OSPAR COMMISSION

Comprehensive Atmospheric Monitoring Programme

Deposition of air pollutants around the North Sea and the North-East Atlantic in 2010

Monitoring and Assessment Series

2012

OSPAR Convention

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. The Contracting Parties are Belgium, Denmark, the European Union, Finland, France, Germany, Iceland, Ireland, Luxembourg, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom of Great Britain and Northern Ireland.

Convention OSPAR

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. Les parties contractantes sont : l'Allemagne, la Belgique, le Danemark, l'Espagne, 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, la Suisse et l'Union européenne.

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Contents

Executive summary

This report presents the results of monitoring undertaken by OSPAR Contracting Parties for the Comprehensive Atmospheric Monitoring Programme (CAMP) during 2010. Under the CAMP, OSPAR Contracting Parties are committed to monitoring, on a mandatory basis, the concentrations of a range of metals, organic compounds and nutrients in precipitation and air, and their depositions. The CAMP also encourages OSPAR Contracting Parties to monitor, on a voluntary basis, additional compounds (such as certain persistent organic pollutants). The report gives detailed information on observed atmospheric inputs of selected contaminants to the OSPAR maritime area and its regions during 2010.

There were few changes in the CAMP reporting for 2010. Several of the stations do not strictly meet the requirements of the CAMP Principles (e.g. distance from the coast). Region II, the North Sea, remains the most intensely observed sub-region. Sub-regional coasts that are most underrepresented are the Irish Sea (Region III), the Bay of Biscay (Region IV), and the far north-east (Region I).

All Contracting Parties reported some data for 2010. The trend towards more complete and more timely reporting remains positive, however, certain elements regularly go unreported. The programme for observation of airborne concentrations of pollutants is least observed, and for the programme for pollutants in precipitation, lindane and mercury receive least attention. Lack of reporting stations hinders interpretation of monitored data especially for lindane and mercury. Monitoring results show high concentrations of mercury in Nordic counties and underline the importance of monitoring in Region I. Data on PCBs is also very limited which limits interpretation.

Récapitulatif

Ce rapport présente les résultats de la surveillance continue mise en oeuvre par les Parties contractantes à OSPAR dans le cadre du Programme exhaustif de surveillance continue de l'atmosphère (CAMP) en 2010. Aux termes du programme CAMP, les Parties contractantes à OSPAR s'engagent à mettre en oeuvre une surveillance continue obligatoire des concentrations d'un ensemble de métaux, de composés organiques et de nutriments dans les précipitations et dans l'atmosphère, ainsi que de leurs dépôts. Le programme CAMP encourage aussi les Parties contractantes à OSPAR à pratiquer une surveillance continue, sur la base du volontariat, de composés supplémentaires (tels que certains polluants organiques persistants). Le rapport présente des informations détaillées sur les apports atmosphériques observés de certains contaminants dans la zone maritime OSPAR et dans ses régions en 2010.

On a observé peu de changements de la notification dans le cadre du Programme CAMP pour 2010. Plusieurs stations ne satisfont pas rigoureusement aux conditions énoncées dans les Principes CAMP (par exemple la distance à partir du littoral). La Région II, c'est-à-dire la mer du Nord, reste la sous-région la plus intensément observée. Les littoraux sous-régionaux les plus sous-représentés sont la mer d'Irlande (Région III), la Baie de Biscay (Région IV) et l'extrême nord-est (Région I).

Toutes les Parties contractantes ont fourni quelques données pour 2010. La tendance vers une notification plus complète, réalisée dans de meilleurs délais, reste positive, malgré cela certains éléments sont régulièrement omis par la notification. Le programme d'observation des concentrations atmosphériques de polluants est celui qui est le moins observé, et en ce qui concerne le programme d'observation des polluants dans les précipitations, on fait le moins attention au lindane et au mercure. Le manque de stations disponibles pour la notification entrave l'interprétation des données de surveillance, surtout pour le lindane et le mercure. Les résultats de la surveillance indiquent des concentrations élevées de mercure dans les pays nordiques et soulignent l'importance de la surveillance dans la Région I. Les données sur les polychlorobiphényles sont également très limitées, ce qui restreint leur interprétation.

Deposition of air pollutants around the North Sea and North-East Atlantic in 2010

1. Introduction

This report collates and describes the observations from coastal monitoring stations across the OSPAR region (see Figure 1.1) under the Comprehensive Atmospheric Monitoring Programme (CAMP), this forming one element within the wider Joint Assessment and Monitoring Programme of OSPAR. The CAMP aims to assess, as accurately as appropriate, the atmospheric input of the selected contaminants to the maritime area and regions thereof (Figure 1.1) on an annual basis through monitoring the concentrations of selected contaminants in precipitation and air, and determining their deposition. The monitoring regime employed is set out in the CAMP Principles (OSPAR reference number: 2001-7), describing the relevant substances, sampling approach, locations and frequency, and assessment methodologies. The approach used in this report moves **towards an indicator based assessment**, using a colour code scale indicating the relative magnitudes of pollutant deposition. The scale has been developed using all the data reported over 10 years (2000-2010) with percentile categories 0-10, 10-30, 30-70, 70-90, 90-100. Thus a value falling in the 0-10 range is considered low while a value falling in the 90-100 category is considered high. The colour code indicates the relative scale deposition from low (blue) to high (red), similar to the Water Framework Directive but without the same interpretation. So red does not indicate poor status, rather a relatively high deposition of the component. Grey indicates no data.

Figure 1.1: OSPAR maritime area and regions. Region I: Arctic waters, II: Greater North Sea, III: Celtic Seas, IV: Bay of Biscay, V: Wider Atlantic

The components of interest to the CAMP are divided into two groups for measurement on a mandatory basis and for measurement on a voluntary basis. These are listed in Table 1.1.

Table 1.1: Components to be measured under the 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 PAHs: Phenanthrene, anthracene, flouranthene, pyrene, benzo(*a*)anthracene, chrysene, benzo(*a*)pyrene, benzo(*ghi*)perylene, indeno(*1,2,3-cd*)pyrene
Airborne	NO_2, HNO_3, NH_3, NH_4^{+a}, NO_3^{-a}	As, Cd, Cr, Cu, Pb, Hg, Ni, Zn, γ-HCH, PCB 28,52,101,118,138,153,180, PAHs: Phenanthrene, anthracene, flouranthene, pyrene, benzo(*a*)anthracene, chrysene, benzo(*a*)pyrene, benzo(*ghi*)perylene, indeno(*1,2,3-cd*)pyrene, NO

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

The CAMP Principles call for each Contracting Party bordering the OSPAR maritime area (excluding the EU) to operate at least one monitoring station on the coast and/or offshore as part of the CAMP. Where Parties border more than one region (see Figure 1.1) at least one station should be operating in each. The stations should be so-called “background stations”, i.e. not directly influenced by local emission sources. The stations should be located not more than 10 km from the coastline.

The data assembled by monitoring stations are reported by Contracting Parties to the Norwegian Institute for Air Research (NILU) on a yearly basis, using a reporting format and according to the time schedule set out in the CAMP Principles. Based on the data received, NILU prepares a CAMP data report on an annual basis for OSPAR.

The present CAMP data report “*Pollutant depositions in the OSPAR region of the North-East Atlantic in 2010*” gives in Chapter 2 an overview of reported data and the implementation of the CAMP Principles in 2010. The overview includes the geographical coverage, the coverage by each Party of contaminants from the Mandatory and Voluntary lists, the timeliness of data submission, and the reporting of additional components.

In Chapter 3, the 2010 observed annual depositions of components subject to mandatory monitoring are mapped. A relative colour scale is also used as a step towards an indicator based assessment. The scale has been developed using all the data reported over 10 years with percentile categories 0-10, 10-30, 30-70, 70-90, 90-100. Thus a value falling in the 0-10 range is considered low while a value falling in the 90-100 category is considered high.

Chapter 4 provides overviews of temporal patterns in the observations in recent years and introduces the use of the colour scale for temporal trends.

Chapter 5 summarises the main points on the reported CAMP data for 2010 and includes suggestions for improving the CAMP programme. The data submitted by Contracting Parties as monthly values are appended to this report (see Annex).

2. The OSPAR CAMP Monitoring Programme in 2010

2.1 Geographical coverage

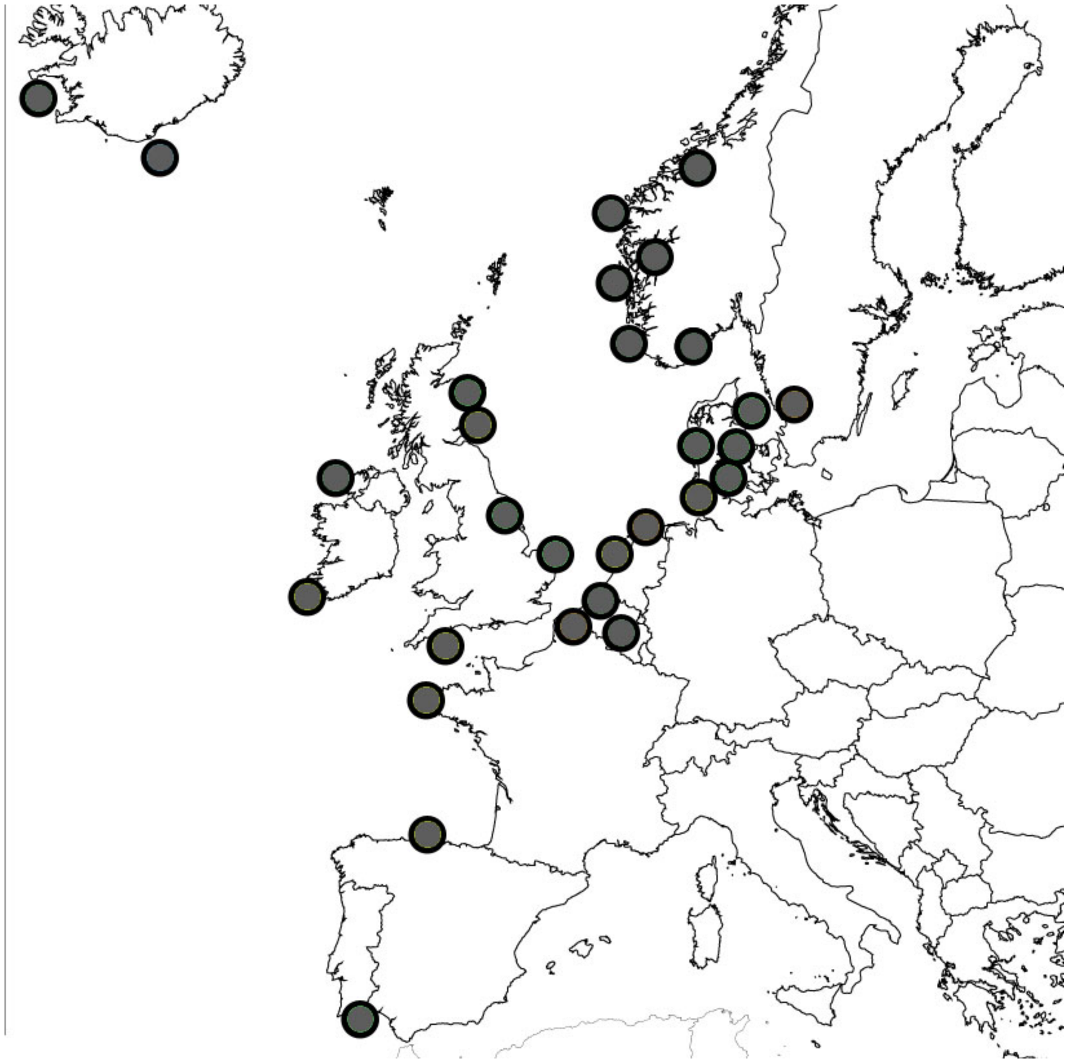

Figure 2.1: Monitoring sites reporting to OSPAR in 2010

*Note that additional stations include **Spitsbergen** (NO), **Doñana** (ES) and **Noia** (ES)[1]. The data for these are available through the database portal but were not used in this report. They will be fully incorporated in 2011.*

The reporting network during 2010 changed slightly and there were some changes in which components were observed at each station. Despite the mandatory label applied to the first column of components in table 1.1, not all stations reported data for all components, as commented in section 2.2.

[1] Spain intends to include the Noia and Doñana stations in the CAMP programme. In the medium term, Spain will not be able to report all mandatory components for these two stations. However Spain submits complete datasets for its Niembro monitoring station and in doing so meets the reporting requirements of the CAMP Principles.

