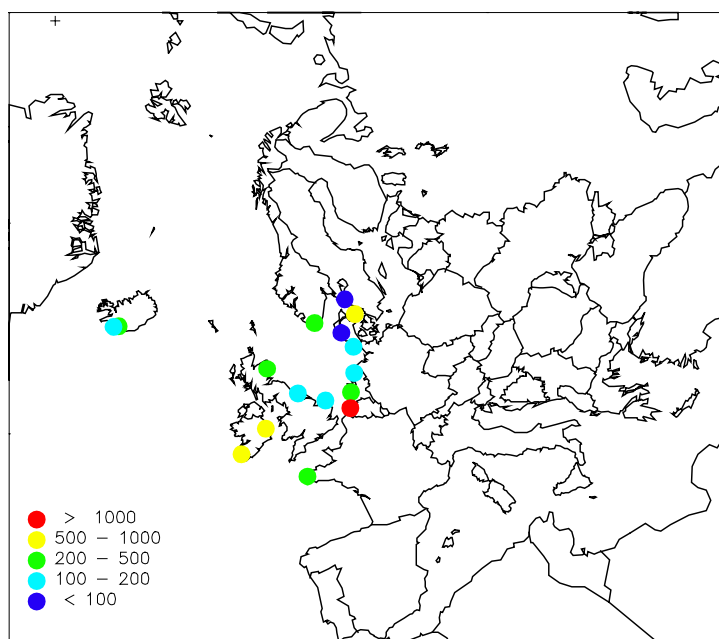


Figure 4.7: Estimated deposition of Chromium in precipitation, 2000.
Units: $\mu\text{g Cr m}^{-2} \text{yr}^{-1}$

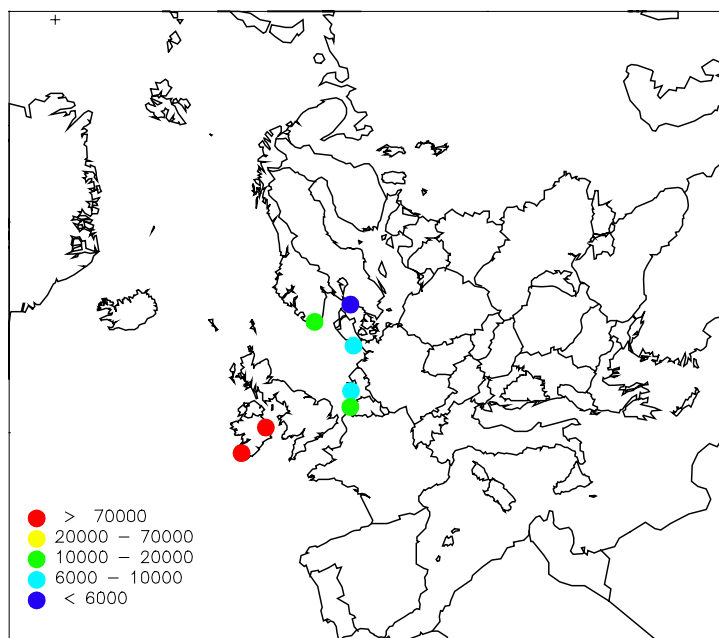


Figure 4.8: Estimated deposition of mercury in precipitation, 2000.
Units: $\text{ng Hg m}^{-1} \text{yr}^{-1}$.

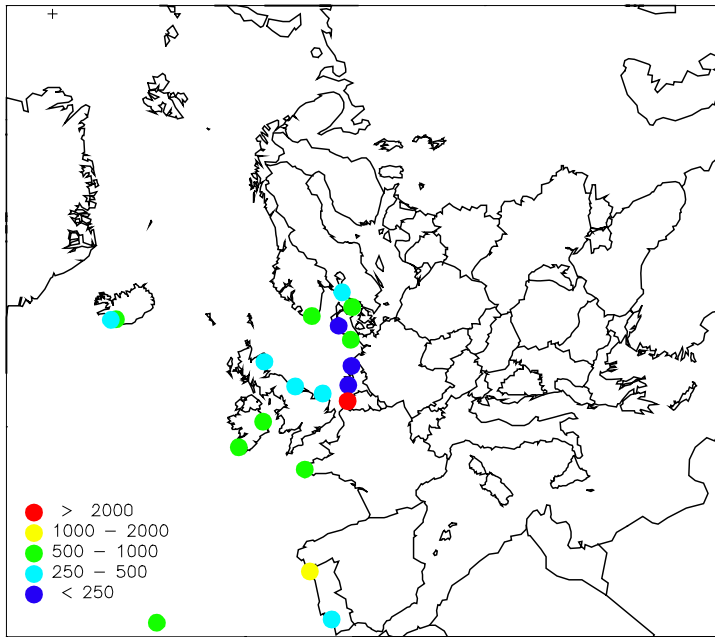


Figure 4.9: Estimated deposition of nickel in precipitation, 2000.
units: $\mu\text{g Ni m}^{-1} \text{yr}^{-1}$.

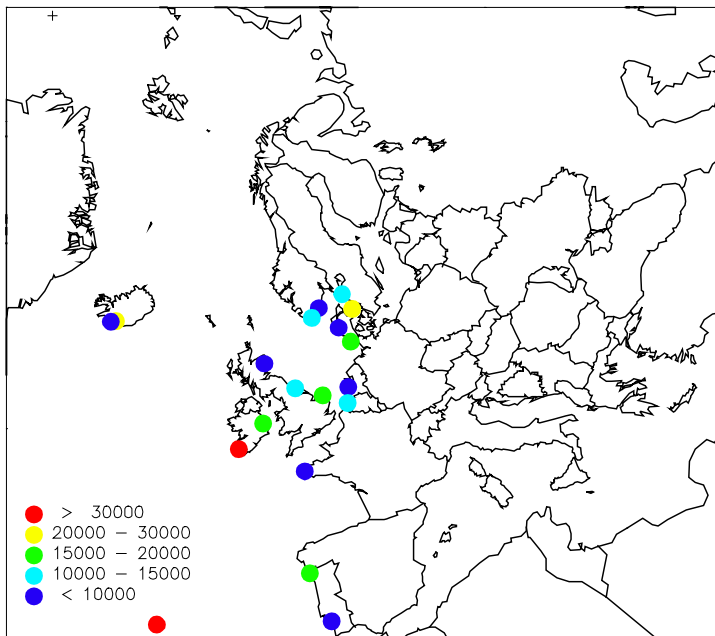


Figure 4.10: Estimated deposition of zinc in precipitation, 2000.
Units: $\mu\text{g Zn m}^{-1} \text{yr}^{-1}$.

Table 4.3: Mean concentrations of metals in precipitation (prec. weighted), 2000.

| | As | Cd | Cr | Cu | Pb | Hg | Ni | Zn | Precip |
|----------------------|--------------------|--------------------|--------------------|--------------------|---------------------|---------------------|--------------------|---------------------|---|
| | $\mu\text{g/l}$ | $\mu\text{g/l}$ | $\mu\text{g/l}$ | $\mu\text{g/l}$ | $\mu\text{g/l}$ | ng/l | $\mu\text{g/l}$ | $\mu\text{g/l}$ | mm |
| IS02 Irafoss | 0.03 | 0.02 | 0.26 | 1.04 | 0.56 | | 0.38 | 17.03 | 1545 |
| IS90 Reykjavik | 0.04 | 0.01 | 0.18 | 1.58 | 0.61 | | 0.67 | 4.27 | 745 |
| NO01 Birkenes | | 0.03 | | | 1.39 | | | 3.22 | 2253 |
| NO99 Lista | 0.29 | 0.04 | 0.16 | 1.11 | 1.63 | 7.02 ¹¹ | 0.34 | 6.60 | 1472 ¹¹ 1570 ¹² |
| SE02 Roervik | | | | | | 7.32 | | | 772 |
| SE97 Gaardsjoen | 0.10 | 0.05 | 0.08 | | 1.59 | | 0.25 | 13.01 | 1042 |
| DK08 Anholt | 1.38 | 0.24 | 0.95 | 5.63 | 9.90 | | 1.11 | 41.86 | 670 |
| DK31 Ulborg | 0.13 ¹⁰ | 0.03 ¹⁰ | 0.10 ¹⁰ | 0.53 ¹⁰ | 0.76 ¹⁰ | | 0.20 ¹⁰ | 7.90 ¹⁰ | 837 ¹⁰ |
| DE41 West. Tinum | 0.15 | 0.07 | 0.18 | | 1.09 | 9.54 | 0.79 | 24.53 | 630 662 ^{Hg} |
| NL09 Kollumerw. | 0.25 ¹⁰ | 0.08 ¹⁰ | 0.27 ¹⁰ | 1.92 ¹⁰ | 2.15 ¹⁰ | | 0.31 ¹⁰ | | 674 ¹⁰ |
| NL91 De Zilk | 0.12 ¹¹ | 0.07 ¹¹ | 0.33 ¹¹ | 2.21 ¹¹ | 3.99 ¹¹ | 10.54 | 0.33 ¹¹ | 7.48 ¹¹ | 693 ¹¹ 731 ¹² |
| BE04 Knokke wet only | 1.29 ¹¹ | 0.68 ¹¹ | 5.79 ¹¹ | 3.55 ¹¹ | 25.60 ¹¹ | 21.54 ¹¹ | 3.70 ¹¹ | 18.07 ¹¹ | 724 ¹¹ 822 ¹² |
| bulk | | 0.30 ¹¹ | | 4.50 ¹¹ | 6.14 ¹¹ | | | 14.14 ¹⁰ | 1147 ¹¹ 969 ^{Zn} |
| GB14 High Muffles | 0.14 ⁸ | 0.05 ⁸ | 0.14 ⁷ | 0.79 ⁷ | 2.04 ⁷ | | 0.22 ⁷ | 9.61 ⁸ | 1153 ⁸ 1113 ⁷ |
| GB90 East Ruston | 0.31 ¹¹ | 0.09 ¹¹ | 0.22 | 1.77 ¹¹ | 1.64 | | 0.36 ¹¹ | 26.88 | 731 ¹² 708 ¹¹ |
| GB91 Banchory | 0.07 ¹¹ | 0.04 ¹¹ | 0.25 ¹¹ | 1.03 ¹⁰ | 0.90 ¹¹ | | 0.26 ¹⁰ | 9.26 ¹¹ | 1049 ¹¹ 1015 ^{Cu} 982 ^{Ni} |
| FR90 Porspoder | 0.04 | 0.02 | 0.18 | 0.86 | 1.81 | | 0.71 | 2.26 | 1322 |
| IE01 Valentia Is. | 0.41 | 0.04 | 0.41 | 2.32 | 0.50 | 50.00 | 0.41 | 32.59 | 1769 |
| IE02 Turlough Hill | 0.33 ¹¹ | 0.07 ¹¹ | 0.40 ¹¹ | 5.95 ¹¹ | 0.52 ¹¹ | 41.38 ¹¹ | 0.39 ¹¹ | 8.33 ¹¹ | 1579 ¹¹ 1907 ¹² |
| PT03 V.d.Castelo | | 0.39 | | 1.24 | 0.75 | | 0.71 | 10.43 | 1891 |
| PT04 Monte Velho | | 0.38 ⁹ | | 0.46 ⁹ | 0.59 ⁹ | | 0.69 ⁹ | 7.66 ⁹ | 574 ⁹ |
| PT10 A.d.Heroismo | | 0.42 | | 1.31 | 1.63 | | 0.76 | 35.77 | 919 |

Numbers or superscript indicate no. months if other than 12.

Table 4.4: Estimated annual wet depositions of priority metals, 2000.

| | As | Cd | Cr | Cu | Pb | Hg | Ni | Zn |
|----------------------|--------------------|-------------------|--------------------|---------------------|---------------------|---------------------|--------------------|---------------------|
| | $\mu\text{g/m}^2$ | $\mu\text{g/m}^2$ | $\mu\text{g/m}^2$ | $\mu\text{g/m}^2$ | $\mu\text{g/m}^2$ | ng/m^2 | $\mu\text{g/m}^2$ | $\mu\text{g/m}^2$ |
| IS02 Irafoss | 42 | 25 | 399 | 1608 | 858 | | 583 | 26305 |
| IS90 Reykjavik | 28 | 8 | 137 | 1181 | 456 | | 497 | 3185 |
| NO01 Birkenes | | 69 | | | 3132 | | | 7265 |
| NO99 Lista | 456 | 61 | 252 | 1750 | 2559 | 11027 ¹¹ | 536 | 10362 |
| SE02 Roervik | | | | | | 5646 | | |
| SE97 Gaardsjoen | 105 | 55 | 81 | | 1654 | | 258 | 13553 |
| DK08 Anholt | 923 | 163 | 634 | 3774 | 6632 | | 746 | 28038 |
| DK31 Ulborg | 108 ¹⁰ | 29 ¹⁰ | 85 ¹⁰ | 440 ¹⁰ | 633 ¹⁰ | | 165 ¹⁰ | 6613 ¹⁰ |
| DE41 West. Tinum | 100 | 43 | 120 | | 715 | 6321 | 517 | 16152 |
| NL09 Kollumerw. | 166 ¹⁰ | 57 ¹⁰ | 182 ¹⁰ | 1293 ¹⁰ | 1451 ¹⁰ | | 209 ¹⁰ | |
| NL91 De Zilk | 85 ¹¹ | 52 ¹¹ | 244 ¹¹ | 1618 ¹¹ | 2916 ¹¹ | 7703 | 239 ¹¹ | 5469 ¹¹ |
| BE04 Knokke wet only | 1057 ¹¹ | 559 ¹¹ | 4758 ¹¹ | 2920 ¹¹ | 21046 ¹¹ | 17707 ¹¹ | 3043 ¹¹ | 14854 ¹¹ |
| bulk | | 340 ¹¹ | | 5168 ¹¹ | 7041 ¹¹ | | | 16220 ¹⁰ |
| GB14 High Muffles | 165 ⁸ | 57 ⁸ | 164 ⁷ | 914 ⁷ | 2349 ⁷ | | 258 ⁷ | 11083 ⁸ |
| GB90 East Ruston | 225 ¹¹ | 64 ¹¹ | 158 | 1295 ¹¹ | 1198 | | 262 ¹¹ | 19646 |
| GB91 Banchory | 78 ¹¹ | 45 ¹¹ | 264 ¹¹ | 1081 ¹⁰ | 946 ¹¹ | | 270 ¹⁰ | 9710 ¹¹ |
| FR90 Porspoder | 53 | 31 | 241 | 1131 | 2399 | | 938 | 2990 |
| IE01 Valentia Is. | 722 | 74 | 722 | 4109 | 889 | 88445 | 722 | 57649 |
| IE02 Turlough Hill | 638 ¹¹ | 124 ¹¹ | 764 ¹¹ | 11344 ¹¹ | 989 ¹¹ | 78920 ¹¹ | 744 ¹¹ | 15877 ¹¹ |
| PT03 V.d.Castelo | | 740 | | 2336 | 1422 | | 1345 | 19726 |
| PT04 Monte Velho | | 217 ⁹ | | 265 ⁹ | 341 ⁹ | | 395 ⁹ | 4402 ⁹ |
| PT10 A.d.Heroismo | | 389 | | 1215 | 1524 | | 708 | 33351 |

Numbers or superscript indicate no. months if other than 12.

Table 4.5: Observed mean annual air concentrations of metals, 2000.

| | As ng/m ³ | Cd ng/m ³ | Cr ng/m ³ | Cu ng/m ³ | Pb ng/m ³ | Hg ng/m ³ | Ni ng/m ³ | Zn ng/m ³ | Months |
|----------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-------------------------|-----------------------|
| BE04 Knokke | | | | 20.08 | 41.18 | | 22.58 | 74.5 | Pb 11 11;Ni 10 |
| DE01 Westerland | 1.02 | 0.17 | | | 6.47 | | | | |
| DK08 Anholt | 0.35 | 0.08 | 0.37 | 1.18 | 4.94 | | 1.44 | 10.30 | |
| DK31 Ulborg | 0.28 | 0.08 | 0.36 | 0.98 | 4.25 | | 0.92 | 10.13 | |
| GB14 High Muffles | 0.50 | 0.24 | 1.26 | 3.12 | 6.57 | | 2.45 | 67.46 | |
| GB90 East Ruston | 0.89 | 0.22 | 1.23 | 2.24 | 10.23 | | 0.97 | 30.50 | |
| GB91 Banchory | 0.28 | 0.05 | 0.67 | 0.91 | 2.13 | | 0.58 | 20.80 | |
| IE01 Valentia Island | 0.35 | 0.08 | 0.37 | 1.18 | 4.94 | | 1.44 | 10.30 | |
| IS91 Storhofdi | 0.10 | 0.09 | 9.74 | 1.35 | 0.54 | | 6.24 | 9.01 | |
| NL09 Kollumerwaard | 0.24 | 0.09 | | | 4.40 | | | 11.95 | |
| NO99 Lista | 0.29 | 0.07 | 0.84 | 0.66 | 2.47 | 1.60 | 0.82 | 6.15 | |
| NO42 Zeppelinfjellet | 0.30 | 0.02 | 0.04 | 0.41 | 0.41 | 1.81 | 0.08 | 1.57 | Hg 4 |

4.3 Organic compounds

In Tables 4.7–4.12 the annual average values for organic compounds reported to CAMP are listed. With limited 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 4.6: Annual mean precipitation weighted concentrations of PCB's in precipitation, 2000.

| | months | PCB's | | | | | | | | | |
|----------------|--------|------------|------------|------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| | | 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 |
| IE02 Turlough | 10 | | | 1.43 | 2.14 | | 2.17 | 1.98 | 1.98 | | 1.65 |
| IS91 Storhofdi | 12 | 0.07 | 0.07 | 0.03 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 | 0.004 | 0.01 |

Table 4.7: Estimated annual wet depositions of PCB's, 2000.

| | months | PCB's | | | | | | | | | |
|------|--------|-------------|-------------|-------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| | | 28 ng/m2 | 31 ng/m2 | 52 ng/m2 | 101 ng/m2 | 105 ng/m2 | 118 ng/m2 | 138 ng/m2 | 153 ng/m2 | 156 ng/m2 | 180 ng/m2 |
| IE02 | 10 | | | 2728.15 | 4084.35 | | 4136.45 | 3772.10 | 3772.10 | | 3142.95 |
| IS91 | 12 | 45.62 | 41.67 | 17.72 | 6.43 | 5.74 | 5.64 | 8.97 | 10.23 | 2.40 | 7.42 |

Table 4.8: Observed mean annual air concentrations of PCB's, 2000.

| | mnths | PCB's | | | | | | | | | | |
|------|-----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|
| | | 28 | 31 | 52 | 101 | 105 | 118 | 138 | 153 | 156 | 180 | |
| | | pg/m3 | pg/m3 | pg/m3 | pg/m3 | pg/m3 | pg/m3 | pg/m3 | pg/m3 | pg/m3 | pg/m3 | |
| IS91 | Storhofdi | 12 | 1.71 | 1.39 | 0.71 | 0.30 | 0.10 | 0.16 | 0.24 | 0.27 | 0.10 | 0.18 |

Table 4.9: Observed annual wet depositions and mean annual concentrations of non-PCB voluntary list organic substances (prec. weighted), 2000.

| | | anthracene | pyrene | benzo(a) pyrene | benzo(ghi) perylene | chrysene | indeno(123cd) pyrene |
|------------------------------|-------|------------|--------|--------------------|------------------------|----------|-------------------------|
| Depositions | | ng/m2 | ng/m2 | ng/m2 | ng/m2 | ng/m2 | ng/m2 |
| DE41 | Tinum | 4548 | 10264 | 2063 | 3558 | 6597 | 2726 |
| Precipitation concentrations | | ng/l | ng/l | ng/l | ng/l | ng/l | ng/l |
| DE41 | Tinum | 6.91 | 15.59 | 3.13 | 5.40 | 10.02 | 4.14 |

4.4 Time Trends

For the pan-European state of the environment Kiev Report, 2003, OSPAR will be invited to submit both year 2000 and time trend deposition data for the coastal water. The information required will be aggregated rather than station specific raw data. As a suggestion for further development, the following sample of information held on the database is presented whilst only simple indication of the data now assembled by CAMP, figure 4.11 displays time trends for selected components since 1995. These are combinations of several stations (listed) with each station given equal weighing and normalized against its 1994-s two-year mean deposition. These are the stations for which long records are available. Many other stations have not reported so continuously. The figure are intended to contribute do debate. Time trends are of depositions in precipitation, expressed as percentage of 1994-5 means.

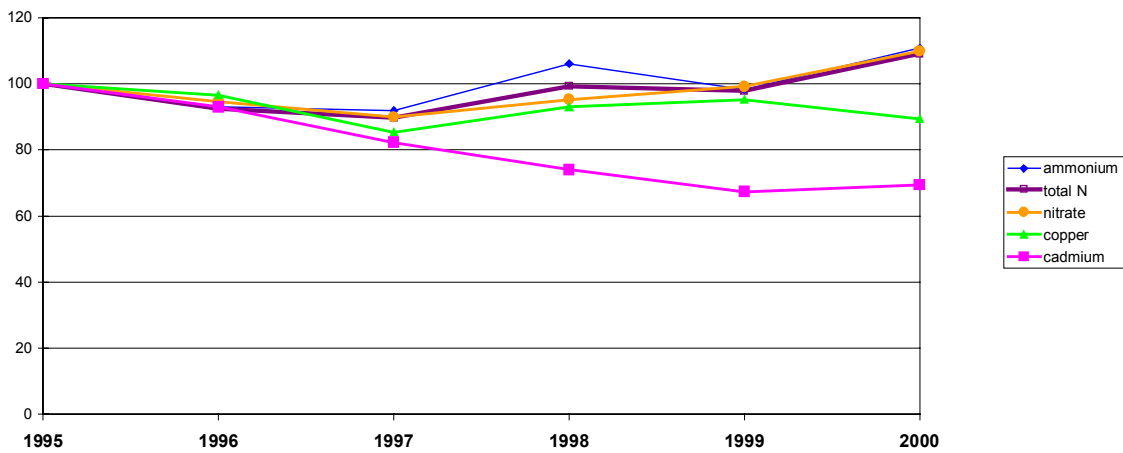


Figure 4.11: Selected time trends of observed annual deposition precipitation: Percentage of 1994-5 depositions.

Table 4.10: Stations used to construct displayed time trends. Stations have complete or near complete data from 1994 to 2000. Stations weighted equally.

| Nitrogen | Cadmium | Copper |
|----------|---------|--------|
| be03 | dk31 | be04 |
| de01 | gb14 | dk31 |
| gb06 | gb91 | gb14 |
| gb14 | ie02 | gb90 |
| ie02 | nl09 | ie01 |
| nl09 | nl91 | is02 |
| no01 | no01 | is90 |
| pt04 | no99 | nl09 |
| se02 | se97 | nl91 |
| | | no99 |

5 Summary

5.1 Observed values

This report contains the results of monitoring undertaken for CAMP during 2000. 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. Summary results for rates of deposition in precipitation to the coastal waters of the five North Sea regions are given in table 5.1.

Table 5.1: Estimated annual average rates of deposition in precipitation of nutrients and metals to the coastal waters of the five OSPAR maritime area and regions

| Region | NO₃ <i>mg N/l</i> | NH₄ <i>mg N/l</i> | As <i>µg/l</i> | Cd <i>µg/l</i> | Cr <i>µg/l</i> | Cu <i>µg/l</i> | Pb <i>µg/l</i> | Hg <i>ng/l</i> | Ni <i>µg/l</i> | Zn <i>µg/l</i> | prec <i>mm</i> |
|---------------|--|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| I | 0.12 | 0.05 | 0.03 | 0.01 | 0.23 | 1.22 | 0.57 | | 0.47 | 12.88 | 970-1150 |
| II | 0.47 | 0.47 | 0.23 | 0.08 | 0.23 | 1.32 | 2.44 | 8.41 | 0.42 | 11.33 | 930-1160 |
| III | 0.21 | 0.12 | 0.31 | 0.05 | 0.38 | 3.79 | 0.90 | 49.99 | 0.51 | 15.97 | 1750-1840 |
| IV | 0.15 | 0.17 | | 0.39 | | 1.06 | 0.72 | | 0.71 | 9.79 | 1100-1230 |
| V | 0.06 | 0.19 | | 0.42 | | 1.32 | 1.66 | | 0.77 | 36.29 | 920 |

Maritime regions shown in figure 1.1. Distribution of monitoring stations between regions given in tables 3.1, 4.1. and 4.3. Values are precipitation weighted. Precipitation values represent the range across components for that region. Part-year values scaled to 12-months proportional with precipitation if known, otherwise linearly with time.

Stations coverage is variable between regions. Region II is represented by upto 13 stations according to component, whilst region V is represented by only one station. Patterns are to a good degree understandable. Values in region II (Greater North Sea) tend to the upper end of observations. Those in region I (Arctic waters) and to a lesser extent region IV (Bay of Biscay/Iberian Coast) are at the lower end. It is inevitably more difficult to extend the results from a single station, as in Wider Atlantic (region V) waters, to the whole region; careful QA/QC work for the station is thus advisable. Other results indicate benefit might be gained from a thorough quality review. For example, the region III (Celtic Seas) value for mercury reflects high reported concentrations by two Irish stations, these being notably above the observations from the five stations supplying the estimate for region II.

5.2 Monitoring and reporting procedures, year 2000.

Monitoring should be conducted at monitoring stations located in proximity to the coast. Most stations in 2000 did meet the ten kilometre objective, the furthest station from the coast being some 26 kilometres inland. All countries submitted data.

Geographical coverage is greatest for the Greater North Sea (zone 2). For this region the derivation of reliable estimates of total-basin supply may be considered feasible. Perhaps inevitably given the restricted coastline therein, coverage is most limited for wider Atlantic waters (zone 5). Improved coverage might also be desirable for the Celtic seas (zone 3) and especially for Arctic waters (zone 1): at present observations are reported only from the western and northern extremities, despite very long coastlines. Several countries do have additional stations within their national networks, and review by Contracting Parties of whether additional existing national stations which might be able to supply data of value to OSPAR might be undertaken.

Monitoring of Mandatory precipitation components is reasonable, although some were monitored to a notably lesser degree than others, e.g. γ -HCH and mercury. Less attention is given to the Voluntary programme, especially to the precipitation element in which organic substances feature.

Countries monitor equivalent time periods, with some exceptions. A number of countries do recommence their monitoring periods at the start of each month thus allowing true monthly values to be derived. However, some do not, and some have very long monitoring period, making comparability less straightforward. Reporting practices also vary. Whilst some aggregate all samples in each month prior to analysis, others aggregate results of several shorter samples, and others report raw short-period data. Reporting of observations to the CAMP manager followed the revised time scale reasonably well (see Appendix B). Delay occurred at the stage of review by countries of calculated monthly values.

Differences in techniques, laboratories and procedures may be worth some evaluation by countries. For example, metal and organic concentrations frequently are below the detection limits of analytical devices and in some cases detection limits are unusually high. Side-by-side samples analysed at different laboratories yield large differences in estimates. Similarly, some quite clear differences in the estimates provided by different countries may not only reflect differences in environmental occurrence. Where there is a very limited geographical coverage of stations the importance of good practice is highlighted. In light of these various factors, Contracting Parties are invited to carefully review their practices.

Appendix A

Observed monthly mean depositions in precipitation and concentrations in air at CAMP coastal monitoring stations, 2000

Appendix is divided by country, and thereafter by station. Each station heading contains observations of both precipitation and airborne concentrations during 2000. The following countries and stations which reported data for 2000 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 |
| Spain | ES0005, ES0008 |
| Sweden | SE0002, SE0097, SE0098 |
| United Kingdom | GB0014, GB0016, GB0090, GB0091, GB0095 |

Grey areas on tables indicate measurements below detection limits, or derived from shorter time resolution measurements which were largely below detection limits. OSPAR principles were applied to calculate mean values (Appendix B).

Belgium

BE0003 Brugge Depositions in Precipitation

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|---------------------|---------|----------|-------|-------|--------|-------|-------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m ² | 18.78 | 45.04 | 61.78 | 31.56 | 145.17 | 27.08 | 36.92 | 131.58 | 35.65 | 41.86 | 38.34 | 37.11 | 651 | 12 |
| nitrate | mg N/m ² | 10.73 | 20.98 | 26.99 | 32.85 | 80.60 | 29.48 | 33.39 | 63.75 | 22.65 | 27.49 | 23.99 | 16.40 | 389 | 12 |
| precipitation | mm | 23.4 | 53.3 | 35.4 | 31.5 | 109.9 | 34.9 | 87.4 | 108.5 | 50.2 | 106.5 | 106.3 | 65.0 | 812 | 12 |

BE0004 Knokke

Mean Air Concentrations

Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | no. months |
|--------|-------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|-------------|------------|
| copper | ng/m ³ | 20.00 | 20.00 | 21.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.00 | 20.08 | 12 |
| lead | ng/m ³ | 54.00 | 45.00 | 39.00 | 33.00 | 40.00 | 35.00 | 30.00 | 34.00 | 44.00 | 47.00 | 51.00 | 52.00 | 42.00 | 12 |
| nickel | ng/m ³ | 22.00 | 22.00 | 24.00 | 23.00 | 25.00 | 23.00 | 24.00 | 24.00 | 22.00 | 21.00 | 20.00 | 21.00 | 22.58 | 12 |
| zinc | ng/m ³ | 89.00 | 77.00 | 71.00 | 70.00 | 67.00 | 64.00 | 54.00 | 53.00 | 82.00 | 84.00 | 92.00 | 91.00 | 74.50 | 12 |

BE0004 Knokke**Depositions in Precipitation** Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|-------------------------|-------|---------|----------|---------|---------|------|---------|---------|---------|-----------|---------|----------|----------|--------------|------------|
| Wet-only sampler | | | | | | | | | | | | | | | |
| aldrin | ng/m2 | 105.34 | 130.88 | 57.22 | 112.44 | | 64.00 | 133.63 | 87.17 | 127.55 | 193.02 | 160.60 | 109.70 | 1282 | 11 |
| p-DDD | ng/m2 | 52.67 | 65.44 | 28.61 | 56.22 | | 32.00 | 66.82 | 43.58 | 63.78 | 96.51 | 80.32 | 54.85 | 641 | 11 |
| p-DDE | ng/m2 | 52.67 | 65.44 | 28.61 | 56.22 | | 32.00 | 66.82 | 43.58 | 63.78 | 96.51 | 80.32 | 54.85 | 641 | 11 |
| p-DDT | ng/m2 | 52.67 | 65.44 | 28.61 | 56.22 | | 32.00 | 66.82 | 43.58 | 63.78 | 96.51 | 80.32 | 54.85 | 641 | 11 |
| dieldrin | ng/m2 | 52.67 | 65.44 | 28.61 | 56.22 | | 32.00 | 66.82 | 43.58 | 63.78 | 96.51 | 80.32 | 54.85 | 641 | 11 |
| endrin | ng/m2 | 105.34 | 130.88 | 57.22 | 112.44 | | 64.00 | 133.63 | 87.17 | 127.55 | 193.02 | 80.32 | 109.70 | 1201 | 11 |
| a-HCH | ng/m2 | 52.67 | 65.44 | 28.61 | 56.22 | | 32.00 | 66.82 | 43.58 | 63.78 | 96.51 | 80.32 | 54.85 | 641 | 11 |
| g-HCH | ng/m2 | 158.01 | 392.64 | 1401.79 | 3598.08 | | 544.00 | 400.90 | 392.26 | 382.66 | 579.07 | 642.60 | 164.55 | 8657 | 11 |
| heptachlor | ng/m2 | 52.67 | 65.44 | 28.61 | 56.22 | | 32.00 | 66.82 | 43.58 | 63.78 | 96.51 | 80.32 | 54.85 | 641 | 11 |
| | | | | | | | | | | | | | | | |
| arsenic | ug/m2 | 68.47 | 85.07 | 37.19 | 73.09 | | 41.60 | 86.86 | 56.66 | 82.91 | 241.28 | 104.42 | 179.47 | 1057 | 11 |
| cadmium | ug/m2 | 36.87 | 45.81 | 40.05 | 39.35 | | 22.40 | 46.77 | 30.51 | 76.53 | 67.56 | 56.22 | 96.64 | 559 | 11 |
| chromium | ug/m2 | 42.14 | 117.79 | 105.85 | 2754.78 | | 172.80 | 734.98 | 104.60 | 153.06 | 173.72 | 249.00 | 148.84 | 4758 | 11 |
| copper | ug/m2 | 352.89 | 137.42 | 163.07 | 134.93 | | 278.40 | 106.91 | 65.38 | 318.88 | 453.61 | 401.60 | 506.60 | 2920 | 11 |
| lead | ug/m2 | 1000.73 | 444.99 | 1830.91 | 2248.80 | | 896.00 | 1804.03 | 4053.31 | 2423.49 | 3570.94 | 1445.75 | 1327.50 | 21046 | 11 |
| mercury | ng/m2 | 526.70 | 1963.20 | 858.24 | 1686.60 | | 1280.00 | 668.16 | 1307.52 | 1913.28 | 2895.36 | 2409.60 | 2198.16 | 17707 | 11 |
| nickel | ug/m2 | 284.42 | 91.62 | 85.82 | 1855.26 | | 44.80 | 46.77 | 56.66 | 114.80 | 135.12 | 120.48 | 206.89 | 3043 | 11 |
| zinc | ug/m2 | 790.05 | 785.28 | 2574.72 | 2080.14 | | 896.00 | 340.76 | 523.01 | 1084.19 | 1737.22 | 1285.12 | 2757.30 | 14854 | 11 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 52.7 | 65.4 | 28.6 | 56.2 | 98.1 | 32.0 | 66.8 | 43.6 | 63.8 | 96.5 | 107.7 | 110.7 | 822 | 12 |
| | | | | | | | | | | | | | | | |