Table 2.1 Details of locations of monitoring stations with coordinates and corresponding OSPAR region

Country	Station number	Station name	OSPAR Region	Latitude	Longitude
Iceland	IS0090R	Irafoss	I	64º 08'N	21º54'W
	IS0091R	Storhofdi	I	63º 24'N	20º17'W
Norway	NO0001R	Birkenes	II	58º 23'N	8º 15'E
	NO0039R	Kårvatn	I	62º 47'N	8º 53'E
	NO0090R	Andøya		69º16'N	16º0'E
	NO0554R	Haukeland	I	60°49'N	5°35'E
	NO0572R	Vikedal	I	59°32'12"N	5°58'19"E
	NO0655R	Nausta	I	61°34'38"N	5°53'53"E
		Spitsbergen	This station is now associated to CAMP. The data are available through the database portal but were not used for the purposes of this report. They will be incorporated from 2011.		
Belgium	BE0014R	Koksijde	II	51°7'15''N	2°39'30''E
	BE0011R	Damme	II	51°15'16''N	3°21'45''E
	BE0013R	Houtem	II	51°0'59''N	2°34'56''E
Netherlands	NL0009R	Kollumerwaard	II	53º20'N	6º17'E
	NL0091R	De Zilk	II	52º18'N	4º31'E
Germany	DE0001R	Westerland	II	54º56'N	8º19'E
Denmark	DK0005R	Keldsnor	II	54º44'N	10º44'E
	DK008R	Anholt	II	56º43'N	11º31'E
	DK0022R	Sepstrup Sande	II	55º5'N	9º36'E
	DK0031R	Ulborg	II	56º17'N	8º26'E
Sweden	SE0014R	Råö	II	57º24'N	11º55'E
United Kingdom	GB0006R	Lough Navar	III	54º26'N	7º54'W
	GB0013R	Yarner Wood	II	50º36'N	3º43'W
	GB0014R	High Muffles	II	54º20'N	0º48'W
	GB0017R	Heigham Holmes	II	52º43'N	1º37'E
	GB0054R	Glen Saugh	II	56°54'26"N	2°33'33"W
	GB0091R	Banchory	II	57º05'N	2º32'W
Ireland	IE0001R	Valentia Island	III	51º56'N	10º15'W
France	FR0090R	Porspoder	II	48º31'N	4º45'W
Spain	ES0008R	Niembro	IV	43º26'N	4º51'W
	ES005R	Noia	This station is now associated to CAMP. The data are available through the database portal but were not used for the purposes of this report. They will be incorporated from 2011.		
	ES0017R	Donaña	This station is now associated to CAMP. The data are available through the database portal but were not used for the purposes of this report. They will be incorporated from 2011.		
Portugal	PT0002R	Faro	IV	37°1'N	7°58'0"W

2.2 Completion of the observation programmes

The Comprehensive Atmospheric Monitoring Programme (CAMP) provides ground truth data on atmospheric pollution of OSPAR waters in a coordinated manner.

All Parties participated in the 2010 programme, see Table 2.2. Data from Denmark, Ireland, Portugal, UK was not complete or delivered late and so only part of the data is included.

Important discrepancies in the data sets submitted by Germany were detected in the validation procedure, underlining the importance of this procedure.

Some countries also delivered data for many additional components that are not listed by CAMP. Implementation of the Mandatory Programme for airborne pollutants is varied. The least reported mandatory contaminants in precipitation are mercury and lindane, two important pollutants.

Table 2.2: Mandatory monitoring of contaminants ✓ indicates some observations

2.2 a) In precipitation, 2010

	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	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓

2.2 b) Dry, in aerosol and in air, 2010

	As	Cd	Cr	Cu	Pb	Hg	Ni	Zn	γ-HCH	**NO_x**	**NH3 NH_4^+**
Belgium	✓	✓	✓	✓	✓	✓	✓	✓		✓	
Denmark											
France											
Germany	✓	✓		✓	✓		✓	✓	✓	✓	✓
Iceland									✓		
Ireland											
Netherlands	✓	✓			✓		✓	✓		✓	✓
Norway	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Portugal											
Spain	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓
Sweden						✓			✓		
United Kingdom	✓	✓	✓	✓	✓	✓	✓	✓		✓	✓

From the combined numbers of Contracting Parties and of pollutants, the percentage data delivery for the mandatory contaminant monitoring can be determined, based on the assumption that full completion of the programme would be represented by delivery of 12 monthly averages which pass quality control criteria for each of the listed components. The Mandatory Programme for components in precipitation, for example, contains 11 substances and that for airborne concentrations contains at least 3 substances, so that 14 x 12 month averages successfully meeting quality control criteria would be needed to achieve 100% delivery. Reported values which are insufficient to calculate monthly averages are not taken into account. Fulfilment of the CAMP 2010 Mandatory Programme is shown in Figure 2.2.

Parties	0	<50%	50-80%	80-100%
Denmark Ireland Great Britain Portugal			Some data were delivered too late to be validated and to include in the report.	
Belgium France Iceland Netherlands Norway Spain Sweden				Most data were reported in time to be validated and to be included in the report
Germany				Most data were reported in time but a database error was detected during validation

Figure 2.2: Completion of the Mandatory Programmes 2010 (100% = 12 months x 14 values)

2.3 Timeliness of reporting

Initially, reporting of observation data for 2010 was somewhat delayed, the process beginning with a delayed data request by NILU. The Quality Control data checks were delivered on time by NILU, but the data check round was slow, although for many Parties this is usually dictated by external factors. Data was still being submitted during the last week of November, so the timing of the delivery of the draft report was also delayed to accommodate as much data as possible.

Table2.3: Timetable for data reporting according to the CAMP Principles. There were departures from this timetable both in the timeliness of the reporting and the data processing.

30th June	Call for metadata and data issued from NILU (regarding new data and metadata), with instructions and reference to supporting software (e.g. where to find tools on the NILU website).
30th September	Participants submit data and metadata via email, in specified formats.
31st October	NILU returns data and metadata via email or on diskette in the form of a ‘validation report’ to data originators for verification and signing off by the data originators within two weeks of reception.
30th November	NILU submits draft report.

Country	Reporting date	Comment
ES-Spain	29-07-2011	Timely reporting of most data
SE-Sweden	03-08-2011	
NO-Norway	01-09-2011	
FR-France	12-09-2011	
BE-Belgium	13-09-2011	
NL-Netherlands	28-09-2011	
IS-Iceland	29-09-2011	
PT-Portugal	30-09-2011	
DE-Germany	30-09-2011	
GB-Great Britain	10-10-2011	Some late reporting
IR-Ireland	28-10-2011	
DK-Denmark	23-11-2011	

2.4 Reporting of additional components

Parties report a wider range of components than is covered by CAMP. All the components reported by Contracting Parties during 2010 are uploaded in the database and will be accessible once the report is finalized and accepted. The reported concentration values are given in the Annex.

Values such as -9999.999 and some integers are flags that denote various problems in the data, such as no data, no precipitation data or quantification / detection limit problems.

The main body of this report is a description of observations of the mandatory components alone. These are shown as maps and on a relative colour bar scale using the same colours as the maps. Excluded are only the major ions which are reported solely to provide the potential for quality control, and compounds which are a part of other international programmes, but which may be expected to lie outside the core interest of OSPAR, e.g. sulphates, ozone, PM measurements.

3. Observed pollutant depositions at monitoring stations in 2010

This section describes relative air pollutant status at coastal stations around the North-East Atlantic in 2010. The annual average (mean) concentrations of contaminants subject to mandatory monitoring are listed and mapped. Outliers have an effect on the average (mean) and it may be useful to consider the median values. Metal concentrations and depositions in precipitation are presented in Figures 3.1-3.7. Data for mercury is shown in Figure 3.8, and lindane in Figure 3.9. Nitrogen concentrations and depositions in precipitation are mapped in Figures 3.1-3.11. In all figures, Portuguese data from the Azores is located below the relative colour scale. Colour coding in grey on the maps means no data.

It is important to note that different precipitation amounts are used for the calculation of the different components. These are: major ions; POPs; mercury; and other metals. The different precipitation amounts correspond to the different instruments used for the different components.

In addition to mapping of the annual depositions, a table of the monthly mean concentrations reported at each station for each component is presented in the Annex.

3.1 Metals (except mercury)

There is no evidence of any regional differences in metal deposition from the 2010 data set. This may be due to significant data gaps. There are some surprisingly high ranges in observations with some very high values. This has also been noted in previous years. An intercalibration exercise may be useful in interpreting some of the differences. The size of the maps has been increased to improve clarity.

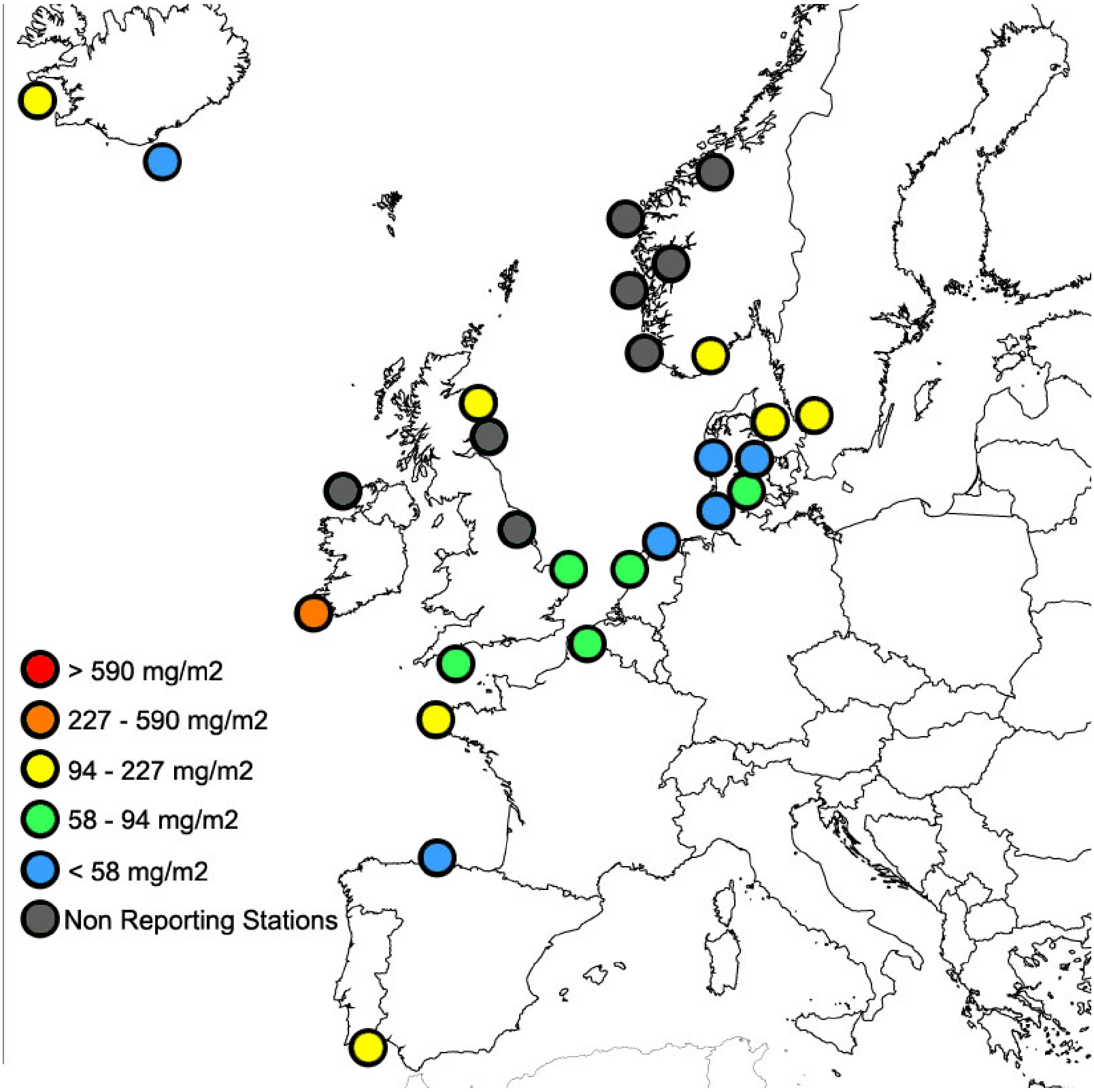

Figure 3.1: As annual depositions 2010 mg/m^2

The results in 2010 for annual Arsenic deposition are very low (blue), low (green) or moderate (yellow) at most stations, with only one station recording higher values (orange). There does not appear to be any regional trend.