BE0004 Knokke
Depositions in Precipitation (continued)

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------------|-------------------|---------|----------|---------|---------|---------|---------|------|---------|-----------|---------|----------|----------|--------------|------------|
| Bulk sampler | | | | | | | | | | | | | | | |
| cadmium | µg/m ² | 6.45 | 10.86 | 24.55 | 38.65 | 32.95 | 52.58 | | 7.37 | 5.62 | 8.89 | 6.83 | 145.32 | 340 | 11 |
| copper | µg/m ² | 395.16 | 521.66 | 278.07 | 657.51 | 493.57 | 237.28 | | 278.05 | 469.83 | 739.65 | 567.84 | 529.83 | 5168 | 11 |
| lead | µg/m ² | 341.64 | 335.71 | 437.09 | 2504.52 | 1536.48 | 445.32 | | 186.26 | 294.49 | 122.68 | 328.97 | 507.97 | 7041 | 11 |
| zinc | µg/m ² | 425.15 | 1536.29 | 1267.97 | 1160.27 | 3114.14 | 1168.03 | | 1422.41 | 1811.89 | | 3744.20 | 569.70 | 16220 | 10 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 94.9 | 124.8 | 66.7 | 77.3 | 105.6 | 55.7 | | 67 | 112.4 | 177.8 | 136.5 | 128.6 | 1147 | 11 |

BE0011 Moerkerke
Mean Air Concentrations

| | | January | February | March | April | May | June | July | August | September | October | November | December | mean | months |
|-----------------|---------------------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|------|--------|
| NO ₂ | µg N/m ³ | 8.52 | 6.39 | 6.70 | 6.09 | 6.09 | 4.87 | 4.26 | 5.48 | 5.17 | 5.48 | 5.78 | 7.00 | 5.99 | 12 |
| NO | µg N/m ³ | 3.73 | 1.87 | 2.33 | 0.93 | 0.93 | 0.93 | 0.93 | 1.40 | 1.40 | 1.40 | 0.93 | 7.00 | 1.98 | 12 |

BE0013 Houtem

Mean Air Concentrations Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | mean | months |
|-----------------|---------------------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|------|--------|
| NO ₂ | µg N/m ³ | 6.09 | 4.57 | 5.78 | 4.87 | 4.87 | 4.26 | 3.65 | 4.57 | 4.26 | 4.26 | 4.26 | 4.26 | 4.64 | 12 |
| NO | µg N/m ³ | 1.87 | 0.93 | 1.87 | 0.93 | 0.93 | 0.00 | 0.00 | 0.93 | 0.93 | 0.93 | 0.00 | 4.20 | 1.25 | 12 |

Denmark**DK0008 – Anholt
Depositions in precipitation**

| | | January | February | March | April | May | June | July | August | September | October | November | December | total | months |
|----------------------|---------------------|---------|----------|---------|---------|---------|---------|--------|---------|-----------|---------|----------|----------|-------|--------|
| ammonium | mg N/m ² | 11.98 | 14.23 | 14.87 | 60.90 | 43.83 | 7.74 | 7.21 | 11.73 | 24.45 | 51.27 | 49.17 | 16.13 | 314 | 12 |
| nitrate | mg N/m ² | 14.86 | 21.99 | 21.20 | 55.05 | 50.04 | 21.44 | 14.93 | 39.50 | 32.30 | 58.04 | 70.16 | 22.95 | 422 | 12 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| arsenic | µg/m ² | 5.50 | 9.85 | 58.94 | 90.41 | 55.31 | 27.00 | 9.54 | 8.79 | 108.22 | 260.12 | 188.24 | 100.91 | 923 | 12 |
| cadmium | µg/m ² | 1.10 | 1.07 | 4.98 | 15.63 | 10.85 | 5.54 | 1.52 | 3.40 | 23.56 | 43.60 | 36.58 | 15.68 | 163 | 12 |
| chromium | µg/m ² | 5.58 | 8.73 | 45.63 | 198.95 | 44.02 | 25.33 | 10.13 | 24.37 | 60.32 | 106.85 | 78.06 | 26.49 | 634 | 12 |
| copper | µg/m ² | 12.90 | 12.68 | 105.32 | 655.65 | 438.31 | 81.17 | 48.65 | 146.62 | 757.91 | 620.82 | 686.98 | 206.78 | 3774 | 12 |
| lead | µg/m ² | 26.84 | 20.83 | 179.10 | 1091.88 | 623.38 | 151.24 | 72.79 | 250.82 | 818.23 | 1555.85 | 1340.84 | 499.84 | 6632 | 12 |
| nickel | µg/m ² | 10.55 | 5.73 | 30.41 | 136.13 | 56.94 | 12.10 | 15.62 | 50.87 | 140.73 | 113.16 | 159.27 | 14.37 | 746 | 12 |
| zinc | µg/m ² | 243.40 | 200.18 | 1822.05 | 2841.03 | 2614.08 | 1045.44 | 270.12 | 1665.70 | 3857.31 | 6124.96 | 5521.54 | 1832.32 | 28038 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation-N | mm | 26.2 | 24.6 | 63.5 | 83.7 | 63.3 | 54.1 | 39.7 | 36.7 | 75.2 | 95.0 | 99.0 | 41.4 | 703 | 12 |
| precipitation-metals | mm | 22.7 | 23.5 | 57.6 | 71.9 | 61.5 | 52.7 | 31.8 | 31.2 | 80.4 | 85.8 | 87.4 | 63.4 | 670 | 12 |

Mean Air Concentrations Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | no. months |
|----------|-------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|-------------|------------|
| arsenic | ng/m3 | 0.23 | 0.28 | 0.21 | 0.60 | 0.29 | 0.30 | 0.13 | 0.14 | 0.40 | 0.61 | 0.57 | 0.42 | 0.35 | 12 |
| cadmium | ng/m3 | 0.10 | 0.07 | 0.01 | 0.12 | 0.03 | 0.05 | 0.03 | 0.05 | 0.08 | 0.20 | 0.10 | 0.10 | 0.08 | 12 |
| chromium | ng/m3 | 0.60 | 0.41 | 0.16 | 0.36 | 0.54 | 0.61 | 0.06 | 0.17 | 0.33 | 0.42 | 0.50 | 0.29 | 0.37 | 12 |
| copper | ng/m3 | 0.92 | 1.17 | 0.53 | 1.47 | 1.19 | 1.31 | 0.22 | 0.68 | 1.28 | 1.87 | 2.12 | 1.46 | 1.18 | 12 |
| lead | ng/m3 | 4.39 | 3.74 | 1.87 | 6.99 | 3.12 | 3.27 | 1.31 | 2.18 | 6.20 | 10.84 | 9.27 | 6.07 | 4.94 | 12 |
| nickel | ng/m3 | 0.81 | 1.11 | 1.10 | 2.82 | 1.88 | 2.06 | 1.40 | 1.07 | 1.21 | 1.49 | 1.35 | 1.03 | 1.44 | 12 |
| zinc | ng/m3 | 9.27 | 9.67 | 4.82 | 15.82 | 8.29 | 8.09 | 4.66 | 5.09 | 10.95 | 16.74 | 18.62 | 11.60 | 10.30 | 12 |

DK0031 – Ulborg
Depositions in precipitation

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | no. months |
|---------------|-------------------|----------|----------|---------|-------|---------|---------|---------|---------|-----------|----------|----------|----------|-------------|------------|
| arsenic | ug/m ² | 199.29 | 40.96 | 65.12 | | 102.66 | 19.80 | 13.57 | 64.77 | 182.16 | 375.07 | | 17.85 | 108 | 10 |
| cadmium | ug/m ² | 64.31 | 34.88 | 11.79 | | 14.77 | 7.27 | 10.93 | 11.92 | 41.73 | 86.20 | | 9.05 | 29 | 10 |
| chromium | ug/m ² | 137.00 | 83.56 | 63.02 | | 84.25 | 12.05 | 9.09 | 29.81 | 73.89 | 227.31 | | 19.50 | 74 | 10 |
| copper | ug/m ² | 607.33 | 233.50 | 161.55 | | 315.70 | 104.54 | 127.49 | 157.83 | 707.69 | 1196.79 | | 79.76 | 369 | 10 |
| lead | ug/m ² | 1360.44 | 540.81 | 293.93 | | 738.43 | 175.10 | 111.71 | 215.38 | 907.35 | 1870.08 | | 116.55 | 633 | 10 |
| nickel | ug/m ² | 319.88 | 108.84 | 198.11 | | 58.19 | 17.32 | 25.58 | 99.99 | 223.44 | 188.11 | | 33.64 | 127 | 10 |
| zinc | ug/m ² | 16021.09 | 5345.42 | 1486.25 | | 6991.25 | 1217.57 | 1169.89 | 2083.49 | 6759.41 | 16204.74 | | 1999.48 | 5928 | 10 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 126.24 | 98.60 | 70.57 | | 79.74 | 45.16 | 50.68 | 65.41 | 100.04 | 142.22 | | 58.65 | 837 | 10 |

Mean Air Concentrations Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | no. months |
|----------|---------------------|---------|----------|-------|-------|-------|------|------|--------|-----------|---------|----------|----------|-------------|------------|
| NO3+HNO3 | µg N/m ³ | 0.46 | 0.79 | 0.44 | 1.60 | 0.82 | 0.61 | 0.30 | 0.38 | 0.68 | 0.33 | 0.87 | 0.65 | 0.66 | 12 |
| NH3+NH4 | µg N/m ³ | 0.80 | 1.29 | 1.11 | 3.69 | 2.41 | 1.20 | 0.98 | 0.83 | 1.47 | 0.66 | 1.18 | 1.22 | 1.40 | 12 |
| arsenic | ng/m3 | 0.17 | 0.24 | 0.19 | 0.56 | 0.37 | 0.21 | 0.10 | 0.14 | 0.32 | 0.41 | 0.24 | 0.47 | 0.28 | 12 |
| cadmium | ng/m3 | 0.07 | 0.06 | 0.03 | 0.09 | 0.06 | 0.06 | 0.05 | 0.00 | 0.08 | 0.13 | 0.12 | 0.19 | 0.08 | 12 |
| chromium | ng/m3 | 0.27 | 0.22 | 0.08 | 0.49 | 0.84 | 0.58 | 0.09 | 0.23 | 0.36 | 0.44 | 0.47 | 0.28 | 0.36 | 12 |
| copper | ng/m3 | 0.68 | 0.69 | 0.27 | 1.53 | 1.37 | 1.07 | 0.43 | 0.32 | 1.15 | 1.54 | 1.32 | 1.44 | 0.98 | 12 |
| lead | ng/m3 | 3.45 | 4.05 | 1.93 | 6.82 | 3.67 | 3.47 | 1.60 | 1.52 | 5.17 | 7.75 | 5.88 | 5.65 | 4.25 | 12 |
| nickel | ng/m3 | 0.71 | 0.88 | 0.78 | 1.59 | 1.16 | 1.22 | 0.83 | 0.75 | 0.85 | 0.75 | 0.81 | 0.68 | 0.92 | 12 |
| zinc | ng/m3 | 7.49 | 8.71 | 6.28 | 14.41 | 11.72 | 7.89 | 4.30 | 4.35 | 11.45 | 16.73 | 13.39 | 14.79 | 10.13 | 12 |

France**FR0090R – Porspoder
Depositions in precipitation**

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|---------------------|---------|----------|--------|--------|--------|--------|--------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m ² | 11.86 | 5.06 | 41.92 | 37.37 | 72.81 | 30.96 | 47.71 | 9.41 | 35.76 | 18.21 | 3.54 | 3.15 | 318 | 12 |
| nitrate | mg N/m ² | 37.49 | 10.66 | 55.99 | 98.42 | 12.28 | 75.55 | 42.39 | 15.03 | 19.59 | 8.90 | 13.37 | 18.74 | 408 | 12 |
| | | | | | | | | | | | | | | | |
| arsenic | µg/m ² | 5.08 | 5.70 | 5.93 | 12.01 | 3.80 | 3.39 | 3.37 | 1.94 | 1.05 | 2.46 | 4.55 | 4.05 | 53 | 12 |
| cadmium | µg/m ² | 1.69 | 0.81 | 2.16 | 6.86 | 2.53 | 3.39 | 1.87 | 1.21 | 1.05 | 1.23 | 4.55 | 4.05 | 31 | 12 |
| chromium | µg/m ² | 20.33 | 3.26 | 2.16 | 3.43 | 26.57 | 32.19 | 12.34 | 5.08 | 17.77 | 13.55 | 86.53 | 18.22 | 241 | 12 |
| copper | µg/m ² | 99.10 | 113.96 | 44.20 | 187.04 | 61.99 | 108.42 | 118.56 | 64.13 | 37.62 | 65.30 | 127.51 | 103.22 | 1131 | 12 |
| lead | µg/m ² | 255.79 | 175.82 | 64.68 | 247.10 | 173.31 | 151.61 | 181.39 | 56.87 | 110.77 | 155.23 | 500.94 | 325.86 | 2399 | 12 |
| nickel | µg/m ² | 28.80 | 62.68 | 30.18 | 211.07 | 68.31 | 54.21 | 170.92 | 65.34 | 27.17 | 59.14 | 91.08 | 68.82 | 938 | 12 |
| zinc | µg/m ² | 286.29 | 103.38 | 213.98 | 657.23 | 266.92 | 327.79 | 289.85 | 54.45 | 147.35 | 204.51 | 195.82 | 242.88 | 2990 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 84.7 | 81.4 | 53.9 | 171.6 | 126.5 | 84.7 | 37.4 | 24.2 | 104.5 | 123.2 | 227.7 | 202.4 | 1322 | 12 |

Germany

DE0041 Westerland - Tinum Depositions in Precipitation

| | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|------------------------------|---------|----------|---------|---------|--------|--------|---------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium mg N/m ² | 25.82 | 27.62 | 29.34 | 43.65 | 55.27 | 30.20 | 20.49 | 32.23 | 38.21 | 25.58 | 37.91 | 18.20 | 385 | 12 |
| nitrate mg N/m ² | 21.13 | 36.01 | 33.74 | 29.98 | 39.16 | 23.79 | 16.36 | 31.01 | 40.85 | 34.43 | 74.29 | 30.47 | 411 | 12 |
| | | | | | | | | | | | | | | |
| all organics are ng/m2 | | | | | | | | | | | | | | |
| HCB | 22.36 | 11.28 | 14.29 | 70.33 | 10.10 | 13.23 | 25.03 | 6.68 | 15.61 | 25.40 | 41.60 | 21.11 | 277 | 12 |
| alpha_HCH | 10.92 | 24.56 | 24.19 | 18.52 | 35.18 | 27.69 | 39.71 | 19.47 | 31.87 | 67.97 | 74.79 | 44.01 | 419 | 12 |
| anthracene | 29.00 | 261.00 | 165.00 | 1509.00 | 251.00 | 222.00 | 347.00 | 220.00 | 275.00 | 224.00 | 517.00 | 528.00 | 4548 | 12 |
| benz_a anthracene | 68.00 | 237.00 | 172.00 | 904.00 | 240.00 | 176.00 | 311.00 | 309.00 | 250.00 | 241.00 | 672.00 | 663.00 | 4243 | 12 |
| benzo_a pyrene | 36.00 | 99.00 | 55.00 | 101.00 | 161.00 | 157.00 | 156.00 | 267.00 | 141.00 | 183.00 | 354.00 | 353.00 | 2063 | 12 |
| benzo_b fluoranthene | 123.00 | 339.00 | 208.00 | 204.00 | 253.00 | 178.00 | 199.00 | 350.00 | 236.00 | 379.00 | 1350.00 | 1148.00 | 4967 | 12 |
| benzo_ghi perylene | 98.00 | 236.00 | 175.00 | 139.00 | 205.00 | 133.00 | 181.00 | 310.00 | 188.00 | 267.00 | 845.00 | 781.00 | 3558 | 12 |
| benzo_k fluoranthene | 53.00 | 135.00 | 82.00 | 93.00 | 114.00 | 81.00 | 92.00 | 164.00 | 98.00 | 150.00 | 479.00 | 428.00 | 1969 | 12 |
| chrysene | 129.00 | 428.00 | 265.00 | 548.00 | 311.00 | 241.00 | 293.00 | 445.00 | 304.00 | 487.00 | 1855.00 | 1291.00 | 6597 | 12 |
| dieldrin | 11.76 | 14.26 | 11.73 | 6.09 | 7.10 | 4.50 | 7.94 | 4.53 | 8.70 | 29.84 | 58.12 | 27.97 | 193 | 12 |
| fluoranthene | 276.04 | 866.33 | 3402.36 | 436.88 | 828.04 | 830.56 | 2246.88 | 477.12 | 627.30 | 3462.12 | 3701.88 | | 17156 | 11 |
| gamma_HCH | 49.01 | 183.70 | 225.43 | 737.48 | 847.98 | 379.82 | 236.71 | 123.22 | 216.83 | 412.21 | 384.81 | 206.66 | 4004 | 12 |
| inden 123cd pyrene | 40.00 | 162.00 | 143.00 | 87.00 | 137.00 | 86.00 | 40.00 | 221.00 | 135.00 | 203.00 | 646.00 | 826.00 | 2726 | 12 |

| | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|-----------------------------------|---------|----------|---------|---------|---------|---------|--------|---------|-----------|---------|----------|----------|--------------|------------|
| phenanthrene | 277.00 | 1106.00 | 672.00 | 1847.00 | 872.00 | 758.00 | 887.00 | 1014.00 | 873.00 | 1500.00 | 3862.00 | 2736.00 | 16404 | 12 |
| pyrene | 179.00 | 550.00 | 379.00 | 1045.00 | 506.00 | 443.00 | 585.00 | 806.00 | 633.00 | 914.00 | 2333.00 | 1890.72 | 10264 | 12 |
| | | | | | | | | | | | | | | |
| arsenic $\mu\text{g}/\text{m}^2$ | 3.75 | 8.89 | 7.95 | 5.99 | 6.95 | 4.13 | 2.95 | 4.94 | 7.62 | 14.21 | 19.66 | 12.70 | 100 | 12 |
| cadmium $\mu\text{g}/\text{m}^2$ | 2.26 | 2.07 | 3.39 | 2.97 | 2.80 | 3.21 | 1.66 | 2.34 | 3.24 | 4.99 | 9.12 | 5.00 | 43 | 12 |
| chromium $\mu\text{g}/\text{m}^2$ | 3.24 | 3.20 | 4.65 | 6.86 | 10.21 | 9.49 | 7.88 | 2.45 | 11.37 | 20.47 | 25.16 | 14.58 | 120 | 12 |
| lead $\mu\text{g}/\text{m}^2$ | 47.33 | 69.52 | 39.20 | 26.42 | 54.50 | 34.41 | 32.27 | 35.36 | 58.90 | 61.76 | 180.02 | 75.44 | 715 | 12 |
| mercury $\mu\text{g}/\text{m}^2$ | 240.10 | 350.47 | 191.45 | 429.63 | 398.41 | 472.00 | 264.46 | 447.78 | 480.60 | 439.71 | 1065.87 | 1540.07 | 6321 | 12 |
| nickel $\mu\text{g}/\text{m}^2$ | 27.06 | 36.04 | 31.94 | 40.74 | 37.32 | 67.43 | 23.97 | 25.19 | 28.86 | 65.14 | 77.32 | 55.94 | 517 | 12 |
| zinc $\mu\text{g}/\text{m}^2$ | 964.92 | 1139.32 | 1389.08 | 2036.85 | 1315.88 | 1269.45 | 811.36 | 996.71 | 1113.21 | 1497.42 | 2388.78 | 1229.02 | 16152 | 12 |
| | | | | | | | | | | | | | | |
| precipitation all mm | 29.4 | 36.4 | 48.4 | 36.7 | 49.1 | 46.5 | 46.1 | 22.1 | 58.9 | 84.6 | 115.4 | 84.8 | 658 | 12 |
| precipitation -N | 30.0 | 38.0 | 43.2 | 35.3 | 48.6 | 50.4 | 45.4 | 20.2 | 59.2 | 84.0 | 101.8 | 73.9 | 630 | 12 |
| precipitation - Hg | 34.5 | 39.2 | 44.1 | 36.9 | 47.8 | 49.2 | 45.7 | 22.0 | 59.3 | 92.7 | 109.2 | 81.6 | 662 | 12 |

**DE0001 Westerland
Mean Air Concentrations**

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | no. months |
|----------|---------------------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|-------------|------------|
| NO2 | ug N/m ³ | 2.50 | 2.60 | 1.70 | 2.10 | 1.70 | 1.30 | 1.00 | 1.20 | 2.10 | 2.90 | 4.00 | 2.80 | 2.16 | 12 |
| nitrate | ug N/m ³ | 0.56 | 0.96 | 0.53 | 1.20 | 0.52 | 0.56 | 0.18 | 0.60 | 0.88 | 0.88 | 1.03 | 1.00 | 0.74 | 12 |
| ammonium | ug N/m ³ | 0.15 | 0.17 | 0.27 | 0.92 | 0.20 | 0.41 | 0.10 | 0.32 | 0.85 | 0.98 | 0.78 | 0.96 | 0.51 | 12 |
| | | | | | | | | | | | | | | | |
| arsenic | ng/m3 | 0.64 | 1.09 | 0.56 | 1.16 | 1.62 | 0.60 | 0.79 | 0.80 | 1.30 | 1.30 | 0.63 | 1.74 | 1.02 | 12 |
| cadmium | ng/m3 | 0.16 | 0.16 | 0.08 | 0.21 | 0.19 | 0.09 | 0.04 | 0.11 | 0.22 | 0.26 | 0.21 | 0.27 | 0.17 | 12 |
| lead | ng/m3 | 7.31 | 6.57 | 3.01 | 7.90 | 6.56 | 4.17 | 2.19 | 3.54 | 8.30 | 10.73 | 7.99 | 9.31 | 6.47 | 12 |

Iceland

IS0002 – Irafoss

Depositions in precipitation Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|----------------------|----------------------|---------|----------|----------|--------|---------|--------|---------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N /m ² | 6.443 | 7.0805 | 21.909 | 0.43 | 16.7165 | 45.792 | 0.952 | 2.366 | 19.676 | 14.836 | 3.717 | 0.238 | 140 | 12 |
| nitrate | mg N /m ² | 4.184 | 2.252 | 10.843 | 4.11 | 17.449 | 7.616 | 10.0245 | 2.09 | 8.801 | 1.733 | 2.38 | 0.846 | 72 | 12 |
| arsenic | µg/m ² | 1.94 | 3.48 | 7.04 | 2.31 | 7.95 | 1.93 | 4.61 | 3.16 | 4.74 | 2.61 | 1.21 | 1.04 | 42 | 12 |
| cadmium | µg/m ² | 6.86 | 2.90 | 3.50 | 0.83 | 2.01 | 0.75 | 2.04 | 1.25 | 1.16 | 1.04 | 0.78 | 1.74 | 25 | 12 |
| chromium | µg/m ² | 4.60 | 21.95 | 14.08 | 25.39 | 18.92 | 25.56 | 9.22 | 197.43 | 20.70 | 5.22 | 30.50 | 24.98 | 399 | 12 |
| copper | µg/m ² | 150.29 | 192.09 | 332.02 | 91.65 | 98.60 | 116.30 | 78.36 | 139.50 | 126.30 | 47.05 | 108.51 | 127.22 | 1608 | 12 |
| lead | µg/m ² | 64.81 | 110.06 | 173.81 | 77.06 | 75.04 | 42.71 | 51.92 | 39.41 | 60.04 | 31.56 | 30.79 | 101.10 | 858 | 12 |
| nickel | µg/m ² | 12.29 | 30.55 | 43.31 | 40.71 | 62.83 | 35.40 | 9.22 | 201.49 | 37.38 | 32.07 | 43.34 | 33.90 | 583 | 12 |
| zinc | µg/m ² | 2913.65 | 3793.72 | 10398.85 | 618.90 | 803.08 | 436.49 | 1057.70 | 554.33 | 1395.48 | 1317.40 | 1132.82 | 1882.98 | 26305 | 12 |
| | µg/m ² | | | | | | | | | | | | | | |
| precipitation-N | mm | 69.6 | 124.3 | 242.6 | 86.3 | 204.9 | 77.0 | 190.8 | 117.8 | 183.7 | 102.3 | 48.5 | 40.0 | 1488 | 12 |
| precipitation-metals | mm | 77.6 | 139.3 | 281.7 | 93.4 | 188.3 | 76.2 | 184.7 | 120.2 | 188.4 | 104.5 | 48.6 | 41.7 | 1545 | 12 |

IS0090 Reykjavik**Depositions in Precipitation** Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|----------------------|----------------------|---------|----------|--------|--------|--------|--------|--------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N /m ² | 26.47 | 24.35 | 39.65 | 6.13 | 5.35 | 9.81 | 0.18 | 8.09 | 30.74 | 10.86 | 3.89 | 3.50 | 169 | 12 |
| nitrate | mg N /m ² | 4.16 | 3.44 | 9.09 | 2.87 | 5.64 | 5.60 | 4.09 | 2.64 | 7.66 | 1.88 | 0.764 | 1.2 | 49 | 12 |
| | | | | | | | | | | | | | | | |
| arsenic | ug/m ² | 5.34 | 2.30 | 3.06 | 1.44 | 3.01 | 2.79 | 1.1176 | 1.94 | 3.92 | 1.29 | 0.30 | 1.11 | 28 | 12 |
| cadmium | ug/m ² | 2.33 | 0.55 | 0.97 | 0.54 | 0.96 | 0.53 | 0.45 | 0.33 | 0.92 | 0.34 | 0.061 | 0.20497 | 8 | 12 |
| chromium | ug/m ² | 17.39 | 3.26 | 6.71 | 26.77 | 10.85 | 26.48 | 13.176 | 5.12 | 15.86 | 2.58 | 2.34 | 6.15 | 137 | 12 |
| copper | ug/m ² | 132.22 | 50.90 | 120.39 | 118.83 | 116.04 | 162.85 | 68.72 | 81.05 | 107.72 | 99.45 | 42.21 | 80.44 | 1181 | 12 |
| lead | ug/m ² | 36.32 | 23.19 | 51.40 | 51.24 | 42.27 | 52.64 | 24.93 | 24.50 | 51.61 | 69.59 | 11.24 | 17.50 | 456 | 12 |
| nickel | ug/m ² | 118.90 | 10.99 | 28.49 | 103.55 | 43.12 | 39.04 | 17.57 | 46.77 | 26.79 | 35.07 | 10.30 | 15.9518 | 497 | 12 |
| zinc | ug/m ² | 326.83 | 101.93 | 174.64 | 456.23 | 405.70 | 350.66 | 161.43 | 161.16 | 430.75 | 338.99 | 136.56 | 140.183 | 3185 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation - N | mm | 42.9 | 63.7 | 112.5 | 27.7 | 43.8 | 57.6 | 36.6 | 65.3 | 130.5 | 48.9 | 10.8 | 35.1 | 675 | 12 |
| precipitation - rest | mm | 82.9 | 65.1 | 119.5 | 31.7 | 47.2 | 58.8 | 37.1 | 63.1 | 137.0 | 51.7 | 12.4 | 38.7 | 745 | 12 |

IS0091 Storhofdi**Depositions in Precipitation** Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|----------|-------|---------|----------|-------|-------|-------|------|------|--------|-----------|---------|----------|----------|--------------|------------|
| HCB | ng/m2 | 0.80 | 1.10 | 1.19 | 4.10 | 1.41 | 0.49 | 0.49 | 0.38 | 1.43 | 0.79 | 0.71 | 0.93 | 14 | 12 |
| PCB28 | ng/m2 | 4.8 | 4.80 | 4.80 | 4.80 | 4.81 | 4.80 | 1.8 | 1.78 | 4.31 | 1.80 | 1.80 | 5.29 | 46 | 12 |
| PCB31 | ng/m2 | 3.70 | 5.65 | 3.69 | 3.69 | 3.69 | 3.69 | 2.9 | 1.60 | 4.51 | 1.59 | 1.60 | 5.30 | 42 | 12 |
| PCB52 | ng/m2 | 1.8 | 1.80 | 1.80 | 1.80 | 1.79 | 1.80 | 1.30 | 0.80 | 1.58 | 0.81 | 0.79 | 1.60 | 18 | 12 |
| PCB101 | ng/m2 | 0.6 | 0.59 | 0.60 | 1.39 | 0.59 | 0.60 | 0.20 | 0.20 | 0.36 | 0.19 | 0.87 | 0.20 | 6 | 12 |
| PCB105 | ng/m2 | 0.3 | 0.90 | 0.55 | 0.94 | 0.30 | 0.40 | 0.24 | 0.10 | 0.56 | 0.25 | 0.63 | 0.51 | 6 | 12 |
| PCB118 | ng/m2 | 0.40 | 0.39 | 0.39 | 1.39 | 0.39 | 0.40 | 0.20 | 0.20 | 0.33 | 0.19 | 0.98 | 0.32 | 6 | 12 |
| PCB138 | ng/m2 | 0.70 | 0.69 | 0.70 | 2.45 | 0.70 | 0.70 | 0.3 | 0.30 | 0.69 | 0.30 | 0.87 | 0.52 | 9 | 12 |
| PCB153 | ng/m2 | 0.70 | 0.69 | 0.70 | 3.05 | 0.70 | 0.70 | 0.65 | 0.30 | 0.76 | 0.30 | 1.14 | 0.49 | 10 | 12 |
| PCB156 | ng/m2 | 0.19 | 0.19 | 0.20 | 0.20 | 0.19 | 0.19 | 0.20 | 0.20 | 0.19 | 0.19 | 0.20 | 0.20 | 2 | 12 |
| PCB180 | ng/m2 | 0.49 | 0.51 | 0.49 | 3.25 | 0.50 | 0.50 | 0.40 | 0.20 | 0.36 | 0.19 | 0.30 | 0.20 | 7 | 12 |
| a-HCH | ng/m2 | 10.39 | 12.60 | 11.01 | 6.50 | 11.50 | 5.79 | 7.90 | 13.89 | 21.01 | 21.67 | 7.40 | 10.50 | 140 | 12 |
| b-HCH | ng/m2 | 0.19 | 0.59 | 0.48 | 0.20 | 0.19 | 0.19 | 0.24 | 0.25 | 0.52 | 0.38 | 1.17 | 0.35 | 5 | 12 |
| g-HCH | ng/m2 | 2.60 | 5.30 | 5.90 | 2.89 | 15.20 | 4.59 | 4.67 | 2.77 | 7.20 | 6.48 | 2.69 | 3.19 | 64 | 12 |
| cis-CD | ng/m2 | 0.6 | 1.10 | 0.79 | 0.44 | 0.46 | 0.29 | 0.19 | 0.10 | 0.36 | 0.41 | 0.19 | 0.38 | 5 | 12 |
| dieldrin | ng/m2 | 2.50 | 3.77 | 4.82 | 2.20 | 2.70 | 1.00 | 0.95 | 0.60 | 2.46 | 3.12 | 2.05 | 1.93 | 28 | 12 |
| op-DDT | ng/m2 | 0.40 | 0.39 | 0.39 | 0.39 | 0.39 | 0.70 | 0.09 | 0.10 | 0.11 | 0.11 | 0.09 | 0.1 | 3 | 12 |
| pp-DDD | ng/m2 | 0.19 | 0.19 | 0.20 | 0.20 | 0.19 | 0.39 | 0.20 | 0.20 | 0.19 | 0.19 | 0.20 | 0.20 | 3 | 12 |
| pp-DDE | ng/m2 | 0.6 | 1.02 | 0.61 | 0.20 | 0.19 | 0.19 | 0.75 | 0.22 | 0.11 | 0.11 | 0.09 | 0.29 | 4 | 12 |

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|-------|---------|----------|-------|-------|------|-------|------|--------|-----------|---------|----------|----------|--------------|------------|
| pp-DDT | ng/m2 | 0.3 | 1.04 | 0.30 | 0.44 | 1.56 | 0.297 | 0.20 | 0.20 | 0.19 | 1.30 | 0.20 | 0.20 | 6 | 12 |
| trans-CD | ng/m2 | 0.3 | 0.44 | 0.46 | 0.29 | 0.30 | 0.29 | 0.09 | 0.10 | 0.37 | 0.11 | 0.09 | 0.1 | 3 | 12 |
| trans-NO | ng/m2 | 0.3 | 0.44 | 0.46 | 0.29 | 0.30 | 0.29 | 0.09 | 0.10 | 0.11 | 0.11 | 0.09 | 0.1 | 3 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 35 | 57 | 75 | 23.5 | 68 | 18.5 | 53 | 48 | 99 | 76 | 22 | 42 | 617 | 12 |