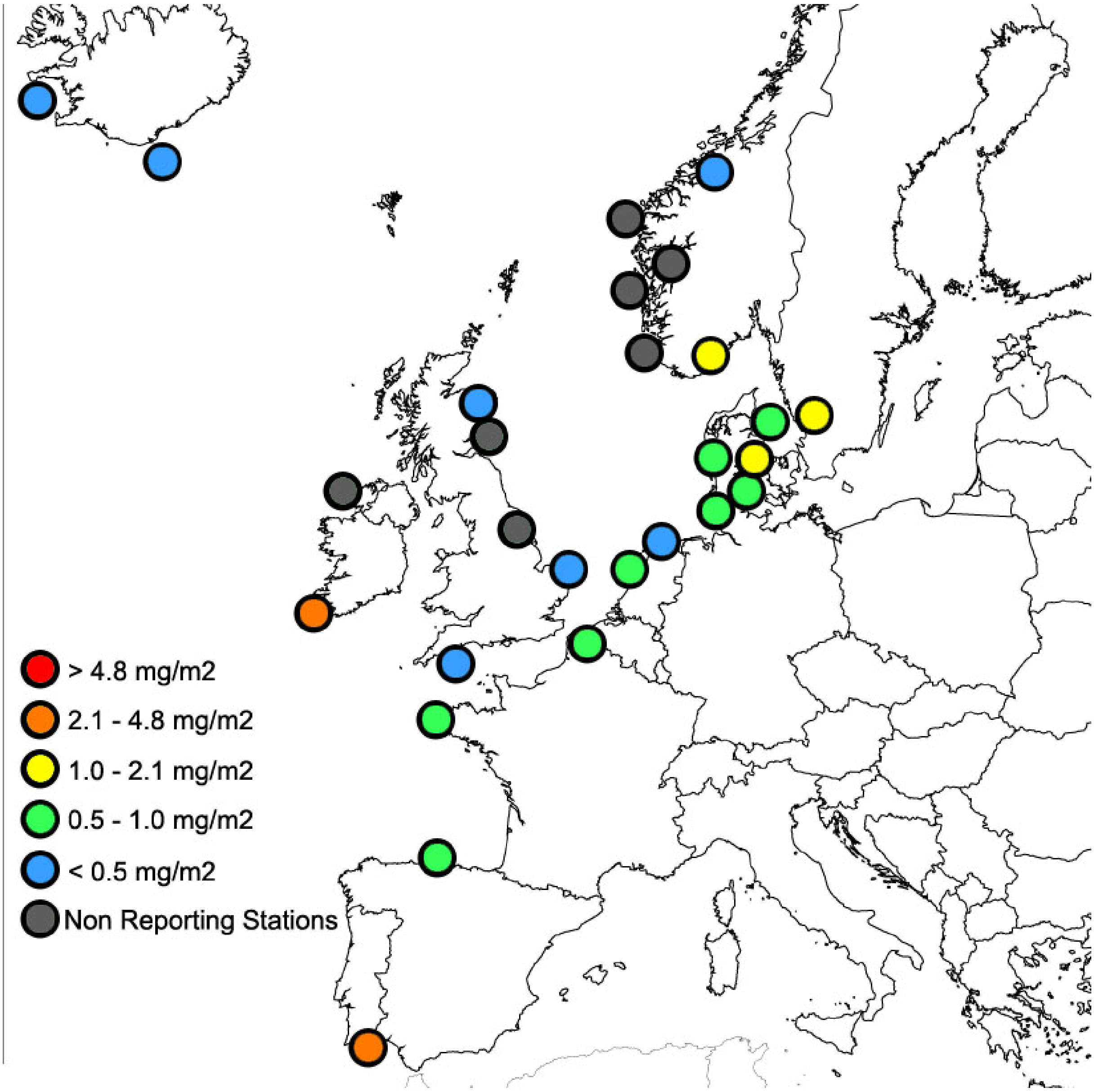

Figure 3.2: Cd annual depositions 2010, mg/m²

The results in 2010 for annual Cadmium deposition are mostly very low (blue) or low (green), with only three moderate (yellow) stations and only two stations recording higher values (orange). There does not appear to be any regional trend.

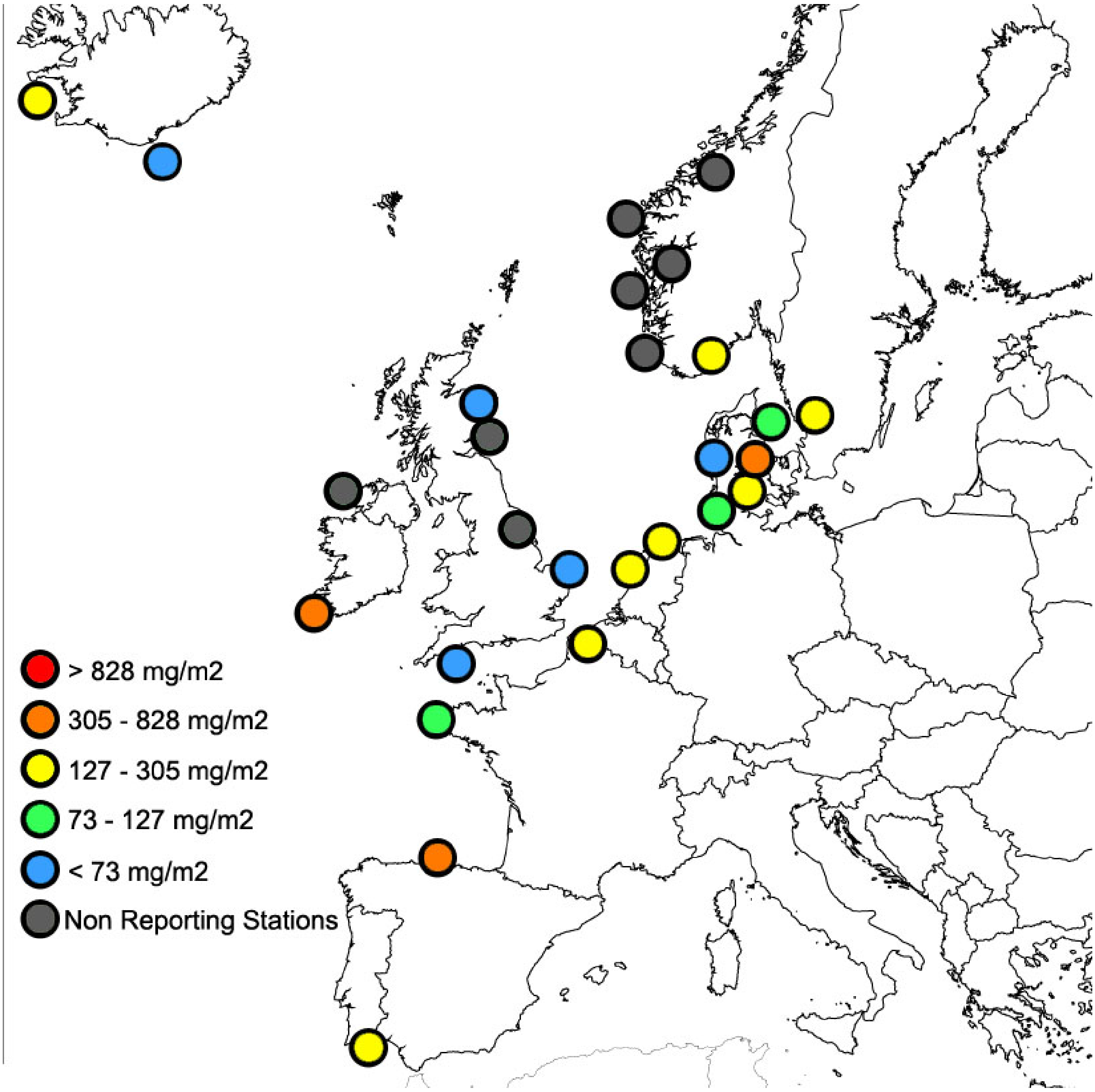

Figure 3.3: Cr annual depositions 2010, mg/m²

The results in 2010 for annual Chromium deposition are very low (blue), low (green) or moderate (yellow) at most stations, with only three stations recording higher values (orange). There does not appear to be any regional trend.

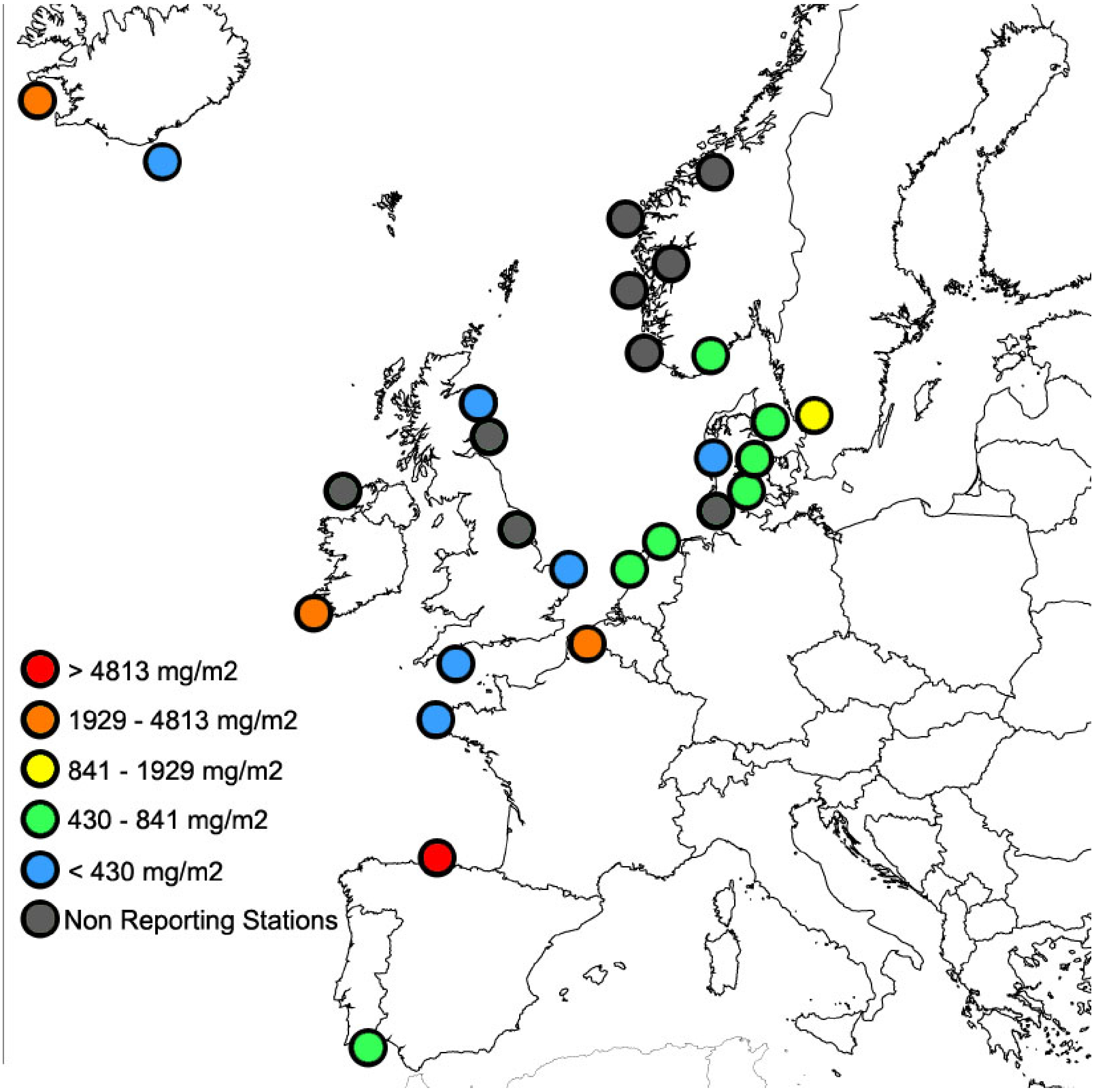

Figure 3.4: Cu annual depositions 2010, mg/m²

The results in 2010 for annual Copper deposition are very low (blue) or low (green) at most stations, with one moderate station (yellow), three stations recording higher values (orange) and one station high deposition (red). There does not appear to be any regional trend.

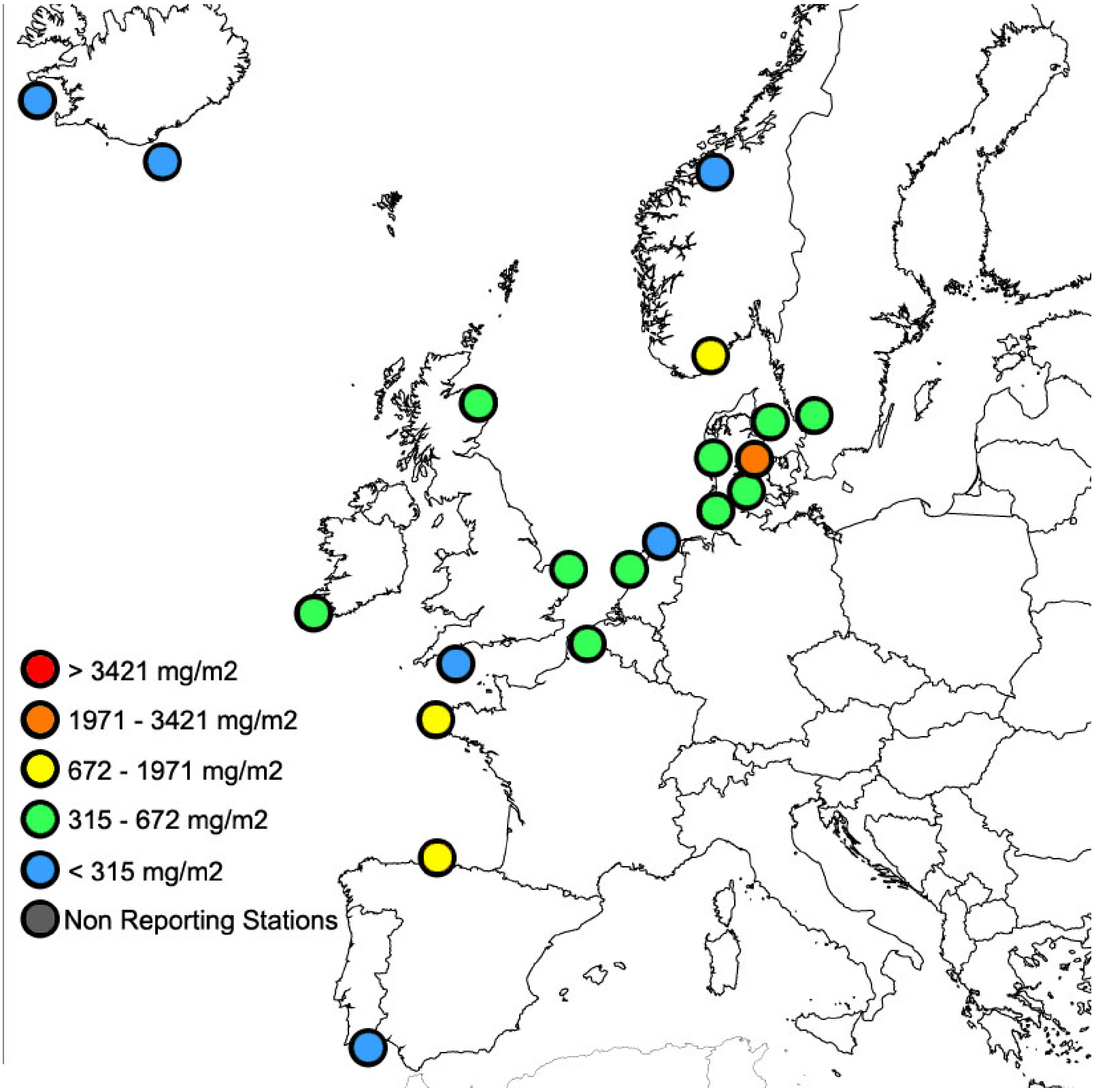

Figure 3.5: Pb mean annual depositions 2010, mg/m²

The results in 2010 for annual Lead deposition are very low (blue) or low (green) at most stations, moderate (yellow) at three stations, with only one station recording higher values (orange). There does not appear to be any regional trend.