Mean Air Concentrations Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|----------|---------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|--------------|------------|
| arsenic | ng/m3 | 0.07 | 0.14 | 0.11 | 0.17 | 0.11 | 0.08 | 0.08 | 0.06 | 0.12 | 0.07 | 0.10 | 0.11 | 0.10 | 12 |
| cadmium | ng/m3 | 0.08 | 0.16 | 0.19 | 0.06 | 0.16 | 0.02 | 0.08 | 0.05 | 0.02 | 0.03 | 0.03 | 0.14 | 0.08 | 12 |
| chromium | ng/m3 | 19.86 | 12.06 | 14.89 | 4.65 | 4.61 | 14.75 | 15.94 | 7.55 | 16.85 | 9.64 | 3.75 | 5.57 | 10.84 | 12 |
| copper | ng/m3 | 1.86 | 1.61 | 0.98 | 3.08 | 1.11 | 0.83 | 0.65 | 0.44 | 1.95 | 0.76 | 1.86 | 2.17 | 1.44 | 12 |
| lead | ng/m3 | 0.73 | 0.82 | 0.63 | 0.77 | 0.53 | 0.38 | 0.64 | 0.22 | 0.49 | 0.20 | 0.50 | 0.57 | 0.54 | 12 |
| nickel | ng/m3 | 17.23 | 9.84 | 9.33 | 2.82 | 3.28 | 8.06 | 9.16 | 5.45 | 9.82 | 6.59 | 2.97 | 3.93 | 7.37 | 12 |
| zinc | ng/m3 | 15.82 | 25.68 | 11.86 | 7.79 | 17.85 | 2.37 | 4.10 | 3.17 | 4.57 | 2.79 | 6.77 | 7.69 | 9.20 | 12 |
| | | | | | | | | | | | | | | | |
| nitrate | ug N/m ³ | 0.03 | 0.02 | 0.03 | 0.04 | 0.05 | 0.07 | 0.11 | 0.02 | 0.04 | 0.02 | 0.06 | 0.02 | 0.04 | 12 |
| | | | | | | | | | | | | | | | |
| HCB | pg/m3 | 5.19 | 6.68 | 5.23 | 6.67 | 6.30 | 5.18 | 3.61 | 4.30 | 6.85 | 6.03 | 5.56 | 8.74 | 5.87 | 12 |
| PCB28 | pg/m3 | 2.20 | 2.52 | 2.09 | 2.49 | 2.20 | 2.30 | 0.79 | 0.88 | 0.83 | 0.88 | 0.91 | 2.31 | 1.71 | 12 |
| PCB31 | pg/m3 | 1.69 | 1.95 | 1.61 | 1.92 | 1.70 | 1.77 | 0.71 | 0.79 | 0.74 | 0.78 | 0.81 | 2.16 | 1.39 | 12 |
| PCB52 | pg/m3 | 0.82 | 0.94 | 0.78 | 0.93 | 0.82 | 0.86 | 0.35 | 0.39 | 0.37 | 0.39 | 0.40 | 1.34 | 0.71 | 12 |
| PCB101 | pg/m3 | 0.27 | 0.31 | 0.26 | 0.31 | 0.27 | 0.28 | 0.33 | 0.19 | 0.38 | 0.09 | 0.29 | 0.56 | 0.30 | 12 |
| PCB105 | pg/m3 | 0.14 | 0.15 | 0.13 | 0.15 | 0.13 | 0.14 | 0.04 | 0.04 | 0.08 | 0.04 | 0.05 | 0.04 | 0.10 | 12 |
| PCB118 | pg/m3 | 0.185 | 0.20 | 0.17 | 0.20 | 0.18 | 0.19 | 0.08 | 0.09 | 0.13 | 0.09 | 0.10 | 0.18 | 0.16 | 12 |
| PCB138 | pg/m3 | 0.32 | 0.36 | 0.30 | 0.36 | 0.32 | 0.33 | 0.13 | 0.14 | 0.13 | 0.14 | 0.15 | 0.14 | 0.24 | 12 |
| PCB153 | pg/m3 | 0.32 | 0.37 | 0.31 | 0.36 | 0.32 | 0.34 | 0.36 | 0.15 | 0.23 | 0.15 | 0.15 | 0.23 | 0.27 | 12 |

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|----------|-------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|--------------|------------|
| PCB156 | pg/m3 | 0.09 | 0.10 | 0.09 | 0.10 | 0.09 | 0.10 | 0.09 | 0.10 | 0.09 | 0.10 | 0.10 | 0.10 | 0.10 | 12 |
| PCB180 | pg/m3 | 0.23 | 0.26 | 0.22 | 0.26 | 0.23 | 0.24 | 0.09 | 0.10 | 0.09 | 0.28 | 0.10 | 0.10 | 0.18 | 12 |
| a-HCH | pg/m3 | 6.30 | 7.74 | 5.65 | 8.02 | 7.91 | 7.84 | 6.91 | 8.41 | 11.46 | 8.31 | 6.80 | 8.30 | 7.80 | 12 |
| b-HCH | pg/m3 | 0.09 | 0.10 | 0.09 | 0.10 | 0.19 | 0.34 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.10 | 12 |
| g-HCH | pg/m3 | 1.89 | 1.95 | 3.04 | 4.59 | 6.53 | 4.61 | 3.25 | 2.87 | 5.26 | 3.58 | 4.97 | 3.41 | 3.83 | 12 |
| cis-CD | pg/m3 | 0.82 | 0.79 | 0.88 | 1.04 | 1.08 | 1.06 | 1.43 | 1.29 | 1.21 | 1.13 | 0.93 | 0.83 | 1.04 | 12 |
| dieldrin | pg/m3 | 0.96 | 1.16 | 1.27 | 1.20 | 1.38 | 1.44 | 1.18 | 0.85 | 0.97 | 0.97 | 1.07 | 0.89 | 1.11 | 12 |
| op-DDT | pg/m3 | 0.19 | 0.21 | 0.17 | 0.21 | 0.18 | 0.19 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.05 | 0.12 | 12 |
| pp-DDD | pg/m3 | 0.09 | 0.10 | 0.09 | 0.10 | 0.09 | 0.10 | 0.09 | 0.10 | 0.09 | 0.10 | 0.10 | 0.10 | 0.10 | 12 |
| pp-DDE | pg/m3 | 0.23 | 0.21 | 0.31 | 0.10 | 0.18 | 0.10 | 0.30 | 0.21 | 0.17 | 0.19 | 0.40 | 0.31 | 0.23 | 12 |
| pp-DDT | pg/m3 | 0.14 | 0.16 | 0.13 | 0.15 | 0.14 | 0.27 | 0.09 | 0.01 | 0.09 | 0.10 | 0.10 | 0.10 | 0.13 | 12 |
| trans-CD | pg/m3 | 0.55 | 0.48 | 0.61 | 0.62 | 0.60 | 0.72 | 0.58 | 0.48 | 0.44 | 0.41 | 0.39 | 0.38 | 0.52 | 12 |
| trans-NO | pg/m3 | 0.55 | 0.48 | 0.61 | 0.73 | 0.60 | 0.77 | 0.70 | 0.53 | 0.50 | 0.51 | 0.50 | 0.45 | 0.58 | 12 |

Ireland

IE0001 Valentia

Depositions in Precipitation Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|-------------------|---------|----------|---------|---------|---------|---------|---------|---------|-----------|----------|----------|----------|--------------|------------|
| arsenic | µg/m ² | 26.03 | 49.30 | 10.63 | 19.25 | 30.38 | 27.03 | 41.00 | 45.35 | 76.10 | 154.45 | 135.00 | 107.35 | 722 | 12 |
| cadmium | µg/m ² | 2.60 | 4.93 | 2.98 | 1.93 | 3.04 | 2.70 | 4.10 | 4.54 | 7.61 | 15.45 | 13.50 | 10.74 | 74 | 12 |
| chromium | µg/m ² | 26.03 | 49.30 | 10.63 | 19.25 | 30.38 | 27.03 | 41.00 | 45.35 | 76.10 | 154.45 | 135.00 | 107.35 | 722 | 12 |
| copper | µg/m ² | 62.46 | 49.30 | 51.00 | 19.25 | 72.90 | 27.03 | 41.00 | 181.40 | 76.10 | 154.45 | 3267.00 | 107.35 | 4109 | 12 |
| lead | µg/m ² | 26.03 | 49.30 | 42.50 | 19.25 | 30.38 | 27.03 | 41.00 | 45.35 | 76.10 | 154.45 | 270.00 | 107.35 | 889 | 12 |
| mercury | µg/m ² | 5205.00 | 9860.00 | 2125.00 | 3850.00 | 6075.00 | 5405.00 | 4100.00 | 4535.00 | 7610.00 | 15445.00 | 13500.00 | 10735.00 | 88445 | 12 |
| nickel | µg/m ² | 26.03 | 49.30 | 10.63 | 19.25 | 30.38 | 27.03 | 41.00 | 45.35 | 76.10 | 154.45 | 135.00 | 107.35 | 722 | 12 |
| zinc | µg/m ² | 4819.83 | 7513.32 | 2023.00 | 1547.70 | 1944.00 | 3005.18 | 4436.20 | 3165.43 | 2587.40 | 11985.32 | 9963.00 | 4658.99 | 57649 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 104.1 | 197.2 | 42.5 | 77 | 121.5 | 108.1 | 82 | 90.7 | 152.2 | 308.9 | 270 | 214.7 | 1769 | 12 |

Mean Air Concentrations Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | months |
|----------|-------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|-------------|--------|
| arsenic | ng/m3 | 0.23 | 0.28 | 0.21 | 0.60 | 0.29 | 0.30 | 0.13 | 0.14 | 0.40 | 0.61 | 0.57 | 0.42 | 0.35 | 12 |
| cadmium | ng/m3 | 0.10 | 0.07 | 0.01 | 0.12 | 0.03 | 0.05 | 0.03 | 0.05 | 0.08 | 0.20 | 0.10 | 0.10 | 0.08 | 12 |
| chromium | ng/m3 | 0.60 | 0.41 | 0.16 | 0.36 | 0.54 | 0.61 | 0.06 | 0.17 | 0.33 | 0.42 | 0.50 | 0.29 | 0.37 | 12 |
| copper | ng/m3 | 0.92 | 1.17 | 0.53 | 1.47 | 1.19 | 1.31 | 0.22 | 0.68 | 1.28 | 1.87 | 2.12 | 1.46 | 1.18 | 12 |
| lead | ng/m3 | 4.39 | 3.74 | 1.87 | 6.99 | 3.12 | 3.27 | 1.31 | 2.18 | 6.20 | 10.84 | 9.27 | 6.07 | 4.94 | 12 |
| nickel | ng/m3 | 0.81 | 1.11 | 1.10 | 2.82 | 1.88 | 2.06 | 1.40 | 1.07 | 1.21 | 1.49 | 1.35 | 1.03 | 1.44 | 12 |
| zinc | ng/m3 | 9.27 | 9.67 | 4.82 | 15.82 | 8.29 | 8.09 | 4.66 | 5.09 | 10.95 | 16.74 | 18.62 | 11.60 | 10.30 | 12 |

IE0002 Turlough Hill**Depositions in Precipitation** Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|-----------|----------------------|---------|----------|---------|---------|---------|---------|---------|---------|-----------|----------|----------|----------|--------------|------------|
| ammonium | mg N /m ² | 33.03 | 9.69 | 16.07 | 73.44 | 61.82 | 79.85 | 27.68 | 48.85 | 32.66 | 25.44 | | | 409 | 10 |
| nitrate | mg N /m ² | 13.21 | 12.46 | 13.96 | 52.02 | 23.78 | 31.54 | 17.61 | 26.75 | 20.63 | 16.19 | | | 228 | 10 |
| arsenic | ug/m ² | 27.53 | 34.60 | 10.58 | 38.25 | 23.78 | 16.78 | 31.45 | 58.15 | 85.95 | 115.65 | 195.00 | | 638 | 11 |
| cadmium | ug/m ² | 2.75 | 9.69 | 4.65 | 15.30 | 6.66 | 1.68 | 3.15 | 5.82 | 8.60 | 23.13 | 42.90 | | 124 | 11 |
| chromium | ug/m ² | 27.53 | 34.60 | 84.60 | 38.25 | 76.08 | 16.78 | 31.45 | 58.15 | 85.95 | 115.65 | 195.00 | | 764 | 11 |
| copper | ug/m ² | 165.15 | 138.40 | 224.19 | 137.70 | 104.61 | 16.78 | 106.93 | 58.15 | 85.95 | 439.47 | 9867.00 | | 11344 | 11 |
| lead | ug/m ² | 77.07 | 138.40 | 118.44 | 38.25 | 114.12 | 16.78 | 31.45 | 58.15 | 85.95 | 115.65 | 195.00 | | 989 | 11 |
| mercury | ng/m ² | 5505.00 | 6920.00 | 2115.00 | 7650.00 | 4755.00 | 3355.00 | 3145.00 | 5815.00 | 8595.00 | 11565.00 | 19500.00 | | 78920 | 11 |
| nickel | ug/m ² | 27.53 | 34.60 | 63.45 | 91.80 | 23.78 | 16.78 | 31.45 | 58.15 | 85.95 | 115.65 | 195.00 | | 744 | 11 |
| zinc | ug/m ² | 396.36 | 567.44 | 380.70 | 306.00 | 418.44 | 16.78 | 553.52 | 500.09 | 653.22 | 1827.27 | 10257.00 | | 15877 | 11 |
| alpha_HCH | ng/m ² | 770.70 | 415.20 | 359.55 | | | 603.90 | 62.90 | 116.30 | 85.95 | 115.65 | 195.00 | 328.60 | 3054 | 10 |
| gamma_HCH | ng/m ² | 770.70 | 415.20 | 359.55 | | | 67.10 | 125.80 | 290.75 | 85.95 | 115.65 | 390.00 | 1150.10 | 3771 | 10 |
| aldrin | ng/m ² | 770.70 | 415.20 | 359.55 | | | 134.20 | 62.90 | 116.30 | 85.95 | 115.65 | 195.00 | 328.60 | 2584 | 10 |
| dieldrin | ng/m ² | 770.70 | 415.20 | 359.55 | | | 134.20 | 62.90 | 116.30 | 85.95 | 115.65 | 195.00 | 328.60 | 2584 | 10 |
| endrin | ng/m ² | 770.70 | 415.20 | 359.55 | | | 167.75 | 62.90 | 116.30 | 85.95 | 115.65 | 195.00 | 328.60 | 2618 | 10 |

IE0002 Turlough Hill (continued)

Depositions in Precipitation Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|--------------------|-------|---------|----------|--------|-------|------|--------|-------|--------|-----------|---------|----------|----------|--------------|------------|
| heptachlor | ng/m2 | 770.70 | 415.20 | 359.55 | | | 134.20 | 62.90 | 116.30 | 85.95 | 115.65 | 195.00 | 328.60 | 2584 | 10 |
| heptachlor epoxide | ng/m2 | 770.70 | 415.20 | 359.55 | | | 67.10 | 62.90 | 116.30 | 85.95 | 115.65 | 195.00 | 328.60 | 2517 | 10 |
| PCB52 | ng/m2 | 770.70 | 415.20 | 359.55 | | | 134.20 | 62.90 | 174.45 | 171.90 | 115.65 | 195.00 | 328.60 | 2728 | 10 |
| PCB101 | ng/m2 | 1596.45 | 830.00 | 359.55 | | | 134.20 | 62.90 | 174.45 | 171.90 | 231.30 | 195.00 | 328.60 | 4084 | 10 |
| PCB118 | ng/m2 | 1596.45 | 830.00 | 359.55 | | | 301.95 | 62.90 | 174.45 | 171.90 | 115.65 | 195.00 | 328.60 | 4136 | 10 |
| PCB138 | ng/m2 | 770.70 | 830.00 | 697.95 | | | 134.20 | 62.90 | 465.20 | 171.90 | 115.65 | 195.00 | 328.60 | 3772 | 10 |
| PCB153 | ng/m2 | 770.70 | 830.00 | 697.95 | | | 134.20 | 62.90 | 465.20 | 171.90 | 115.65 | 195.00 | 328.60 | 3772 | 10 |
| PCB180 | ng/m2 | 770.70 | 830.00 | 359.55 | | | 134.20 | 62.90 | 174.45 | 171.90 | 115.65 | 195.00 | 328.60 | 3143 | 10 |
| op_DDD | ng/m2 | 770.70 | 415.20 | 359.55 | | | 67.10 | 62.90 | 116.30 | 85.95 | 115.65 | 195.00 | 328.60 | 2517 | 10 |
| op_DDT | ng/m2 | 770.70 | 415.20 | 359.55 | | | 67.10 | 62.90 | 116.30 | 85.95 | 115.65 | 195.00 | 328.60 | 2517 | 10 |
| pp_DDD | ng/m2 | 1386.00 | 318.60 | 618.80 | | | 55.60 | 36.80 | 107.80 | 131.50 | 77.65 | 82.00 | 269.80 | 3085 | 10 |
| pp_DDE | ng/m2 | 1386.00 | 318.60 | 618.80 | | | 55.60 | 36.80 | 107.80 | 131.50 | 77.65 | 82.00 | 269.80 | 3085 | 10 |
| pp_DDT | ng/m2 | 1386.00 | 318.60 | 618.80 | | | 55.60 | 36.80 | 107.80 | 131.50 | 77.65 | 82.00 | 269.80 | 3085 | 10 |
| precipitation | mm | 110.1 | 138.4 | 42.3 | 153 | 95.1 | 67.1 | 62.9 | 116.3 | 171.9 | 231.3 | 390 | 328.6 | 1907 | 12 |

Netherlands

NL0009 Kollumerwaard

Depositions in Precipitation Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|--------------------|----------------------|---------|----------|--------|--------|--------|--------|--------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N /m ² | | | 100.03 | | | 58.80 | 71.39 | 47.73 | 86.33 | 77.49 | 74.90 | 47.91 | 565 | 8 |
| nitrate | mg N /m ² | | | 59.23 | | | 25.24 | 38.42 | 32.12 | 54.84 | 31.22 | 48.74 | 30.92 | 321 | 8 |
| | | | | | | | | | | | | | | | |
| arsenic | µg/m ² | 5.12 | 5.48 | 27.89 | 36.49 | 13.33 | 8.92 | 15.84 | 3.20 | 28.56 | 21.65 | | | 166 | 10 |
| cadmium | µg/m ² | 4.16 | 5.48 | 7.03 | 6.18 | 7.75 | 2.95 | 3.96 | 2.94 | 9.14 | 7.02 | | | 57 | 10 |
| chromium | µg/m ² | 17.73 | 19.01 | 31.44 | 10.43 | 21.66 | 10.09 | 18.72 | 11.08 | 24.75 | 17.06 | | | 182 | 10 |
| copper | µg/m ² | 90.02 | 64.33 | 242.75 | 153.58 | 142.44 | 144.72 | 123.84 | 69.44 | 142.80 | 118.74 | | | 1293 | 10 |
| lead | µg/m ² | 72.97 | 121.35 | 236.81 | 192.08 | 173.26 | 86.91 | 104.40 | 70.29 | 236.10 | 156.78 | | | 1451 | 10 |
| nickel | µg/m ² | 13.98 | 14.99 | 47.15 | 22.46 | 17.08 | 26.38 | 14.76 | 19.60 | 19.52 | 13.45 | | | 209 | 10 |
| | | | | | | | | | | | | | | | |
| precipitation-N | mm | | | 104.0 | | | 39.2 | 73.6 | 43.0 | 98.1 | 73.8 | 102.6 | 90.4 | 625 | 8 |
| precipitation-rest | mm | 68.2 | 73.1 | 95.2 | 40.1 | 83.3 | 38.8 | 72.0 | 42.6 | 95.2 | 65.6 | | | 674 | 10 |

**NL0009 Kollumerwaard
Mean Air Concentrations**

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | months |
|-------------------|---------------------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|-------------|--------|
| ammonium | µg N/m ³ | 0.86 | 0.73 | 1.06 | 1.05 | 0.71 | 0.73 | 0.68 | 0.82 | 1.19 | 0.85 | 0.82 | 0.90 | 0.87 | 12 |
| nitrate | µg N/m ³ | 0.55 | 0.50 | 0.65 | 0.75 | 0.47 | 0.43 | 0.31 | 0.45 | 0.76 | 0.49 | 0.59 | 0.52 | 0.54 | 12 |
| nitrogen monoxide | µg N/m ³ | 1.28 | 0.39 | 0.18 | 0.82 | 0.41 | 0.25 | 0.32 | 0.30 | 0.57 | 0.63 | 0.92 | 2.66 | 0.73 | 12 |
| nitrogen dioxide | µg N/m ³ | 5.69 | 4.68 | 2.51 | 4.14 | 2.56 | 1.83 | 1.24 | 1.88 | 3.53 | 3.96 | 6.86 | 5.61 | 3.71 | 12 |
| | | | | | | | | | | | | | | | |
| arsenic | ng/m ³ | 0.31 | 0.16 | 0.17 | 0.35 | 0.27 | 0.19 | 0.04 | 0.23 | 0.50 | 0.25 | 0.19 | 0.28 | 0.24 | 12 |
| cadmium | ng/m ³ | 0.15 | 0.07 | 0.08 | 0.14 | 0.06 | 0.06 | 0.02 | 0.04 | 0.11 | 0.10 | 0.09 | 0.11 | 0.09 | 12 |
| lead | ng/m ³ | 11.80 | 2.97 | 3.48 | 5.75 | 3.21 | 2.71 | 1.14 | 2.42 | 5.73 | 4.50 | 4.19 | 4.88 | 4.40 | 12 |
| zinc | ng/m ³ | 31.26 | 8.35 | 10.51 | 13.01 | 7.22 | 8.72 | 7.15 | 4.10 | 12.28 | 12.18 | 14.97 | 13.72 | 11.95 | 12 |

**NL0091 De Zilk
Mean Air Concentrations**

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | no. months |
|-------------------|----------------------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|-------------|------------|
| ammonia | µg N /m ³ | 0.22 | 0.41 | 0.13 | 1.01 | 0.62 | 0.10 | 0.28 | 1.31 | 1.72 | 0.95 | 0.59 | 0.99 | 0.69 | 12 |
| ammonium | µg N /m ³ | 1.09 | 1.11 | 1.56 | 1.49 | 1.67 | 1.26 | 1.37 | 1.35 | 1.50 | 1.19 | 0.82 | 1.16 | 1.30 | 12 |
| nitrate | µg N /m ³ | 0.62 | 0.71 | 1.06 | 1.02 | 0.97 | 0.66 | 0.63 | 0.71 | 0.84 | 0.68 | 0.50 | 0.62 | 0.75 | 12 |
| nitrogen monoxide | µg N /m ³ | 4.36 | 2.21 | 1.50 | 1.23 | 0.52 | 0.77 | 0.61 | 0.81 | 2.54 | 2.36 | 3.04 | 6.78 | 2.23 | 12 |
| nitrogen dioxide | µg N /m ³ | 7.31 | 6.45 | 5.53 | 7.58 | 4.38 | 3.52 | 2.76 | 3.66 | 7.58 | 7.13 | 9.89 | 8.64 | 6.20 | 12 |

NL0091 De Zilk**Depositions in Precipitation** Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|--------------------|----------------------|---------|----------|---------|---------|--------|--------|--------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N /m ² | 21.34 | 33.17 | 64.14 | 56.72 | 64.75 | | 16.86 | 26.68 | 80.29 | 50.81 | 65.89 | 34.78 | 515 | 11 |
| nitrate | mg N /m ² | 19.89 | 27.49 | 53.07 | 38.34 | 40.52 | | 22.77 | 21.30 | 53.60 | 42.22 | 90.18 | 33.96 | 443 | 11 |
| arsenic | ug/m ² | | 5.14 | 10.52 | 8.15 | 7.05 | 6.07 | 3.73 | 4.18 | 8.18 | 8.57 | 15.86 | 7.75 | 85 | 11 |
| cadmium | ug/m ² | | 3.56 | 8.04 | 5.41 | 4.61 | 2.80 | 0.84 | 1.76 | 4.69 | 4.57 | 10.15 | 5.58 | 52 | 11 |
| chromium | ug/m ² | | 17.81 | 26.81 | 11.15 | 24.44 | 4.78 | 12.92 | 6.03 | 28.34 | 29.69 | 54.96 | 26.86 | 244 | 11 |
| copper | ug/m ² | | 66.45 | 194.33 | 123.98 | 177.66 | 146.46 | 91.45 | 135.26 | 105.73 | 130.19 | 325.56 | 120.86 | 1618 | 11 |
| lead | ug/m ² | | 193.86 | 284.01 | 310.17 | 219.96 | 143.89 | 132.70 | 95.12 | 223.45 | 280.93 | 655.34 | 377.05 | 2916 | 11 |
| mercury | ng/m ² | 368.00 | 621.10 | 469.20 | 879.20 | 666.10 | 418.10 | 471.10 | 584.40 | 1281.40 | 735.60 | 742.80 | 466.40 | 7703 | 12 |
| nickel | ug/m ² | | 14.04 | 32.94 | 18.02 | 19.27 | 18.77 | 10.19 | 15.08 | 22.35 | 23.41 | 43.34 | 21.18 | 239 | 11 |
| zinc | ug/m ² | | 280.85 | 411.29 | 622.05 | 564.00 | 329.36 | 213.71 | 164.72 | 523.20 | 628.10 | 1183.84 | 547.49 | 5469 | 11 |
| g-HCH | ng/m ² | 398.50 | 343.00 | 1732.50 | 2198.00 | | 93.50 | | | 523.50 | 570.00 | | 521.00 | 6380 | 8 |
| precipitation-N | mm | 76.2 | 67.7 | 102.3 | 41.4 | 92.5 | 18.0 | 49.6 | 23.0 | 108.5 | 112.9 | 205.9 | 102.3 | 1000 | 12 |
| precipitation-HCH | mm | 79.7 | 68.6 | 106.7 | 31.4 | | 18.7 | | | 104.7 | 114.0 | | 104.2 | 628 | 8 |
| precipitation-rest | mm | 38.1 | 42.5 | 23.5 | 52.5 | 82.5 | 26.3 | 61.5 | 54.6 | 95.8 | 96.8 | 95.4 | 61.5 | 731 | 12 |

Norway

NO0001 Birkenes Depositions in Precipitation

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|----------------------|----------------------|---------|----------|--------|--------|--------|--------|--------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N /m ² | 12.33 | 36.24 | 4.27 | 119.30 | 59.07 | 23.69 | 23.29 | 45.84 | 120.70 | 98.76 | 153.59 | 41.71 | 739 | 12 |
| nitrate | mg N /m ² | 28.67 | 67.70 | 10.55 | 101.19 | 38.30 | 36.17 | 26.69 | 38.48 | 109.46 | 140.77 | 305.79 | 90.37 | 994 | 12 |
| | | | | | | | | | | | | | | | |
| cadmium | µg/m ² | 2.37 | 4.71 | 0.89 | 7.10 | 5.22 | 2.22 | 2.37 | 1.02 | 5.84 | 15.50 | 16.40 | 5.00 | 69 | 12 |
| lead | µg/m ² | 92.32 | 142.42 | 46.43 | 260.44 | 145.33 | 79.01 | 77.18 | 81.11 | 335.25 | 721.99 | 897.80 | 252.24 | 3132 | 12 |
| zinc | µg/m ² | 401.41 | 352.64 | 152.51 | 546.12 | 356.07 | 241.99 | 253.01 | 223.93 | 683.05 | 1334.09 | 1912.95 | 807.12 | 7265 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation-N | mm | 122.3 | 152.8 | 56.8 | 109.0 | 114.1 | 78.3 | 155.2 | 79.8 | 218.7 | 330.7 | 705.6 | 204.3 | 2327 | 12 |
| precipitation-metals | mm | 139.7 | 152.0 | 63.6 | 109.3 | 118.7 | 74.0 | 124.9 | 78.8 | 216.4 | 344.5 | 630.9 | 200.0 | 2253 | 12 |

Mean Air Concentrations

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | no. months |
|-----------------------------------|----------------------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|-------------|------------|
| NO ₂ | µg N /m ³ | 0.52 | 0.61 | 0.52 | 0.54 | 0.51 | 0.37 | 0.36 | 0.35 | 0.52 | 0.68 | 0.70 | 1.16 | 0.57 | 12 |
| HNO ₃ +NO ₃ | µg N /m ³ | 0.08 | 0.16 | 0.10 | 0.32 | 0.21 | 0.23 | 0.10 | 0.13 | 0.29 | 0.38 | 0.26 | 0.19 | 0.20 | 12 |
| NH ₃ +NH ₄ | µg N /m ³ | 0.04 | 0.18 | 0.20 | 0.77 | 0.65 | 0.45 | 0.54 | 0.41 | 0.58 | 0.68 | 0.43 | 0.26 | 0.43 | 12 |

NO0099 Lista
Depositions in Precipitation

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|-----------------------|---------------------|---------|----------|--------|---------|--------|--------|--------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m ² | 41.79 | 46.06 | 22.08 | 64.91 | 42.76 | 35.77 | 0.22 | 57.42 | 93.10 | 139.57 | 104.23 | 45.59 | 694 | 12 |
| nitrate | mg N/m ² | 37.64 | 67.50 | 20.61 | 60.51 | 53.60 | 37.50 | 10.92 | 63.05 | 115.85 | 208.90 | 177.93 | 71.68 | 926 | 12 |
| arsenic | µg/m ² | 41.72 | 27.62 | 7.67 | 26.87 | 24.28 | 6.45 | 12.66 | 15.62 | 22.45 | 172.58 | 57.48 | 40.62 | 456 | 12 |
| cadmium | µg/m ² | 2.21 | 1.80 | 0.79 | 5.87 | 3.92 | 1.47 | 1.10 | 2.85 | 7.79 | 21.57 | 6.70 | 4.92 | 61 | 12 |
| chromium | µg/m ² | 15.28 | 20.55 | 5.26 | 22.88 | 15.12 | 5.67 | 4.41 | 17.69 | 15.71 | 73.26 | 33.67 | 22.38 | 252 | 12 |
| copper | µg/m ² | 433.21 | 168.80 | 44.72 | 110.30 | 89.28 | 37.43 | 62.14 | 121.25 | 90.05 | 356.39 | 138.96 | 97.80 | 1750 | 12 |
| lead | µg/m ² | 149.18 | 114.97 | 30.95 | 268.83 | 138.16 | 76.53 | 35.24 | 169.70 | 238.99 | 834.12 | 322.95 | 179.18 | 2559 | 12 |
| mercury | ng/m ² | 653.19 | 423.92 | 478.21 | 1478.48 | 971.17 | 987.17 | 317.52 | | 422.53 | 3056.06 | 725.52 | 1513.63 | 11027 | 11 |
| nickel | µg/m ² | 61.84 | 34.81 | 10.98 | 37.08 | 48.32 | 15.30 | 58.04 | 50.41 | 34.46 | 111.91 | 47.25 | 26.00 | 536 | 12 |
| zinc | µg/m ² | 2068.40 | 723.36 | 218.87 | 712.02 | 537.90 | 248.36 | 323.74 | 505.94 | 794.62 | 2687.53 | 902.62 | 638.70 | 10362 | 12 |
| HCB | ng/m ² | 28.08 | 37.27 | 12.27 | 19.82 | 23.98 | 13.17 | 11.60 | 34.68 | 50.41 | 239.81 | 227.17 | 132.71 | 831 | 12 |
| alpha_HCH | ng/m ² | 58.02 | 45.40 | 26.47 | 88.14 | 35.50 | 21.97 | 31.56 | 40.39 | 79.80 | 267.17 | 136.47 | 65.25 | 896 | 12 |
| gamma_HCH | ng/m ² | 50.85 | 99.18 | 50.56 | 1925.69 | 630.61 | 92.25 | 67.00 | 181.52 | 285.02 | 958.82 | 552.15 | 186.64 | 5080 | 12 |
| precipitation-N | mm | 109.1 | 144.9 | 63.8 | 61.2 | 66.9 | 59.5 | 44.6 | 88.1 | 152.6 | 304.1 | 275.0 | 124.2 | 1494 | 12 |
| precipitation-organic | mm | 84.33 | 128.97 | 55.26 | 132.15 | 68.13 | 59.06 | 46.21 | 100.23 | 133 | 402.36 | 284.32 | 157.24 | 1651 | 12 |
| precipitation-metal | mm | 105.353 | 128.46 | 52.55 | 117.34 | 78.32 | 48.87 | 44.1 | 98.26 | 132.04 | 449.42 | 186.03 | 129.37 | 1570 | 12 |

Mean Air Concentrations

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | months |
|-----------|-------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|-------------|--------|
| arsenic | ng/m ³ | 0.11 | 0.15 | 0.56 | 0.40 | 0.35 | 0.23 | 0.20 | 0.18 | 0.35 | 0.33 | 0.34 | 0.32 | 0.29 | 12 |
| cadmium | ng/m ³ | 0.04 | 0.04 | 0.08 | 0.11 | 0.06 | 0.06 | 0.03 | 0.05 | 0.12 | 0.07 | 0.06 | 0.08 | 0.07 | 12 |
| chromium | ng/m ³ | 1.00 | 1.07 | 0.90 | 1.02 | 1.17 | 0.97 | 0.56 | 0.46 | 0.71 | 0.71 | 0.86 | 0.67 | 0.84 | 12 |
| copper | ng/m ³ | 0.46 | 0.43 | 0.48 | 0.89 | 0.50 | 0.62 | 0.41 | 1.17 | 0.88 | 0.62 | 0.78 | 0.70 | 0.66 | 12 |
| lead | ng/m ³ | 0.95 | 1.13 | 3.11 | 3.80 | 2.08 | 2.47 | 1.13 | 1.35 | 4.30 | 3.37 | 3.04 | 2.88 | 2.47 | 12 |
| mercury | pg/m ³ | 2.00 | 1.70 | 1.25 | | 1.78 | 1.88 | 1.47 | | 1.64 | 2.19 | 0.56 | 1.52 | 1.60 | 10 |
| nickel | ng/m ³ | 0.17 | 0.31 | 0.40 | 3.43 | 1.77 | 1.01 | 0.39 | 0.48 | 0.61 | 0.48 | 0.44 | 0.35 | 0.82 | 12 |
| zinc | ng/m ³ | 3.39 | 2.70 | 15.31 | 7.11 | 6.13 | 4.97 | 4.41 | 3.25 | 8.47 | 5.93 | 6.61 | 5.59 | 6.15 | 12 |
| | | | | | | | | | | | | | | | |
| HCB | pg/m ³ | 47.08 | 45.30 | 47.48 | 60.72 | 57.63 | 52.36 | 59.70 | 57.87 | 64.23 | 58.65 | 57.00 | 46.67 | 54.56 | 12 |
| gamma_HCH | pg/m ³ | 6.81 | 8.08 | 7.40 | 47.58 | 40.49 | 45.64 | 18.43 | 23.39 | 32.78 | 32.07 | 21.85 | 10.52 | 24.58 | 12 |
| alpha_HCH | pg/m ³ | 11.15 | 10.15 | 10.86 | 19.01 | 21.08 | 18.34 | 26.95 | 27.10 | 30.73 | 23.57 | 15.94 | 12.17 | 18.92 | 12 |