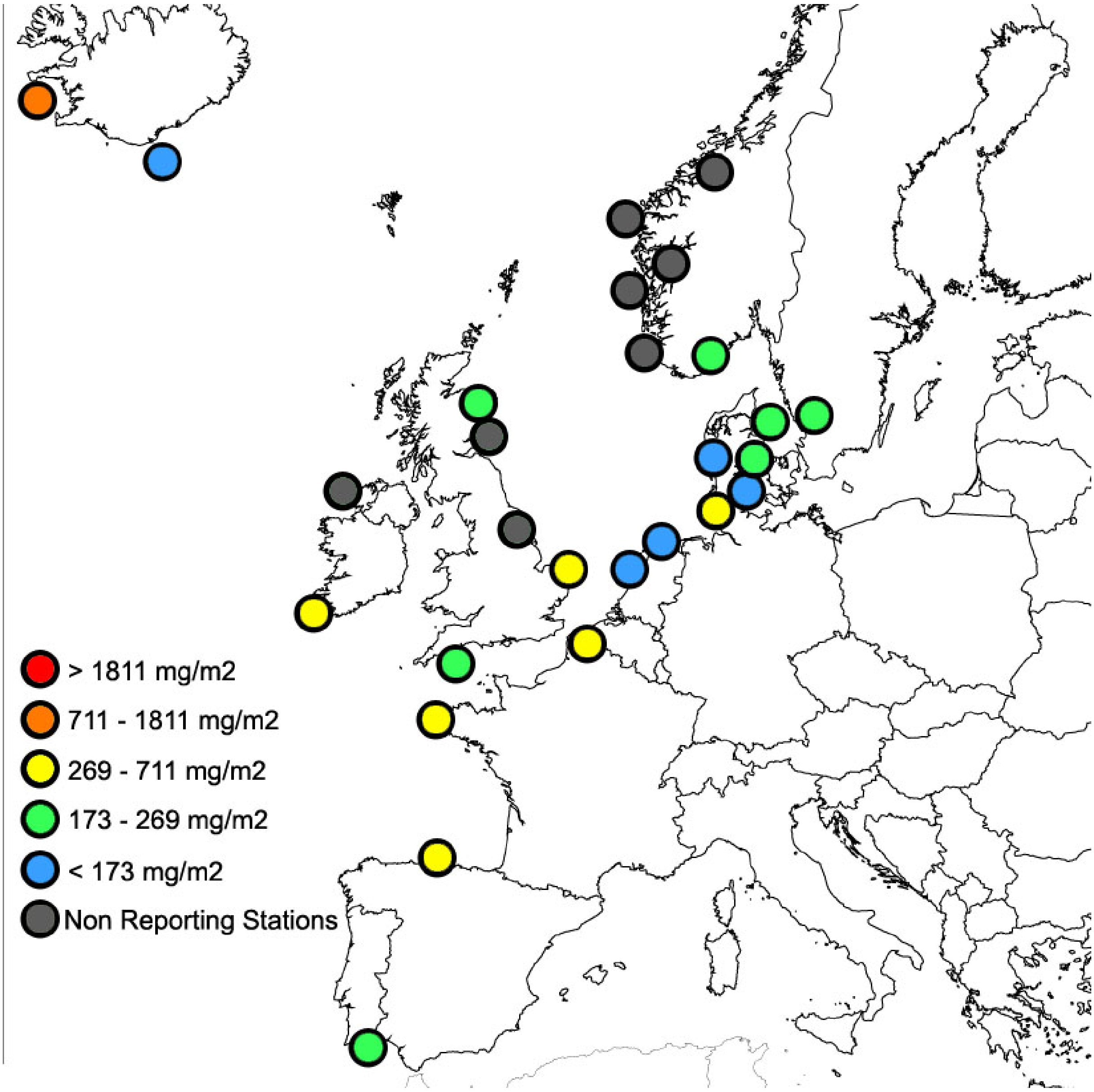

Figure 3.6: Ni annual depositions 2010, mg/m²

The results in 2010 for annual Nickel deposition are mostly very low (blue), low (green) and moderate (yellow) at most stations with only one station recording higher values (orange). There does not appear to be any regional trend.

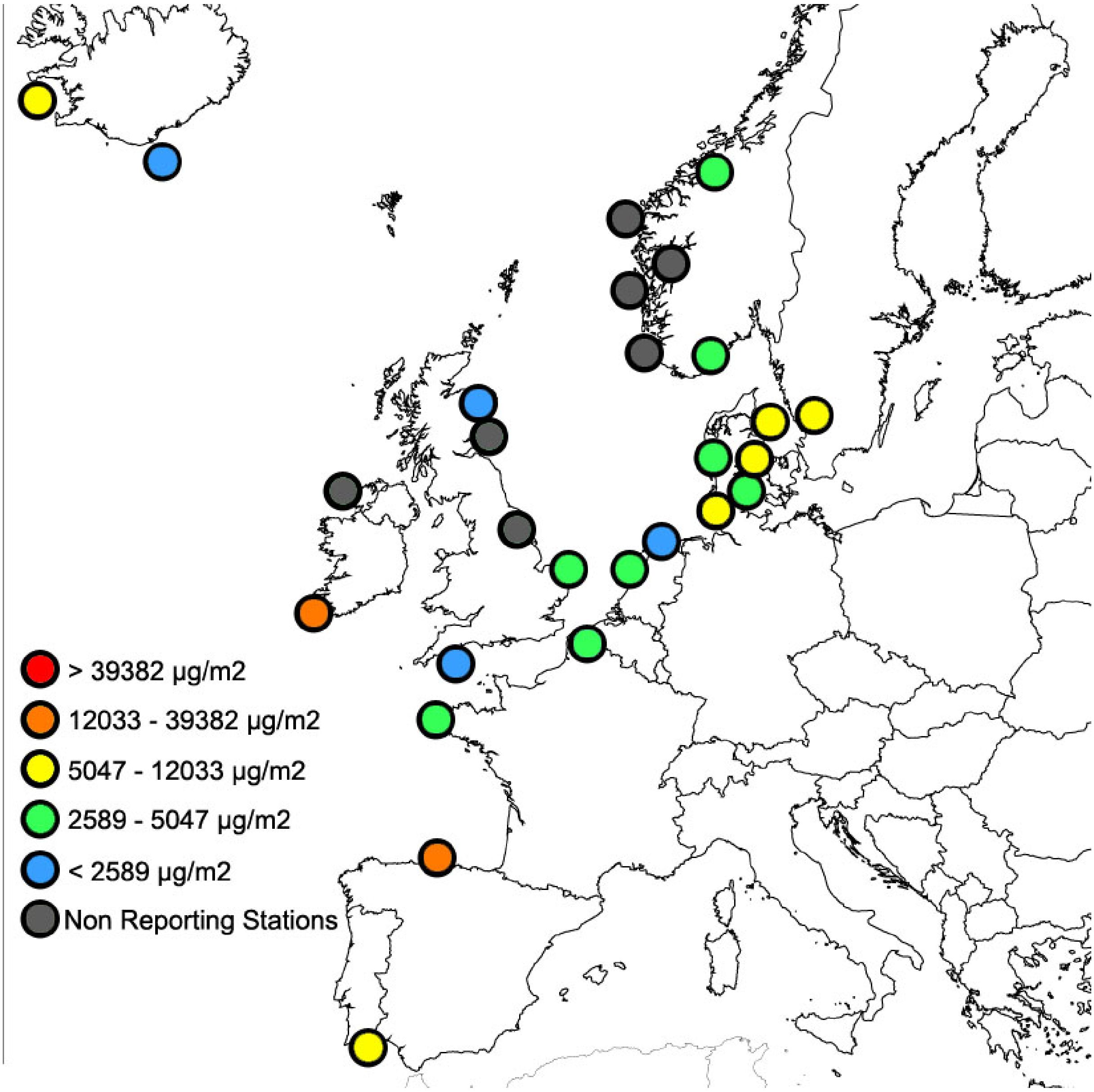

Figure 3.7: Zn annual depositions 2010, mg/m²

The results in 2010 for annual Zinc deposition are mostly very low (blue), low (green) or moderate (yellow) stations with only two stations recording higher values (orange). There does not appear to be any regional trend.

3.2 Mercury

The good comparison in observed concentrations and depositions around the southern North Sea, from Norway around the coast to the United Kingdom, is repeated again in 2010, providing reassurance as to the quality of these measurements. Variations in total depositions may be caused by variations in rainfall amounts.

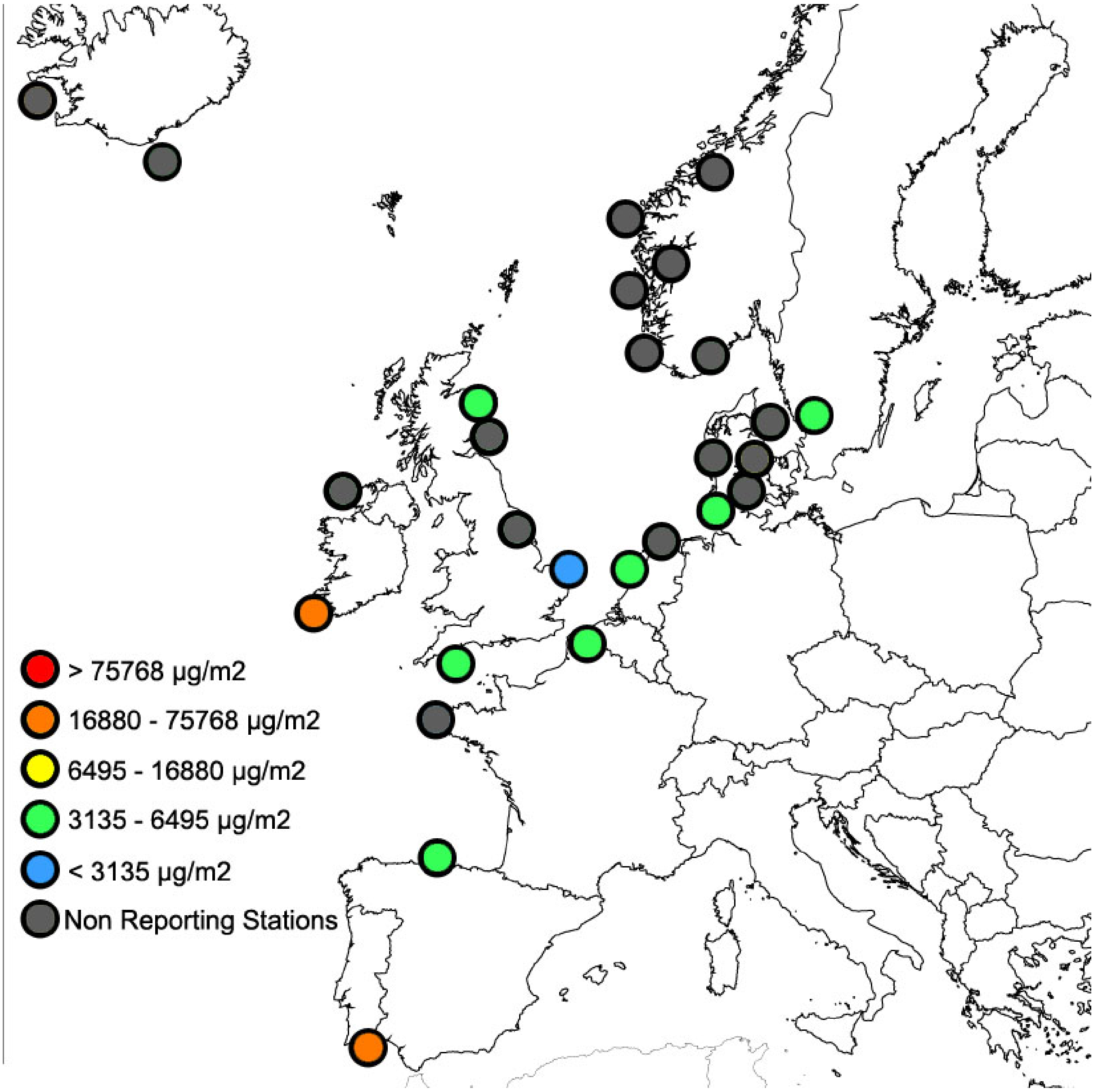

Figure 3.8: Mercury annual depositions 2010, µg/m²

The results in 2010 for annual Mercury deposition are mostly very low (blue) or low (green) with only two stations recording higher values (orange). There does not appear to be any regional trend.