NO0042 Zeppelin Fjell**Mean Air Concentrations** Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | months |
|-----------|----------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|-------------|--------|
| HNO3+NO3 | µg N /m ³ | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 | 0.03 | 0.03 | 0.03 | 0.02 | 0.03 | 0.02 | 0.03 | 0.03 | 12 |
| NH3+NH4 | µg N /m ³ | 0.08 | 0.05 | 0.14 | 0.12 | 0.07 | 0.11 | 0.13 | 0.13 | 0.15 | 0.09 | 0.09 | 0.07 | 0.10 | 12 |
| | | | | | | | | | | | | | | | |
| arsenic | ng/m3 | 0.24 | 0.33 | 0.29 | 0.18 | 0.50 | 0.23 | 0.18 | 0.25 | 0.22 | 0.27 | 0.49 | 0.44 | 0.30 | 12 |
| cadmium | ng/m3 | 0.04 | 0.05 | 0.05 | 0.02 | 0.01 | 0.00 | 0.00 | 0.01 | 0.00 | 0.01 | 0.01 | 0.02 | 0.02 | 12 |
| chromium | ng/m3 | 0.03 | 0.13 | 0.08 | 0.04 | 0.00 | 0.00 | 0.06 | 0.07 | 0.00 | 0.03 | 0.04 | 0.02 | 0.04 | 12 |
| copper | ng/m3 | 0.47 | 0.83 | 0.71 | 0.33 | 0.69 | 0.21 | 0.38 | 0.46 | 0.21 | 0.16 | 0.19 | 0.27 | 0.41 | 12 |
| lead | ng/m3 | 1.28 | 1.73 | 1.65 | 0.82 | 0.43 | 0.07 | 0.06 | 0.05 | 0.02 | 0.26 | 0.30 | 0.55 | 0.41 | 12 |
| mercury | pg/m3 | | | | | | | | | 1.62 | 1.55 | 1.62 | 1.67 | 1.81 | 4 |
| nickel | ng/m3 | 0.07 | 0.19 | 0.14 | 0.09 | 0.07 | 0.02 | 0.06 | 0.30 | 0.00 | 0.02 | 0.01 | 0.00 | 0.08 | 12 |
| zinc | ng/m3 | 2.01 | 4.10 | 2.48 | 1.70 | 1.63 | 0.55 | 1.08 | 1.73 | 0.74 | 0.71 | 0.58 | 1.56 | 1.57 | 12 |
| | | | | | | | | | | | | | | | 0 |
| gamma_HCH | pg/m3 | 4.25 | 4.70 | 4.90 | 7.62 | 9.28 | 5.80 | 5.14 | 4.20 | 4.72 | 8.41 | 7.23 | 4.71 | 5.91 | 12 |
| HCB | pg/m3 | 42.88 | 52.38 | 48.20 | 54.78 | 53.56 | 66.55 | 60.78 | 62.48 | 58.98 | 58.83 | 58.78 | 51.46 | 55.80 | 12 |
| alpha_HCH | pg/m3 | 12.60 | 15.10 | 16.96 | 22.93 | 21.54 | 22.43 | 23.68 | 28.22 | 24.55 | 24.00 | 20.80 | 15.88 | 20.72 | 12 |

**NO0057 Ny Alesund
Depositions in Precipitation**

| | | January | February | March | April | May | June | July | August | September | October | November | December | mean | months |
|---------------|---------------------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|------|--------|
| ammonium | mg N/m ² | 0.54 | | 1.17 | 1.46 | 0.33 | 2.13 | 0.12 | 1.82 | 10.81 | 15.99 | 7.09 | 0.12 | 42 | 11 |
| nitrate | mg N/m ² | 0.44 | | 0.48 | 2.55 | 0.99 | 1.16 | 3.33 | 0.35 | 6.33 | 7.86 | 7.53 | 0.56 | 32 | 11 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 3.6 | 1.1 | 11.6 | 28.0 | 8.1 | 10.6 | 24.0 | 14.1 | 115.0 | 133.3 | 47.9 | 23.4 | 421 | 12 |

Portugal

PT0003 Viana do Castelo

Depositions in Precipitation Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|---------------------|---------|----------|--------|---------|---------|--------|---------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m ² | 9.06 | 11.98 | 7.99 | 17.38 | 29.47 | 4.70 | 58.44 | 46.32 | 26.69 | 11.06 | 23.67 | 13.62 | 243 | 12 |
| nitrate | mg N/m ² | 13.89 | 12.10 | 3.89 | 36.00 | 21.07 | 10.89 | 7.73 | 5.90 | 12.02 | 8.21 | 53.89 | 45.82 | 224 | 12 |
| | | | | | | | | | | | | | | | |
| Cadmium | µg/m ² | 21.97 | 29.62 | 13.77 | 147.56 | 45.43 | 17.21 | 25.33 | 14.20 | 30.94 | 56.99 | 180.97 | 223.13 | 807 | 12 |
| Copper | µg/m ² | 89.07 | 212.16 | 174.21 | 515.26 | 215.82 | 103.95 | 321.78 | 124.39 | 296.17 | 120.58 | 208.95 | 326.75 | 2549 | 12 |
| Lead | µg/m ² | 33.35 | 44.96 | 43.96 | 390.83 | 68.95 | 26.12 | 38.44 | 21.54 | 46.96 | 86.49 | 410.81 | 338.63 | 1522 | 12 |
| nickel | µg/m ² | 40.07 | 54.02 | 25.11 | 269.08 | 82.85 | 31.39 | 46.19 | 25.89 | 56.42 | 105.58 | 326.22 | 406.88 | 1470 | 12 |
| zinc | µg/m ² | 1271.63 | 1733.41 | 783.02 | 2335.17 | 1629.24 | 766.82 | 2857.11 | 811.61 | 2105.52 | 2156.82 | 2524.53 | 3913.91 | 21530 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 51.7 | 69.7 | 32.4 | 347.2 | 106.9 | 40.5 | 59.6 | 33.4 | 72.8 | 134.1 | 417.3 | 525.0 | 1891 | 12 |

PT0004 Monte Velho**Depositions in Precipitation** Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|---------------------|---------|----------|--------|---------|--------|------|------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m ² | 0.08 | 2.51 | 17.29 | 6.53 | 4.83 | | | | 4.34 | 30.08 | 5.38 | 4.01 | 73 | 9 |
| nitrate | mg N/m ² | 0.10 | 1.85 | 15.47 | 11.86 | 7.63 | | | | 5.44 | 13.73 | 11.77 | 16.36 | 81 | 9 |
| | | | | | | | | | | | | | | | |
| cadmium | ug/m ² | 2.13 | 4.63 | 2.98 | 49.47 | 17.00 | | | | 3.61 | 16.83 | 44.33 | 102.85 | 244 | 9 |
| copper | ug/m ² | 1.63 | 3.54 | 36.47 | 65.05 | 13.00 | | | | 26.27 | 25.29 | 49.86 | 83.61 | 298 | 9 |
| lead | ug/m ² | 3.23 | 7.03 | 11.76 | 82.84 | 25.80 | | | | 5.48 | 25.54 | 67.27 | 156.09 | 384 | 9 |
| nickel | ug/m ² | 3.88 | 8.45 | 5.43 | 90.21 | 31.00 | | | | 6.59 | 30.69 | 80.83 | 187.55 | 445 | 9 |
| zinc | ug/m ² | 60.00 | 98.10 | 525.00 | 1094.88 | 175.50 | | | | 238.00 | 372.09 | 1141.49 | 1333.34 | 4958 | 9 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 5.0 | 10.9 | 7.0 | 116.4 | 40.0 | | 0.7 | | 8.5 | 39.6 | 104.3 | 242.0 | 574 | 10 |

PT0010 Angra do Heroismo
Depositions in Precipitation

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|---------------------|---------|----------|----------|---------|---------|---------|---------|---------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m ² | 1.54 | 1.62 | 3.43 | 21.17 | 4.98 | 8.06 | 2.80 | 2.81 | 4.15 | 0.71 | 1.30 | 7.59 | 60 | 12 |
| nitrate | mg N/m ² | 18.17 | 7.20 | 15.13 | 31.88 | 9.02 | 18.08 | 13.92 | 10.36 | 15.04 | 10.27 | 5.59 | 30.50 | 182 | 12 |
| | | | | | | | | | | | | | | | |
| cadmium | ug/m ² | 23.89 | 11.14 | 24.86 | 79.82 | 13.22 | 27.63 | 30.64 | 13.09 | 36.76 | 12.16 | 5.65 | 111.90 | 389 | 12 |
| copper | ug/m ² | 111.67 | 66.65 | 153.22 | 231.84 | 43.85 | 174.13 | 115.97 | 59.48 | 106.23 | 50.20 | 22.61 | 102.96 | 1216 | 12 |
| lead | ug/m ² | 76.91 | 101.42 | 37.73 | 226.79 | 61.27 | 125.88 | 98.91 | 29.54 | 126.92 | 124.44 | 170.46 | 383.18 | 1524 | 12 |
| nickel | ug/m ² | 43.56 | 20.31 | 45.34 | 145.55 | 24.10 | 50.38 | 55.88 | 23.87 | 67.04 | 22.17 | 10.31 | 204.06 | 709 | 12 |
| zinc | ug/m ² | 1731.43 | 726.39 | 11416.25 | 2868.70 | 1866.00 | 1661.37 | 1442.30 | 1013.08 | 2932.00 | 1696.26 | 667.83 | 5570.10 | 33351 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 56.2 | 26.2 | 66.5 | 187.8 | 31.1 | 65.0 | 72.1 | 30.8 | 86.5 | 28.6 | 13.3 | 263.3 | 919 | 12 |

Spain

ES0005 Noya

Mean Air Concentrations Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | months |
|----------------|-----------------------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|-------------|--------|
| ammonium | $\mu\text{g N / m}^3$ | 0.23 | 0.17 | 0.60 | 0.15 | 0.27 | 0.44 | | | | | | | 0.31 | 6 |
| ammonia/um | $\mu\text{g N / m}^3$ | 0.07 | 0.08 | 0.15 | 0.07 | 0.08 | 0.11 | | | | | | | 0.09 | 6 |
| hno3+no3 | $\mu\text{g N / m}^3$ | 0.54 | 0.29 | 0.79 | 0.27 | 0.33 | 0.32 | | | | | | | 0.42 | 6 |
| no2 - abs sol. | $\mu\text{g N / m}^3$ | 1.71 | 4.43 | 0.49 | 0.94 | 1.31 | 7.27 | | | | | | | 2.69 | 6 |
| no2 - monitor | $\mu\text{g N / m}^3$ | 2.40 | 1.23 | 2.23 | 0.94 | 1.10 | 0.95 | | | | | | | 1.47 | 6 |

ES0008 Niembro

Depositions in Precipitation

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|-------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m^2 | 8.05 | 7.50 | 15.57 | 38.10 | 35.78 | 17.45 | 14.54 | 12.50 | 7.16 | 11.63 | 6.10 | 3.68 | 178 | 12 |
| nitrate | mg N/m^2 | 9.27 | 9.72 | 28.20 | 51.69 | 32.75 | 18.51 | 17.16 | 14.54 | 33.32 | 23.78 | 21.59 | 12.33 | 273 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation | $\mu\text{g/m}^2$ | 18.8 | 23.6 | 76.2 | 86.0 | 43.0 | 30.8 | 36.8 | 16.4 | 46.4 | 87.6 | 133.2 | 56.2 | 655 | 12 |

Mean Air Concentrations

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | no. months |
|-----------------------------------|----------------------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|-------------|------------|
| NH ₄ | µg N /m ³ | 0.24 | 0.33 | 0.74 | 0.30 | 0.95 | 0.77 | 0.45 | 0.60 | 1.06 | 0.23 | 0.07 | 0.07 | 0.48 | 12 |
| NH ₃ +NH ₄ | µg N /m ³ | 2.52 | 3.03 | 5.19 | 1.82 | 4.58 | 4.21 | 3.00 | 2.61 | 1.65 | 0.81 | 0.36 | 0.53 | 2.53 | 12 |
| NO ₃ +HNO ₃ | µg N /m ³ | 0.51 | 0.59 | 1.21 | 0.29 | 0.66 | 0.62 | 0.51 | 0.58 | 0.56 | 0.37 | 0.20 | 0.17 | 0.52 | 12 |
| NO ₂ | µg N /m ³ | 2.26 | 1.75 | 0.94 | 0.88 | 2.70 | 6.62 | 5.09 | 5.04 | 2.29 | 1.64 | 0.68 | 1.82 | 2.64 | 12 |
| NO ₂ | µg N /m ³ | 2.50 | 4.00 | 2.94 | 1.87 | 1.63 | 1.47 | 1.73 | 1.70 | 2.09 | 2.18 | 2.03 | 1.52 | 2.14 | 12 |

Sweden

SE0002 Roervik Depositions in Precipitation

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|-------------------------|---------------------|---------|----------|--------|--------|--------|--------|--------|---------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m ² | 9.07 | 18.57 | 11.25 | 20.33 | 4.25 | 2.83 | 5.64 | 35.16 | 9.50 | 48.79 | 14.29 | 23.57 | 203 | 12 |
| nitrate | mg N/m ² | 23.37 | 25.24 | 22.00 | 22.38 | 4.06 | 3.85 | 19.02 | 38.54 | 22.15 | 67.98 | 17.93 | 28.83 | 295 | 12 |
| | | | | | | | | | | | | | | | |
| mercury | ng/m ² | 398.40 | 445.20 | 237.60 | 561.60 | 464.40 | 759.00 | 411.80 | 1159.20 | 791.80 | 201.50 | 95.00 | 120.00 | 5646 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation-N (wo) | mm | 29.5 | 40.4 | 44.9 | 72.6 | 73.7 | 72.7 | 57.5 | 51.4 | 47.2 | 121.3 | 151.1 | 123.6 | 886 | 12 |
| precipitation-Hg (bulk) | | 27.7 | 27.0 | 26.9 | 57.6 | 88.4 | 52.0 | 83.6 | 66.9 | 33.8 | 106.0 | 104.6 | 97.1 | 772 | 12 |

Mean Air Concentrations

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | no. months |
|-----------------------------------|----------------------|---------|----------|-------|-------|------|------|------|--------|-----------|---------|----------|----------|-------------|------------|
| NO ₂ | µg N /m ³ | 2.10 | 1.78 | 1.33 | 1.52 | 1.14 | 1.05 | 0.87 | 0.88 | 0.78 | 1.77 | 2.13 | 2.41 | 1.48 | 12 |
| HNO ₃ +NO ₃ | µg N /m ³ | 0.56 | 0.62 | 0.34 | 1.05 | 0.68 | 0.64 | 0.32 | 0.48 | 0.39 | 0.93 | 0.92 | 0.64 | 0.63 | 12 |
| NH ₃ +NH ₄ | µg N /m ³ | 0.56 | 0.53 | 0.50 | 1.63 | 0.91 | 1.07 | 0.44 | 0.71 | 0.80 | 1.44 | 1.06 | 0.80 | 0.87 | 12 |

SE0097 Gardsjoen**Depositions in Precipitation** Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|-------|---------|----------|--------|--------|--------|---------|---------|---------|-----------|---------|----------|----------|--------------|------------|
| arsenic | ug/m2 | 15.47 | 2.80 | 4.45 | 13.00 | 4.45 | 3.90 | 4.15 | 2.15 | 4.50 | 21.78 | 23.16 | 5.45 | 105 | 12 |
| cadmium | ug/m2 | 2.73 | 1.68 | 8.90 | 5.20 | 1.78 | 1.56 | 6.64 | 2.15 | 1.00 | 8.47 | 9.65 | 5.45 | 55 | 12 |
| chromium | ug/m2 | 4.55 | 6.72 | 16.02 | 3.25 | 4.45 | 3.90 | 4.15 | 2.15 | 14.50 | 6.05 | 9.65 | 5.45 | 81 | 12 |
| lead | ug/m2 | 137.41 | 71.12 | 161.09 | 202.15 | 106.80 | 90.48 | 63.08 | 63.64 | 45.50 | 296.45 | 310.73 | 105.73 | 1654 | 12 |
| nickel | ug/m2 | 22.75 | 20.72 | 40.05 | 15.60 | 11.57 | 14.82 | 19.09 | 20.21 | 15.00 | 14.52 | 36.67 | 27.25 | 258 | 12 |
| zinc | ug/m2 | 335.79 | 512.96 | 922.04 | 625.30 | 923.82 | 2130.18 | 2763.90 | 2426.92 | 525.00 | 1301.96 | 764.28 | 320.46 | 13553 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 91.0 | 56.0 | 89.0 | 65.0 | 89.0 | 78.0 | 83.0 | 43.0 | 25.0 | 121.0 | 193.0 | 109.0 | 1042 | 12 |

SE0098 Svartedalen**Depositions in Precipitation**

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|---------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m ² | 51.94 | 145.70 | 12.87 | 70.47 | 54.08 | 66.03 | 8.74 | 60.30 | | 130.90 | 73.99 | | 675 | 10 |
| nitrate | mg N/m ² | 69.96 | 171.55 | 20.67 | 40.89 | 48.88 | 36.27 | 14.26 | 47.70 | | 81.60 | 102.68 | | 634 | 10 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 106.0 | 235.0 | 39.0 | 87.0 | 104.0 | 93.0 | 46.0 | 90.0 | 14.0 | 170.0 | 151.0 | | 1135 | 11 |

United Kingdom

GB0014 High Muffles Depositions in Precipitation

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|--------------------|---------------------|---------|----------|---------|--------|--------|-------|--------|---------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m ² | 21.02 | 25.55 | 53.22 | 107.54 | 71.72 | 15.41 | 19.85 | 49.63 | 46.68 | 51.35 | 63.28 | 55.80 | 581 | 12 |
| nitrate | mg N/m ² | 18.85 | 17.66 | 41.96 | 104.82 | 43.53 | 17.70 | 16.42 | 37.82 | 47.85 | 42.22 | 71.48 | 50.49 | 511 | 12 |
| | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | |
| arsenic | ug/m ² | 8.70 | 10.83 | 39.02 | | 14.94 | | 7.39 | 26.45 | | 17.93 | 39.46 | | 165 | 8 |
| cadmium | ug/m ² | 2.68 | 6.82 | 16.00 | | 4.27 | | 2.02 | 5.88 | | 4.89 | 14.43 | | 57 | 8 |
| chromium | ug/m ² | 15.39 | | 43.18 | | 37.35 | | 9.41 | 24.49 | | 16.30 | 17.96 | | 164 | 7 |
| copper | ug/m ² | 46.83 | | 279.48 | | 174.77 | | 65.18 | 121.07 | | 107.58 | 118.96 | | 914 | 7 |
| lead | ug/m ² | 104.36 | | 749.01 | | 250.10 | | 75.60 | 292.48 | | 220.05 | 657.84 | | 2349 | 7 |
| nickel | ug/m ² | 16.06 | | 86.15 | | 37.88 | | 18.14 | 43.10 | | 22.82 | 33.57 | | 258 | 7 |
| zinc | ug/m ² | 321.12 | 529.32 | 1833.17 | | 647.03 | | 595.26 | 3181.61 | | 1844.83 | 2130.17 | | 11083 | 8 |
| | | | | | | | | | | | | | | | |
| precipitation-N | mm | 65.7 | 40.0 | 59.6 | 159.6 | 94.6 | 12.3 | 67.3 | 79.3 | 116.7 | 163.0 | 204.8 | 90.2 | 1153 | 12 |
| precipitation-rest | mm | 66.9 | 40.1 | 219.2 | | 106.7 | | 67.2 | 195.9 | | 163.0 | 294.5 | | 1153 | 8 |

Mean Air Concentrations

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | months |
|----------|-------|---------|----------|-------|-------|-------|------|-------|--------|-----------|---------|----------|----------|-------------|--------|
| arsenic | ng/m3 | 1.24 | 0.40 | 0.37 | | 0.58 | | 0.10 | 0.35 | | 0.35 | 0.61 | | 0.50 | 8 |
| cadmium | ng/m3 | 0.70 | 0.25 | 0.19 | | 0.13 | | 0.11 | 0.26 | | 0.12 | 0.19 | | 0.24 | 8 |
| chromium | ng/m3 | 1.20 | 1.34 | 1.77 | | 1.83 | | 1.09 | 0.77 | | 1.05 | 1.04 | | 1.26 | 8 |
| copper | ng/m3 | 3.17 | 3.08 | 4.12 | | 6.63 | | 3.06 | 1.34 | | 1.76 | 1.76 | | 3.12 | 8 |
| lead | ng/m3 | 6.60 | 5.00 | 4.61 | | 4.74 | | 4.60 | 7.70 | | 9.70 | 9.60 | | 6.57 | 8 |
| nickel | ng/m3 | 3.14 | 0.78 | 3.99 | | 1.52 | | | 2.20 | | 2.99 | 2.49 | | 2.45 | 7 |
| zinc | ng/m3 | 237.70 | 38.30 | 52.38 | | 32.36 | | 70.70 | 34.42 | | 37.20 | 36.63 | | 67.46 | 8 |

**GB0016 Glen Dye
Depositions in Precipitation**

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|---------------------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m ² | 3.06 | 1.92 | 35.34 | 69.43 | 7.46 | 14.55 | 19.39 | 53.37 | 107.00 | 25.41 | 24.94 | 47.38 | 409 | 12 |
| nitrate | mg N/m ² | 3.66 | 1.81 | 36.10 | 71.17 | 10.02 | 13.35 | 13.91 | 32.00 | 79.25 | 42.43 | 56.60 | 84.92 | 445 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 42.7 | 8.8 | 63.0 | 163.1 | 40.9 | 29.6 | 49.7 | 109.5 | 154.1 | 192.8 | 172.5 | 210.7 | 1237 | 12 |

**GB0090 East Ruston
Depositions in Precipitation**

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|-------|---------|----------|---------|---------|---------|---------|--------|---------|-----------|---------|----------|----------|--------------|------------|
| arsenic | ug/m2 | 75.82 | 52.28 | | 29.93 | 15.68 | 4.21 | 7.38 | 5.46 | 13.41 | 7.74 | 6.68 | 6.15 | 224.73 | 11 |
| cadmium | ug/m2 | 13.34 | 5.95 | | 21.53 | 6.60 | 1.32 | 2.46 | 1.64 | 3.83 | 1.94 | 2.86 | 2.46 | 64 | 11 |
| chromium | ug/m2 | 15.62 | 20.83 | | 11.03 | 11.55 | 1.84 | 5.54 | 18.02 | 48.86 | 9.68 | 5.72 | 9.23 | 158 | 11 |
| copper | ug/m2 | 158.50 | 320.45 | | 201.08 | 167.48 | 50.23 | 82.41 | 39.31 | 63.23 | 55.18 | 47.70 | 109.47 | 1295 | 11 |
| lead | ug/m2 | 76.20 | 127.50 | 94.00 | 178.50 | 198.00 | 15.78 | 86.10 | 76.44 | 143.70 | 58.08 | 76.32 | 67.65 | 1198 | 12 |
| nickel | ug/m2 | 27.81 | 41.23 | | 32.03 | 28.88 | 9.21 | 23.37 | 27.85 | 21.08 | 8.71 | 14.31 | 27.06 | 262 | 11 |
| zinc | ug/m2 | 1325.88 | 1326.00 | 1776.60 | 2142.00 | 1188.00 | 2430.12 | 910.20 | 2953.86 | 680.18 | 3571.92 | 677.34 | 664.20 | 19646 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 38.1 | 42.5 | 23.5 | 52.5 | 82.5 | 26.3 | 61.5 | 54.6 | 95.8 | 96.8 | 95.4 | 61.5 | 731 | 12 |

Mean Air Concentrations

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | no. months |
|----------|-------|---------|----------|-------|-------|-------|-------|-------|--------|-----------|---------|----------|----------|-------------|------------|
| arsenic | ng/m3 | 1.86 | 1.36 | 0.84 | 1.55 | 0.10 | 1.05 | 0.32 | 0.36 | 0.49 | 0.60 | 1.35 | 0.75 | 0.89 | 12 |
| cadmium | ng/m3 | 0.25 | 0.18 | 0.45 | 0.19 | 0.08 | 0.18 | 0.10 | 0.19 | 0.16 | 0.19 | 0.36 | 0.27 | 0.22 | 12 |
| chromium | ng/m3 | 1.86 | 2.96 | 2.22 | 1.46 | 1.07 | 2.28 | 0.43 | 0.40 | 0.56 | 0.42 | 0.45 | 0.64 | 1.23 | 12 |
| copper | ng/m3 | 2.82 | 2.19 | 2.67 | 1.98 | 1.74 | 2.05 | 1.14 | 1.76 | 1.95 | 2.31 | 3.81 | 2.48 | 2.24 | 12 |
| lead | ng/m3 | 13.10 | 8.60 | 8.90 | 6.20 | 3.20 | 6.20 | 8.60 | 9.10 | 8.70 | 9.20 | 25.10 | 15.90 | 10.23 | 12 |
| nickel | ng/m3 | 1.64 | 1.10 | 1.06 | 1.02 | 0.51 | 0.72 | 0.55 | 0.51 | 0.89 | 0.83 | 1.24 | 1.56 | 0.97 | 12 |
| zinc | ng/m3 | 21.00 | 27.30 | 27.30 | 17.70 | 13.10 | 24.30 | 20.80 | 43.10 | 44.60 | 51.00 | 33.40 | 42.30 | 30.49 | 12 |

**GB0091 Banchory
Depositions in Precipitation**

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|-------|---------|----------|-------|---------|--------|--------|--------|---------|-----------|---------|----------|----------|--------------|------------|
| arsenic | ug/m2 | 1.60 | 1.52 | | 22.78 | 3.85 | 2.84 | 3.86 | 6.86 | 10.34 | 7.87 | 11.85 | 4.39 | 78 | 11 |
| cadmium | ug/m2 | 4.08 | 4.37 | | 5.19 | 1.15 | 2.64 | 1.60 | 7.55 | 6.73 | 2.67 | 6.56 | 2.88 | 45 | 11 |
| chromium | ug/m2 | 3.94 | 3.84 | | 121.49 | 21.67 | 12.74 | 17.73 | 40.56 | 10.34 | 9.35 | 15.21 | 7.55 | 264 | 11 |
| copper | ug/m2 | | 134.55 | | 375.03 | 159.50 | 66.83 | 54.13 | 72.46 | 49.96 | 46.30 | 91.58 | 30.60 | 1081 | 10 |
| lead | ug/m2 | 29.38 | 16.84 | | 244.46 | 69.66 | 47.52 | 31.96 | 167.79 | 96.69 | 80.14 | 102.62 | 58.72 | 946 | 11 |
| nickel | ug/m2 | 20.67 | 14.24 | | 122.97 | | 14.12 | 6.92 | 27.93 | 16.45 | 9.35 | 21.13 | 15.92 | 270 | 10 |
| zinc | ug/m2 | 489.60 | 218.50 | | 2889.12 | 290.25 | 392.70 | 258.44 | 1153.04 | 1009.26 | 1202.04 | 1216.76 | 589.96 | 9710 | 11 |
| precipitation | mm | 34 | 23 | | 185.2 | 67.5 | 33 | 36.4 | 99.4 | 124.6 | 148.4 | 160.1 | 137.2 | 1049 | 11 |

Mean Air Concentrations Grey shaded areas indicate measurements below, or derived largely from measurements below the detection limit

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual mean | no. months |
|----------|-------|---------|----------|-------|-------|------|-------|-------|--------|-----------|---------|----------|----------|-------------|------------|
| arsenic | ng/m3 | 0.10 | 0.36 | | 0.10 | 0.34 | 0.32 | 0.20 | 0.09 | 0.36 | 0.34 | 0.47 | 0.39 | 0.28 | 11 |
| cadmium | ng/m3 | 0.07 | 0.03 | | 0.03 | 0.09 | 0.05 | 0.02 | 0.03 | 0.06 | 0.05 | 0.04 | 0.04 | 0.05 | 11 |
| chromium | ng/m3 | 0.93 | 0.88 | | 1.15 | 1.14 | 1.39 | 0.18 | 0.20 | 0.63 | 0.18 | 0.41 | 0.27 | 0.67 | 11 |
| copper | ng/m3 | 0.70 | 0.41 | | 1.32 | 1.08 | 0.78 | 1.05 | 0.61 | 1.10 | 0.65 | 1.23 | 1.06 | 0.91 | 11 |
| lead | ng/m3 | 1.21 | 1.15 | | 1.71 | 2.08 | 1.28 | 2.13 | 2.02 | 3.59 | 2.77 | 2.98 | 2.48 | 2.13 | 11 |
| nickel | ng/m3 | 0.24 | 0.23 | | 0.80 | 0.59 | 0.56 | | 0.92 | 0.77 | 0.74 | 0.40 | 0.55 | 0.58 | 10 |
| zinc | ng/m3 | 5.79 | 7.40 | | 10.42 | 7.91 | 13.49 | 27.18 | 21.89 | 21.12 | 49.01 | 24.21 | 40.42 | 20.80 | 11 |

GB0095 Driby
Depositions in Precipitation

| | | January | February | March | April | May | June | July | August | September | October | November | December | annual total | no. months |
|---------------|---------------------|---------|----------|-------|-------|-------|------|-------|--------|-----------|---------|----------|----------|--------------|------------|
| ammonium | mg N/m ² | 12.24 | 22.16 | 34.83 | 84.85 | 13.85 | 1.57 | 29.79 | 28.87 | 16.96 | 35.84 | 29.60 | 22.93 | 333 | 12 |
| nitrate | mg N/m ² | 9.39 | 14.67 | 17.04 | 78.13 | 8.02 | 2.11 | 35.72 | 23.88 | 15.22 | 41.13 | 29.50 | 24.32 | 299 | 12 |
| | | | | | | | | | | | | | | | |
| precipitation | mm | 18.5 | 43.5 | 22.8 | 118.6 | 25.2 | 3.3 | 33.9 | 32.0 | 42.6 | 135.2 | 105.1 | 38.1 | 619 | 12 |

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 network¹

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 measured²

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 -HCH³ (lindane)
- nutrients:
 - ammonium (NH₄⁺)
 - nitrate (NO₃⁻)

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 180⁴
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⁺, Ca²⁺, Mg²⁺, SO₄²⁻, Cl⁻, NH₄⁺, NO₃⁻, HCO₃⁻).

3.2. Sampling and analysing methods⁵

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 name⁶, 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.

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 account⁷.

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).

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.

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

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: NO₂, HNO₃, and NH₃
in aerosol phase⁸: ammonium (NH₄⁺) and nitrate (NO₃⁻)

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

- heavy metals: arsenic
cadmium
chromium
copper
lead
mercury
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 methods⁹

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 Precipitation¹⁰ and the JAMP Guidance Note on Sampling and Analysis of PCBs in Air and Precipitation¹¹ should be taken into account.

⁸ As an alternative total nitrate (sum of gaseous HNO₃ and particulate NO₃) and total ammonium (sum of gaseous NH₃ and particulate NH₄) can be measured.

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

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 days¹². 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.

With respect to the nitrogen species, the gaseous compounds NO and NO₂ 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,

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.

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.

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 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 stations¹⁵

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,

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.

an underscore character, and a name (the name only needs to be unique within the organisation that creates it, the 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, \bar{C} , should be estimated by precipitation amount weighted averaging of the concentrations for each of the sampling periods:

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

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 permit 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 organisations¹⁶. It is recommended to follow similar procedures in reporting CAMP data.

When data coverage is less than 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 are used for data below detection limit; when only a flag *below detection limit* is reported, a value of 50% of the reported detection limit¹⁷ is used in the averaging procedure, eq [1].

7.2 Ambient air and aerosol

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

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.

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.

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

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 permit this, the measurements should be flagged as *below detection limit*.

When data coverage is less than 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 surface¹⁸.

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.
- 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 overestimate 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:

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-volatilises.

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

where A is the total area of the North Sea (525,000 km²) 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:

| | |
|--------------|--|
| 30 June | Data and Metadata Request from NILU |
| 30 September | Data submission deadline to NILU |
| 31 October | Return of data for validation within 2 weeks |
| 30 November | Draft reporting by NILU to OSPAR |

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

Data originators in each country

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