3.3 Lindane

Lindane reporting continues to be too low to make firm conclusions. This pollutant was used as a pesticide especially in agriculture and in animal rearing. The temporal decrease of lindane deposition should follow its total banning in 2010, although this may take a number of years as it is a POP-Persistant Organic Pollutant. Some countries are no longer reporting lindane because it has been undetectable /unquantifiable for several years.

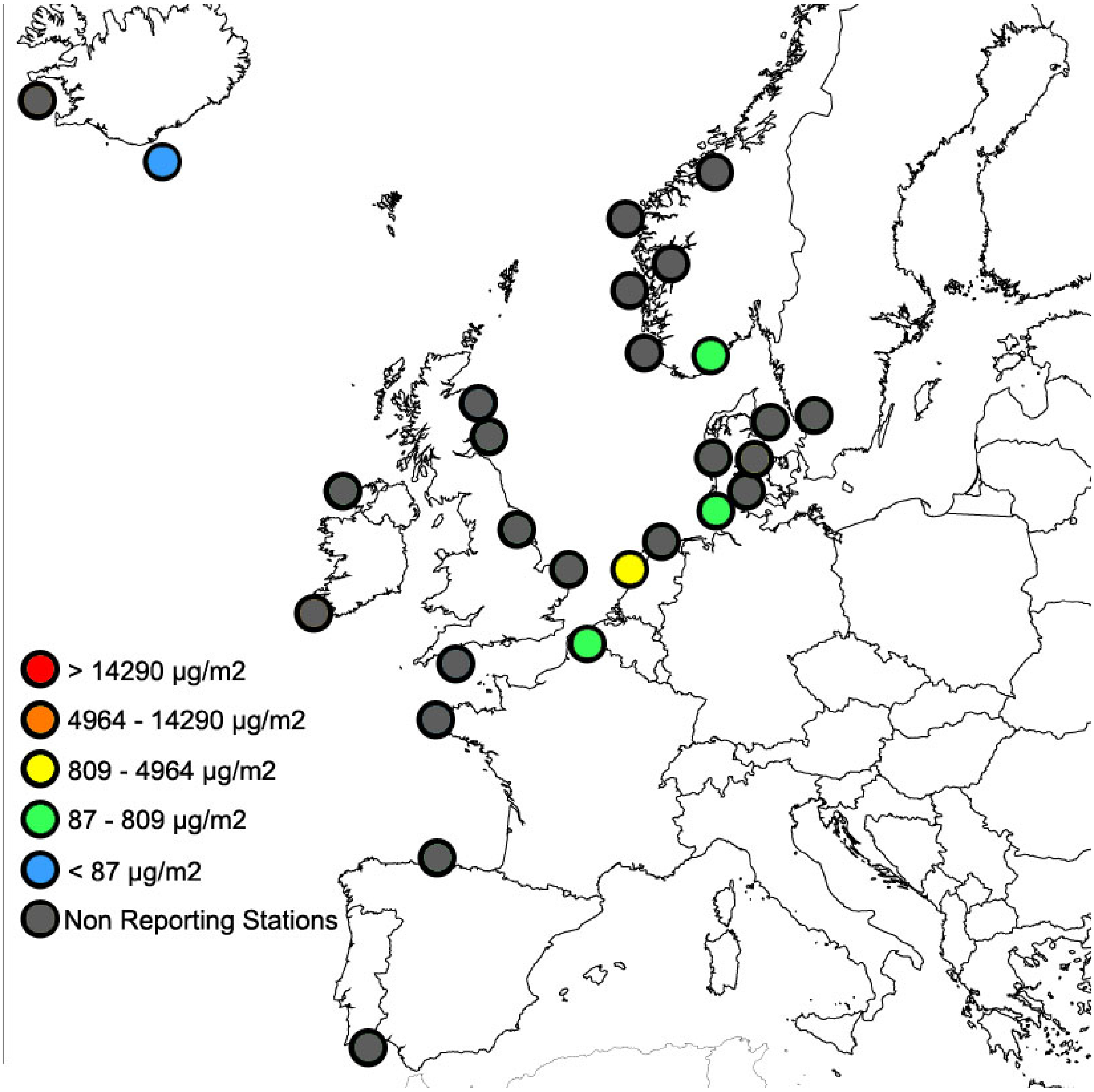

Figure 3.9: Lindane annual depositions 2010 µg/m²

The results in 2010 for annual Lindane deposition were only reported at five stations. They are very low (blue) or low (green) at most stations and moderate (yellow) at one station. There does not appear to be any regional trend.

3.4 Overview of annual coastal deposition of metals

Table 3.1 uses a colour code which is the same as on the maps, to indicate the annual deposition of the metals at each station. It allows a rapid comparison of the sites based on the observations of metals. It also allows us to compare the metals and visualize which still have relatively high depositions. The colour code indicates the relative scale deposition from low (blue) to high (red), similar to but without the same interpretation as in the Water Framework Directive. So red does not indicate poor status, rather a relatively high deposition of the component. Grey indicates insufficient data.

Table 3.1: Annual depositions of metals in precipitation 2010

	As	Cd	Cr	Cu	Pb	Ni	Zn	Hg
	mg/m^2	mg/m^2	mg/m^2	mg/m^2	mg/m^2	mg/m^2	mg/m^2	$\mu g/m^2$
BE0014R	82,022	21,498	304,444	3350,92	653,652	280,147	4279,788	6397,694
DE0001R	56,732	15,061	123,376		454,659	342,283	6199,214	3251,96
DK0005R	47,597	77,744	523,231	751,021	2037,984	192,113	5757,24	
DK0008R	94,328	20,952	109,942	495,407	466,259	218,251	5899,806	
DK0022R	71,754	18,196	142,91	660,518	449,529	124,801	4096,693	
DK0031R	54,816	13,924	70,231	397,516	331,39	111,518	5046,849	
ES0008R	50,771	18,448	619,547	7339,966	710,246	505,789	33114,02	5265,752
FR0090R	204,132	31,821	113,182	114,239	712,317	412,609	4747,612	
GB0013R	74,484	6,663	29,93	384,151	245,643	242,295	1616,751	3464,709
GB0017R	76,175	11,614	35,86	422,288	494,583	295,289	3079,498	2550,313
GB0091R	99,657	11,546	28,107	260,238	363,056	201,032	2048,393	3892,668
IE0001R	460,5	135,35	460,5	4614	568,5	510	38125	46050
IS0090R	94,47	7,082	276,52	2057,994	112,936	961,987	6431,84	
IS0091R	17,186	8,795	41,362	298,806	66,767	111,912	2355,367	
NL0009R	56,504	13,387	176,204	482,756	306,301	137,606	2493,465	
NL0091R	61,725	18,525	202,462	599,687	496,366	170,293	2927,575	5848,974
NO0001R	186,493	41,382	137,335	573,732	962	210,379	4549,186	
NO0039R		11,601			188,489		5008,882	9834,21
PT0002R	102,808	102,808	182,785	782,924	229,81	201,265	6838,819	26248,92
SE0014R	162,81	50,47	277,75	1086,28	322,9	197,18	6171,5	5107,6

The colour codes are the same as on the maps. This shows that relative deposition of metals is low at stations shaded in blue such as IS0091R and relatively high at stations shaded in orange, such as IE0001R or in red, of which there is only one case, Cu at ES0008R. Deposition of most metals is relatively low to moderate (green and yellow).

3.5 Nitrogen depositions in 2010

Nitrogen deposition in 2010 appears to be high around the North Sea, English Channel and Bay of Biscay. However, important regional data gaps limit the interpretation of the data. In view of the implementation of the Nitrate Directive, the Water Framework Directive and the Marine Strategy Framework Directive, the relative importance of atmospheric deposition with respect to runoff and riverine inputs should be monitored closely.

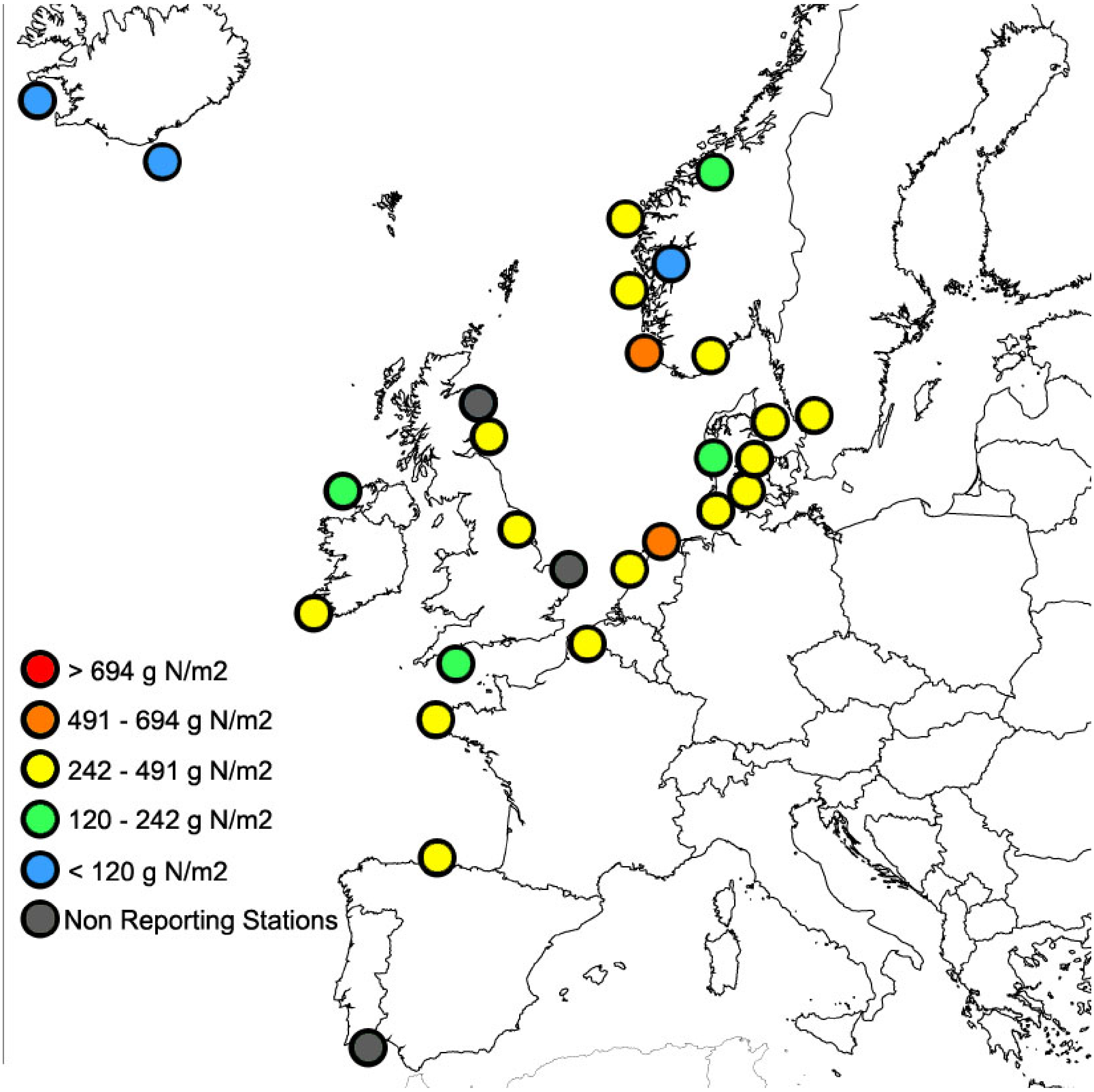

Figure 3.10: NH_4 annual depositions, g N/m²

The results in 2010 for annual Ammonium deposition are moderate (yellow) at most stations, and relatively high at two stations in the North Sea (orange). Only Iceland and one station in Norway reported very low deposition (blue).

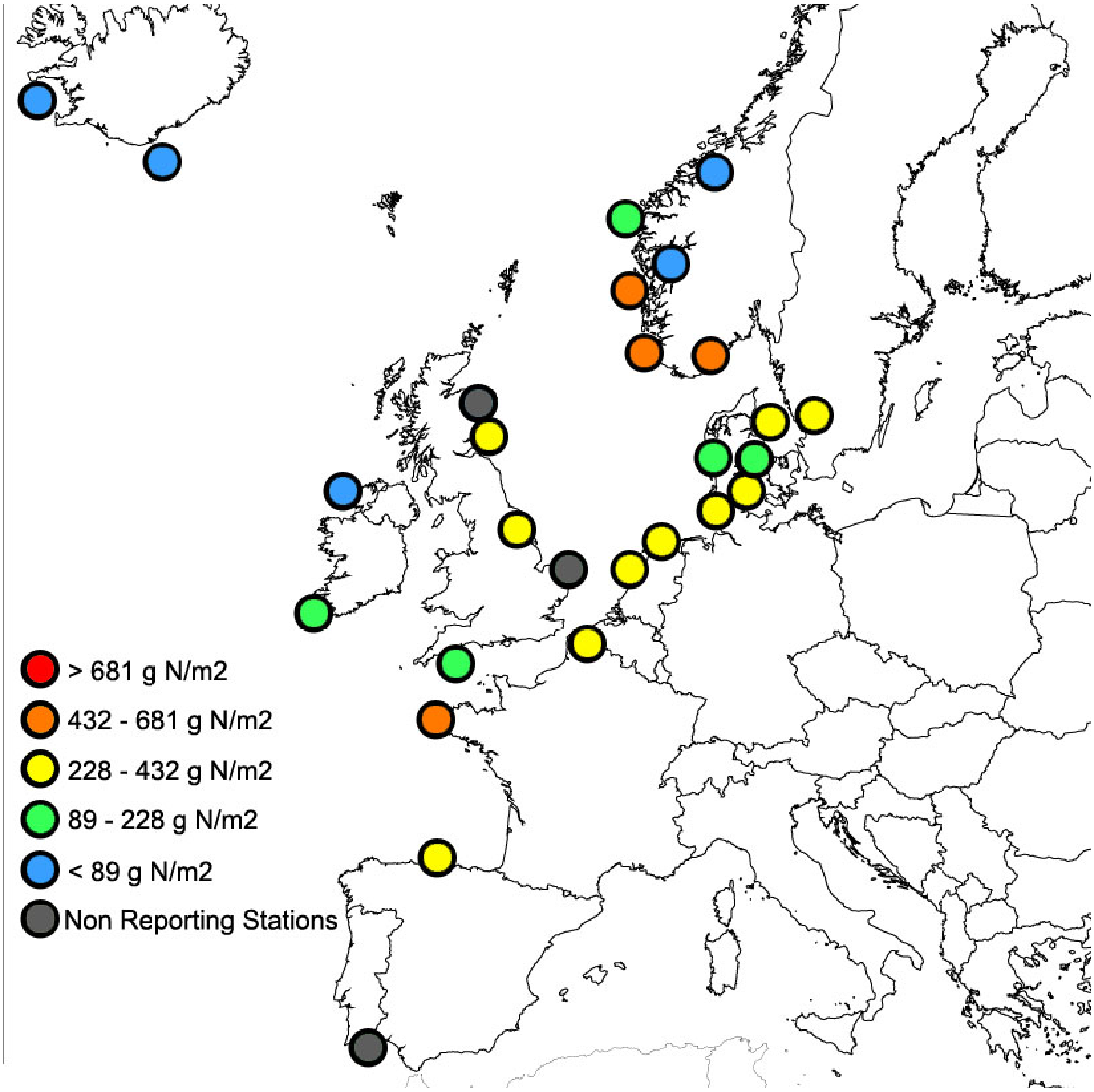

Figure 3.11: NO3 annual depositions, g N/m²

The results in 2010 for annual Nitrate deposition are moderate (yellow) at most stations and high (orange) at four stations. Stations for the Norwegian Sea, Ireland and Iceland reported low to very low deposition (blue).

4. Temporal Patterns and Trends

This report explores various ways to present temporal patterns in the OSPAR CAMP data. It is proposed that a decadal report be prepared using the most suitable and useful representation. To this end, various examples are given.

4.1 Temporal patterns in the OSPAR CAMP data for Norway

In the first example, the most complete national data set was used as an example to show whether there is any improvement in the monitored data with time, possibly as a response to more stringent environmental policies and criteria. If the situation improves as a result of environmental policies and practices, there should be a gradual change in colour from the red end of the scale towards the blue end of the scale. This “traffic light” chart is shown in Figure 4.1 for Norway, the most complete national data set.

	2003	2004	2005	2006	2007	2008	2009	2010
As mg/m²	826,44	212,065	358,883	353,694	133,352	288,027	326,256	186,493
NO_3^- g N/m²	455,5987	393,223	463,3878	476,0544	337,8258	405,172	381,5152	293,0605
Cr mg/m²	305,31	188,43	421,24	272,837		214,443	211,496	137,335
NH_4^+ g N/m²	478,4465	424,417	518,5574	438,9836	444,1804	412,8792	394,8608	299,2238
Hg µg/ m²	8916,466	14102,77	11000,97	14853,54	9073,622	12652,47	16760,33	9834,21
Pb mg/m²	1533,556	1232,024	919,595	904,2175	531,442	777,1265	886,984	575,2445
Ni mg/m²	525,744	358,011	656,442	354,882	303,639	238,512	342,756	210,379
γ-HCH µg/ m²	992,908	1233,754	832,577	849,317	565,155	706,604	583,043	315,658
Cd mg/m²	46,729	39,008	28,73	32,9105	22,898	26,3275	42,128	26,4915
Cu mg/m²	1390,594	595,272	1073,83	931,481	499,188	702,127	818,33	573,732
Zn mg/m²	4923,15	4631,222	4507,306	4222,152	2737,74	3394,626	4431,165	4779,034

Figure 4.1: The mean annual deposition of each mandatory component has been calculated for each year from 2003-10 and colour coded. The colour codes are the same as those used on the maps.

The « traffic light » plot in Figure 4.1 shows a trend from high (red) to moderate (yellow) for Arsenic from 2003 to 2010. Lead, Nickel, Lindane, Cadmium and Copper have gone from moderate (yellow) to low (green). Deposition of Mercury remains moderate in Norway over the same timeframe while Zn remains low (green).

In 2011, a « traffic light plot » for mandatory components in OSPAR Region I will be presented. Region I is the only OSPAR region with sufficient stations and data to allow a regional analysis.

4.2 Temporal patterns in the OSPAR CAMP data for Lead

In the second example, the mean annual Lead deposition has been calculated for the various years. This is shown in Figure 4.2.

Year	2003	2004	2005	2006	2007	2008	2009	2010
Pb mg/m^2	1196	1190	1244	965	839	677	712	509

*Figure 4.2: The mean annual Lead deposition (**mg/m^2**) has been calculated for all stations for each year from 2003-10 and colour coded as on the map*

Temporal patterns in the data for Lead cannot be grouped by OSPAR subregion because there is insufficient data and spatial coverage to further split this to show the temporal trends in the different OSPAR subregions. The importance of atmospheric transport of metals, including lead, gave rise in 1979 to the Convention on Long-range Transboundary Air Pollution and the 1998 Aarhus Protocol on Heavy Metals. The temporal trend (Fig 4.2) indicates that the policy implementation has been effective in reducing atmospheric deposition of lead.

4.3 Temporal patterns with deposition values for Mercury

In the third example, the annual deposition has been calculated for the various years in the most complete data sets.

The data set is shown below in Table 4.3 and a bar chart of the data in Figure 4.3a, with a trend line in 4.3b.

Hg ug/m^2	Year							
Site	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
BE0014R			11138	12633	10214	6575	4987	6398
DE0001R	5351	5563	5002	6014	4493	5239	4895	3252
GB0013R			4180	2894	6108	7405	3122	3465
GB0017R			2825	1928	2791	2121	2161	2550
GB0091R			3039	2793	2882	2818	3274	3893
NL0091R	5444	10362	8259	6874	7273	8189	6072	5849
SE0014R	4626	8114	7008	6029	6953	6210	6277	5108
Mean	**5140**	**8013**	**5921**	**5595**	**5816**	**5508**	**4398**	**4359**

Table 4.3: The annual deposition of mercury (ug/m^2), only at stations with sufficient data, for each year from 2003-10

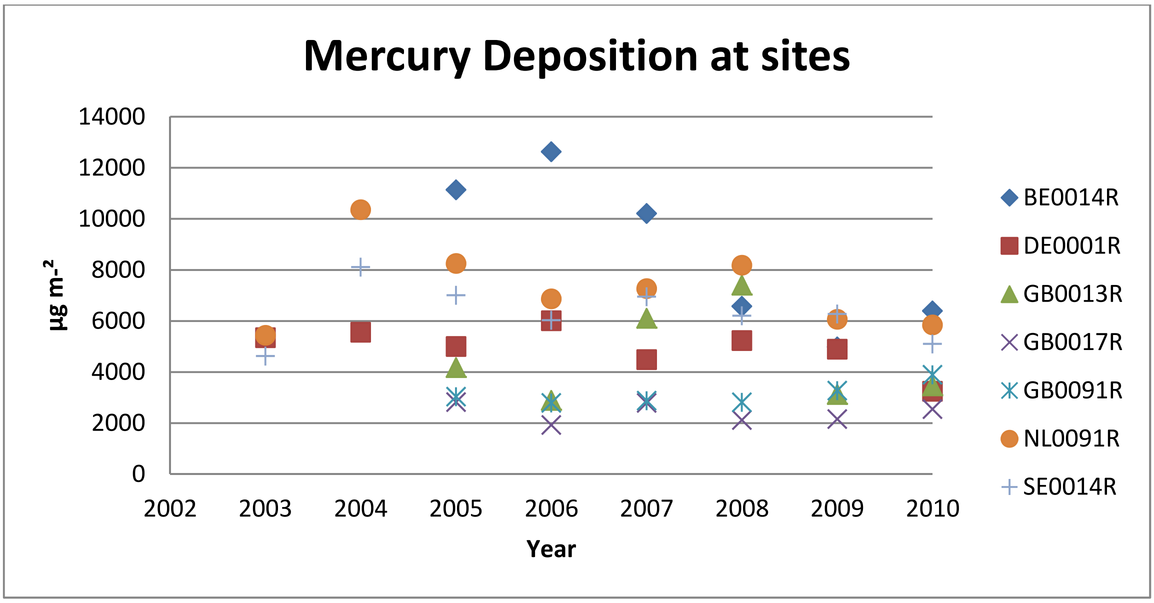

Figure 4.3a: The annual deposition of mercury (ug/m^2) at stations with sufficient data for each year from 2003-10. No colour coding is used in this example.

A trend line (2 year moving average) can also be inserted, as shown in Figure 4.3 b.

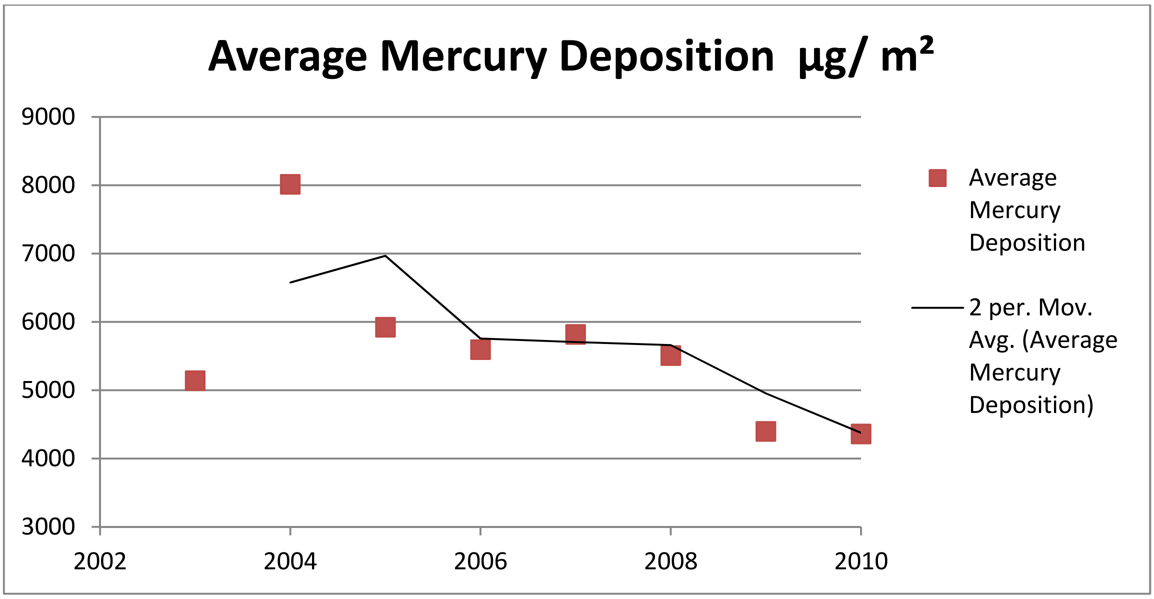

Figure 4.3b: The trend of annual deposition of mercury (ug/m^2) from 2003-10

No colour coding is used in this example. For such charts to be useful, a long period (more than decadal) and a very complete data set are necessary. From 2011, trend analysis will be based on the Trend Detector methodology of the ICES working group for statistics.

5. Main conclusions from NILU (data centre)

There are several weaknesses in the CAMP monitoring network. These result in **problems of scale** and **geographical coverage**. Although the CAMP programme is now several years old, several of the CAMP stations do not strictly meet the requirements of the CAMP Principles (e.g. distance from coastline) and the North Sea remains the most intensely observed sub-region. Important gaps in the network concern Region III (Irish Sea) and Region IV (Bay of Biscay) and the far north-east. It would also be useful to consider including existing AMAP reference stations in Greenland and Faroe Islands and consider cooperation with Russia and their stations on the Kola Peninsula. **Spatial coverage of reporting stations is too low to subdivide the data set into OSPAR subregions I-V**. Modelling may help to overcome these spatial and temporal limitations.

The decreasing trend of lead confirms that policies can result in significant environmental improvement. Lack of reporting hinders such clear statements with respect to mercury and lindane, because **reporting of mandatory components is patchy.** There are systematic gaps in the reporting of some mandatory pollutants, such as **lindane and mercury**. Monitoring results show high concentrations of mercury, especially for the Nordic countries, hence the importance of continued monitoring in that sub-region. Data on PCBs is also very limited and has been variable.

After 10 years **a decadal statistical analysis of the database maybe useful and timely**. The database could be useful to support the **implementation of the Water Framework Directive for transitional and coastal waters** as well as the **Marine Strategy Framework Directive** as there are many overlaps of the **Priority Substances**, **Contaminants** and the CAMP pollutants.

The database contains many non-mandatory data. **Access to the online database** will be enabled once the report has been adopted allowing modellers to access and make use of the data with appropriate caveats.

Further harmonisation of the calculations between EMEP and CAMP would also be useful. There maybe natural environmental explanations for regional differences in some observations such as natural biogenic or geothermal emissions, seasonality of rainfall, but monitoring may also contribute to discrepancies. Some are of such magnitude as to shed uncertainty. **Improvements in the quantification and detection limits**, which in some cases are too high, would also improve the quality and usefulness of observations. A **proficiency testing scheme** could be implemented to check whether the data is fit for purpose and therefore to improve the comparability of the data.

Annex

Reported observations of mandatory components

NOTES

Data for the station SPITSBERGEN (NO) are also available through the data portal but were not incorporated in this report. They will be fully incorporated for 2011.
Data for the stations NIEMBRO and NOIA (ES) are also available through the data portal. Data for these stations are incorporated in the calculations (percentiles) for this report but NOIA is not shown in the maps (nor is Spitzbergen). They will be fully incorporated for 2011.

The Zn data for Spain (ES) were also not incorporated, by omission.

Reporting overview table

Monitoring of contaminants 2010

✓ *indicates some observations in precipitation and air*

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

Monthly Depositions of mandatory components

Table 3.1 Monthly deposition of As mg/m^2

STATION	J	F	M	A	M	J	J	A	S	O	N	D
BE0014R	5.64	25.95	2.59	3.28	1.05	5.07	4.22	10.26	5.91	6.56	5.99	5.53
DE0001R	2.46	3.39	1.02	4.60	3.24	1.91	8.60	6.51	8.23	7.59	7.03	2.17
DK0005R	1.30	5.42	na	6.22	7.20	3.35	5.26	4.63	4.12	na	7.75	2.38
DK0008R	0.96	13.06	9.06	4.45	8.25	7.50	11.29	8.13	6.86	14.29	5.55	4.93
DK0022R	3.34	8.10	4.61	7.33	8.45	3.33	8.76	6.91	4.61	7.21	5.28	3.83
DK0031R	4.63	7.62	2.07	1.59	5.78	1.43	9.90	5.77	5.73	6.03	2.55	1.73
ES0008R	11.03	6.42	1.81	3.46	4.23	1.94	2.50	0.91	3.00	3.41	2.92	9.12
FR0090R	7.40	18.79	7.87	15.92	8.63	9.46	7.17	9.14	15.70	25.63	72.57	5.87
GB0013R	7.71	7.85	8.57	5.36	4.07	2.22	7.55	6.50	5.01	8.68	9.72	1.73
GB0017R	19.30	6.00	3.38	na	na	na	7.38	5.50	na	6.90	5.83	10.34
GB0091R	12.91	11.18	4.90	4.83	5.04	8.24	6.58	4.75	12.97	6.94	13.19	5.65
IE0001R	81.00	34.50	62.50	49.50	27.00	23.25	38.75	8.75	31.75	33.50	43.00	27.00
IS0090R	44.16	5.66	23.02	9.31	3.17	0.97	1.84	-1.14	7.49	na	na	na
IS0091R	0.23	0.15	0.17	na	0.27	0.52	0.89	4.64	10.19	na	na	na
NL0009R	3.31	4.42	1.85	4.46	3.16	2.24	4.65	9.29	7.91	8.37	4.63	3.17
NL0091R	2.69	5.43	3.28	4.40	1.94	2.62	7.32	14.18	7.36	3.66	5.74	3.20
NO0001R	10.24	3.58	3.64	3.25	3.10	2.63	20.41	8.37	13.45	94.01	12.91	10.88
PT0002R	13.60	20.66	14.16	6.94	3.28	2.62	na	na	1.28	19.53	6.04	14.62
SE0014R	2.34	5.29	6.93	39.60	4.20	25.84	25.52	18.02	9.52	13.87	7.93	3.75

Table 3.1 Monthly deposition of Cd mg/m^2

STATION	J	F	M	A	M	J	J	A	S	O	N	D
BE0014R	1.95	1.88	0.52	2.82	0.74	1.17	0.87	2.05	1.18	1.68	4.79	1.85
DE0001R	0.66	1.13	0.41	1.65	0.74	0.50	2.52	1.57	2.00	1.47	1.67	0.75
DK0005R	1.30	5.42	na	6.22	7.20	33.49	5.26	4.63	4.12	na	7.75	2.38
DK0008R	0.22	2.91	1.34	0.70	1.64	6.42	2.74	1.63	0.69	1.50	0.61	0.57
DK0022R	1.21	1.52	1.01	1.74	1.68	3.67	2.28	1.41	0.81	1.44	0.56	0.89
DK0031R	1.98	1.68	0.56	0.52	1.29	0.30	1.45	1.51	1.57	1.05	1.42	0.59
ES0008R	2.06	2.97	1.01	0.38	0.58	0.73	0.31	0.46	1.27	2.65	0.85	5.19
FR0090R	1.37	2.02	2.57	1.90	1.85	1.22	4.30	3.54	3.92	2.56	4.40	2.15
GB0013R	0.92	0.92	1.08	0.67	0.56	0.20	0.20	0.20	0.53	0.49	0.85	0.13
GB0017R	3.43	1.93	0.71	na	na	na	1.09	0.62	na	0.61	0.97	0.73
GB0091R	2.06	1.86	0.05	0.57	0.65	1.32	0.71	0.13	1.43	0.23	1.40	0.34
IE0001R	8.10	3.45	6.25	19.80	5.40	55.80	7.75	1.75	6.35	6.70	8.60	5.40
IS0090R	2.76	0.57	0.82	0.96	0.86	0.19	0.20	-0.23	0.94	na	na	na
IS0091R	0.06	0.03	0.01	na	0.11	0.20	0.26	3.71	4.37	na	na	na
NL0009R	0.48	1.00	0.42	1.05	0.55	0.51	1.34	2.49	1.79	2.65	0.61	0.72
NL0091R	0.61	1.25	0.77	1.69	1.33	0.76	1.91	4.55	1.86	0.83	1.58	1.40
NO0001R	3.06	0.39	0.18	0.42	1.23	0.35	1.82	1.90	1.10	27.60	0.72	2.62
NO0039R	1.06	0.48	3.22	0.39	0.74	1.75	0.64	0.93	0.91	0.94	0.11	0.37
PT0002R	13.60	20.66	14.16	6.94	3.28	2.62	na	na	1.28	19.53	6.04	14.62
SE0014R	0.78	1.38	1.65	13.40	9.60	6.84	2.32	5.30	1.02	6.57	0.61	1.00

Table 3.1 Monthly deposition of Cr mg/m^2

STATION	J	F	M	A	M	J	J	A	S	O	N	D
BE0014R	20.57	36.78	16.24	17.62	3.01	12.66	15.30	51.36	31.34	20.55	51.06	27.97
DE0001R	6.06	5.35	4.07	7.14	6.86	4.08	17.14	19.03	14.03	18.60	13.74	7.27
DK0005R	17.67	50.46	na	173.67	10.05	17.50	16.87	42.00	18.34	na	135.57	41.38
DK0008R	1.43	18.63	8.44	7.33	18.49	6.60	15.29	8.44	7.94	9.43	3.65	4.30
DK0022R	2.79	4.47	4.61	77.98	7.77	4.44	13.66	6.20	6.06	8.54	3.84	2.55
DK0031R	2.24	2.89	3.50	4.13	8.93	3.51	16.90	6.71	9.05	6.32	4.64	1.41
ES0008R	14.73	18.43	18.94	39.91	36.24	28.04	27.71	137.24	89.25	46.89	103.59	58.58
FR0090R	12.68	11.56	5.01	10.61	4.11	14.97	5.58	12.57	3.92	6.99	15.39	9.78
GB0013R	3.43	2.35	2.11	1.87	2.23	1.01	2.71	5.04	2.13	3.93	2.47	0.95
GB0017R	8.68	1.10	2.27	na	na	na	9.50	1.55	na	1.22	0.88	5.04
GB0091R	3.22	2.49	2.57	3.22	1.19	2.27	2.17	3.58	2.14	1.13	3.58	0.98
IE0001R	81.00	34.50	62.50	49.50	27.00	23.25	38.75	8.75	31.75	33.50	43.00	27.00
IS0090R	45.54	10.19	120.01	23.11	17.86	7.28	15.71	5.01	31.82	na	na	na
IS0091R	1.49	0.25	1.54	na	2.11	5.42	4.97	9.27	16.02	na	na	na
NL0009R	6.34	15.21	6.40	14.46	8.35	7.75	20.44	29.77	27.40	29.02	3.35	11.00
NL0091R	9.31	18.75	8.06	14.90	5.77	4.99	23.97	47.81	25.51	12.69	19.89	11.08
NO0001R	4.43	6.00	7.29	4.66	5.43	3.79	20.42	21.47	13.88	32.37	12.25	5.37
PT0002R	13.60	20.66	14.16	6.94	3.28	2.62	na	na	1.28	75.74	13.63	30.74
SE0014R	73.84	22.54	31.02	4.80	17.40	12.92	49.88	20.14	18.70	10.22	8.54	7.75

Table 3.1 Monthly deposition of Cu mg/m^2

STATION	J	F	M	A	M	J	J	A	S	O	N	D
BE0014R	142.34	196.66	45.39	74.60	98.26	220.43	301.70	601.44	410.79	323.15	635.09	301.06
DK0005R	28.86	75.13	na	57.92	78.59	55.52	106.63	99.28	79.10	na	148.48	21.96
DK0008R	16.71	71.61	35.16	29.29	64.62	58.74	74.94	43.92	25.30	42.34	20.05	12.73
DK0022R	5.25	20.85	32.48	50.93	42.82	238.26	100.95	43.70	31.37	44.93	32.47	16.53
DK0031R	12.27	45.18	23.85	46.78	39.16	13.84	75.41	37.43	41.20	36.01	18.28	8.10
ES0008R	313.51	316.44	263.63	616.50	166.26	337.13	230.84	544.34	1090.29	1504.44	619.64	1336.95
FR0090R	13.74	11.56	5.01	10.61	4.11	14.97	5.58	12.57	3.92	6.99	15.39	9.78
GB0013R	20.56	26.94	27.94	19.15	30.78	11.69	25.05	18.71	23.99	157.30	20.94	5.25
GB0017R	76.86	40.04	38.05	na	na	na	74.42	38.21	na	22.85	33.55	20.42
GB0091R	19.01	31.65	10.14	11.95	16.75	27.70	56.91	14.52	29.51	9.60	26.30	8.34
IE0001R	324.00	34.50	250.00	49.50	162.00	186.00	155.00	350.00	381.00	2010.00	172.00	540.00
IS0090R	386.40	246.21	428.26	156.33	110.59	48.50	119.54	62.34	499.82	na	na	na
IS0091R	15.93	5.13	5.06	na	15.64	33.83	21.01	90.86	109.22	na	na	na
NL0009R	79.40	67.35	20.48	37.53	20.17	39.26	59.85	34.77	54.90	46.24	16.59	11.26
NL0091R	43.03	67.51	47.16	61.93	53.01	44.38	89.20	59.83	28.80	33.70	47.66	26.10
NO0001R	18.53	4.71	3.64	12.53	39.72	17.68	101.35	54.74	31.96	238.23	32.03	18.44
PT0002R	68.00	103.30	70.80	112.40	16.40	13.10	na	na	40.96	97.65	30.20	229.52
SE0014R	12.09	20.70	30.69	209.30	157.20	86.26	63.80	93.28	70.72	76.65	133.59	132.00

Table 3.1 Monthly deposition of Pb mg/m^2

STATION	J	F	M	A	M	J	J	A	S	O	N	D
BE0014R	42.41	63.27	13.10	29.20	16.58	59.76	37.19	63.56	121.73	45.81	91.46	69.59
DE0001R	16.31	18.53	12.24	40.02	21.66	20.72	98.61	48.12	51.77	47.85	54.10	24.71
DK0005R	79.28	137.35	na	705.05	61.42	80.52	66.37	157.42	67.31	na	540.29	144.20
DK0008R	6.69	72.10	42.01	30.09	52.86	50.46	59.81	38.02	22.27	53.93	20.20	17.82
DK0022R	29.61	49.33	22.13	38.84	51.71	27.20	73.06	44.54	23.85	42.49	27.19	19.58
DK0031R	20.22	19.12	22.60	22.27	36.43	7.15	63.82	31.67	34.73	33.62	29.89	9.88
ES0008R	53.70	70.40	20.33	78.65	41.11	34.13	30.89	55.34	93.46	50.30	61.44	120.51
FR0090R	37.00	98.26	92.24	201.63	34.52	26.79	27.90	40.01	31.39	26.80	70.37	25.43
GB0013R	31.05	30.50	45.91	16.21	32.24	5.83	13.91	12.26	15.18	14.79	28.59	4.09
GB0017R	127.92	46.81	26.21	na	na	na	82.28	42.47	na	20.59	35.76	38.85
GB0091R	75.71	63.16	1.43	10.95	18.64	29.46	18.52	6.36	38.85	4.85	59.01	9.29
IE0001R	81.00	34.50	62.50	49.50	54.00	23.25	38.75	8.75	31.75	33.50	43.00	108.00
IS0090R	18.91	10.84	16.36	12.07	8.81	4.23	5.49	6.19	30.05	na	na	na
IS0091R	4.45	1.08	0.76	na	1.48	3.30	3.76	7.79	43.69	na	na	na
NL0009R	14.04	17.54	6.29	30.21	13.66	28.06	48.77	37.74	46.38	40.27	17.25	8.67
NL0091R	24.43	44.42	33.81	32.59	43.73	32.44	85.91	69.78	29.31	21.18	44.87	36.00
NO0001R	62.10	37.93	56.07	39.91	26.68	8.99	64.53	41.40	30.51	494.96	33.23	65.92
NO0039R	9.72	3.98	46.51	23.03	11.74	31.09	10.63	14.89	5.28	11.49	11.79	6.52
PT0002R	13.60	69.73	14.16	16.39	3.28	28.82	na	na	14.08	19.53	6.04	44.01
SE0014R	16.51	26.22	26.40	14.90	17.10	11.40	62.64	54.06	9.18	41.61	20.13	22.75

Table 3.1 Monthly deposition of Ni mg/m^2

STATION	J	F	M	A	M	J	J	A	S	O	N	D
BE0014R	14.73	24.67	8.58	23.58	8.48	25.60	27.82	51.37	19.96	12.60	32.85	29.91
DE0001R	13.65	11.78	7.42	16.96	25.75	14.51	55.59	44.05	39.24	48.47	53.59	11.23
DK0005R	27.73	38.57	na	21.38	16.82	10.52	12.90	14.18	14.66	na	26.94	8.91
DK0008R	0.16	24.69	9.06	5.88	35.33	85.80	16.70	10.78	6.35	10.47	8.74	4.30
DK0022R	2.87	8.22	8.13	8.43	12.24	8.73	17.64	24.25	10.51	11.98	6.88	4.94
DK0031R	3.51	16.23	7.78	5.58	13.36	3.02	17.63	12.57	12.56	10.06	6.67	2.55
ES0008R	38.42	41.89	9.73	39.91	71.49	28.37	26.38	31.16	66.94	71.32	27.40	52.79
FR0090R	82.45	52.02	15.02	19.71	18.08	14.97	33.47	76.58	39.24	25.63	19.79	15.65
GB0013R	30.09	23.20	35.23	11.98	14.74	19.87	16.79	20.35	17.04	22.30	29.71	2.81
GB0017R	29.35	23.49	7.38	na	na	na	116.16	15.27	na	10.20	17.42	10.28
GB0091R	48.62	18.13	4.28	3.57	4.74	12.44	12.07	16.91	24.30	2.92	13.19	26.97
IE0001R	81.00	34.50	62.50	49.50	27.00	46.50	38.75	35.00	31.75	33.50	43.00	27.00
IS0090R	259.44	53.77	223.58	191.64	25.63	14.74	31.82	20.02	141.34	na	na	na
IS0091R	4.01	0.89	3.23	na	7.47	7.84	15.79	9.27	62.62	na	na	na
NL0009R	5.42	11.99	5.04	12.18	6.58	6.11	13.60	23.47	21.61	22.88	2.64	8.67
NL0091R	7.34	14.84	8.60	13.00	7.83	5.04	20.27	37.70	20.11	10.00	15.83	10.34
NO0001R	11.34	6.00	7.29	4.79	19.33	7.57	36.43	16.50	14.37	65.74	12.25	8.76
PT0002R	13.60	73.11	14.16	6.94	25.68	2.62	na	na	5.38	19.53	6.04	34.05
SE0014R	5.85	7.82	11.22	12.60	13.20	9.88	38.28	16.96	9.52	16.79	43.31	11.75

Table 3.1 Monthly deposition of Zn mg/m^2

STATION	J	F	M	A	M	J	J	A	S	O	N	D
BE0014R	189	359	172	219	97	426	307	684	394	437	628	368
DE0001R	213	289	131	1012	323	284	801	503	715	742	982	205
DK0005R	381	543	na	544	444	455	481	393	471	na	1321	731
DK0008R	103	665	387	314	481	524	1116	393	307	597	589	425
DK0022R	183	266	259	350	322	971	514	263	210	293	208	258
DK0031R	259	403	240	724	1063	180	457	267	363	376	352	363
ES0008R	3303	1361	842	1821	1231	1308	1278	1670	6753	4938	1080	7528
FR0090R	348	358	169	303	173	232	544	373	744	283	1031	189
GB0013R	155	158	177	149	140	64	158	91	159	225	124	36
GB0017R	745	232	454	na	na	na	464	147	na	177	199	179
GB0091R	236	217	80	61	74	169	172	62	360	62	264	217
IE0001R	8586	3519	3875	1386	1188	1674	4030	1050	3175	938	4816	3888
IS0090R	2967	495	715	415	296	167	270	132	973	na	na	na
IS0091R	93	39	23	na	38	148	213	280	1504	na	na	na
NL0009R	293	248	94	209	96	183	323	242	311	343	95	82
NL0091R	130	256	149	265	162	197	451	452	224	363	183	100
NO0001R	423	24	211	239	178	78	353	173	153	2318	131	270
NO0039R	204	340	1490	114	104	400	130	1575	174	307	60	62
PT0002R	68	1122	444	394	257	393	na	na	90	1090	923	2052
SE0014R	272	187	205	465	1086	654	485	602	171	1278	326	439

Table 3.1 Monthly deposition of Hg $\mu g/m^2$

STATION	J	F	M	A	M	J	J	A	S	O	N	D
BE0014R	186	276	207	441	301	600	858	1399	979	385	576	191
DE0001R	31	105	54	383	161	136	1241	399	299	198	175	69
ES0008R	688	364	253	264	235	514	354	617	817	449	297	528
GB0013R	na	304	na	476	300	157	333	245	652	475	522	na
GB0017R	na	234	na	213	169	198	418	426	286	194	280	133
GB0091R	na	163	na	265	275	131	523	271	319	652	1275	19
IE0001R	8100	3450	6250	4950	2700	2325	3875	875	3175	3350	4300	2700
NL0091R	273	397	277	200	672	79	981	1227	893	346	356	149
NO0002R	392	248	557	527	871	789	2023	606	352	2257	352	860
PT0002R	4080	6198	4248	2082	984	786	na	na	384	5859	877	731

Table 3.1 Monthly deposition of γ-HCH $\mu g/m^2$

STATION	J	F	M	A	M	J	J	A	S	O	N	D
BE0014R	10.56	37.53	15.49	28.03	4.58	18.59	12.58	306.71	26.78	33.60	80.24	13.47
DE0001R	9.83	35.15	42.05	26.90	56.76	22.26	140.71	72.55	37.91	41.76	33.96	9.07
IS0091R	0.41	0.40	0.85	0.86	0.58	0.53	0.59	0.94	1.36	1.12	0.65	0.52
NL0091R	na	72.10	43.60	28.00	48.50	180.00	173.40	97.60	348.20	447.00	na	na
NO0001R	4.56	4.04	10.48	11.31	9.24	6.13	48.06	37.08	43.20	112.99	13.76	14.16

Table 3.1 Monthly deposition of NO_3^- g N/m^2

STATION	J	F	M	A	M	J	J	A	S	O	N	D
BE0014R	18.62	26.33	13.29	4.41	45.12	19.61	15.62	29.36	24.53	17.27	32.33	12.83
DE0001R	13.94	22.93	9.68	31.40	17.04	11.00	54.22	33.93	24.21	31.53	22.60	8.99
DK0005R	na	29.51	20.61	12.29	34.97	19.11	18.83	22.92	20.10	14.61	13.90	35.45
DK0008R	na	58.57	22.21	6.57	23.63	19.06	22.89	34.14	15.90	29.58	21.27	na
DK0022R	na	na	21.74	21.18	17.87	16.35	40.49	22.82	13.00	30.10	na	na
DK0031R	na	na	25.85	11.87	21.54	5.42	9.28	25.07	24.43	27.26	na	8.17
ES0005R	25.52	62.03	36.31	18.70	17.62	16.73	1.03	0.87	6.14	23.74	18.07	17.77
ES0008R	30.34	56.32	14.76	10.63	54.21	21.74	23.03	6.28	59.60	38.36	37.13	50.55
FR0090R	39.11	52.02	46.48	43.21	28.36	11.43	39.85	85.73	51.01	2.33	87.96	29.34
GB0006R	18.00	10.61	4.98	14.01	1.27	3.73	10.66	3.00	5.22	1.40	7.55	4.46
GB0013R	35.94	31.97	25.14	3.06	18.63	4.11	13.16	5.14	11.07	13.67	14.90	na
GB0014R	49.12	48.67	39.20	3.02	2.54	37.30	19.08	17.55	43.17	20.81	38.53	8.85
GB0054R	78.61	34.06	21.80	14.93	5.11	28.58	19.88	7.26	36.68	26.65	64.69	na
IE0001R	9.72	2.76	11.25	6.93	2.70	4.65	21.70	1.05	7.62	8.04	8.60	8.64
IS0090R	5.38	1.78	na	2.76	2.74	4.94	1.81	2.68	4.31	1.50	0.98	1.46
IS0091R	0.77	0.07	0.52	0.29	0.81	4.99	0.00	5.56	16.02	16.91	0.40	8.83
NL0009R	5.40	22.61	9.58	16.92	33.59	22.08	36.42	38.90	36.16	25.95	36.40	8.45
NL0091R	14.86	23.23	12.71	13.56	34.34	14.18	35.43	36.57	27.70	32.97	16.94	9.73
NO0001R	26.30	34.32	33.75	27.15	12.25	5.63	64.62	35.66	33.73	179.99	28.01	29.79
NO0039R	1.82	2.44	10.72	10.99	9.06	22.42	3.28	2.19	0.48	2.86	0.20	7.59
NO0090R	na	na	na	na	na	na	na	na	0.93	5.77	4.54	3.92
NO0554R	2.78	6.86	83.41	158.13	7.78	16.63	67.99	7.23	40.35	34.25	9.05	10.20
NO0572R	3.61	4.90	45.81	77.03	32.30	13.85	98.09	20.88	29.27	67.71	115.81	10.88
NO0655R	2.60	na	28.53	45.05	36.86	12.92	31.47	6.57	10.81	20.44	3.35	15.83
SE0014R	1.90	31.89	25.65	14.30	4.54	22.31	34.37	23.41	25.27	8.88	21.56	20.62

Table 3.1 Monthly deposition of NH_4^+ g N/m^2

STATION	J	F	M	A	M	J	J	A	S	O	N	D
BE0014R	18.10	36.82	41.73	10.40	71.32	38.60	35.35	54.79	38.42	37.75	34.99	12.05
DE0001R	7.46	21.37	13.02	57.45	26.22	20.35	104.74	40.86	22.07	25.82	12.97	5.26
DK0005R	na	18.36	36.04	11.56	53.40	30.84	33.07	31.85	22.06	17.73	11.22	23.08
DK0008R	na	36.72	34.64	10.06	38.62	22.38	33.93	34.44	16.31	20.35	11.21	na
DK0022R	na	na	25.63	48.33	37.87	9.68	65.96	34.66	17.21	31.55	na	na
DK0031R	na	na	31.29	16.23	21.29	7.24	6.16	27.11	23.56	23.69	na	6.34
ES0005R	21.90	69.86	40.85	14.56	16.52	13.41	0.88	0.44	6.22	18.32	7.40	8.31
ES0008R	18.41	27.19	17.28	4.87	23.69	19.21	13.49	6.52	23.72	31.49	19.47	69.40
FR0090R	26.43	28.90	25.03	15.16	22.61	19.70	1.59	45.72	19.62	29.13	21.99	9.78
GB0006R	24.98	15.63	10.68	20.89	2.58	3.91	15.51	0.75	7.91	3.37	25.70	11.83
GB0013R	38.76	30.89	32.88	1.15	20.88	3.86	16.53	4.97	9.24	13.32	22.07	na
GB0014R	47.13	38.67	65.34	4.41	3.92	41.88	22.18	32.02	61.93	33.46	32.33	11.06
GB0054R	53.04	20.52	29.81	13.87	7.29	35.92	17.72	5.97	30.82	31.95	42.02	na
IE0001R	4.86	3.45	17.50	5.94	3.78	3.72	269.70	2.45	7.62	54.94	22.36	4.32
IS0090R	24.98	7.33	na	7.69	6.54	14.88	5.97	3.23	7.77	3.14	7.20	3.97
IS0091R	-0.77	-0.07	-0.52	-0.29	2.03	5.44	3.08	12.98	26.21	-0.37	-0.40	-0.55
NL0009R	7.23	38.76	17.39	25.59	65.93	46.23	85.81	68.23	61.08	45.39	27.78	14.34
NL0091R	16.04	39.41	31.41	23.27	50.68	26.27	60.02	61.53	29.96	31.88	13.00	6.87
NO0001R	9.20	10.83	47.50	29.24	11.20	1.91	52.64	23.13	16.21	178.33	10.43	10.96
NO0039R	3.00	16.46	20.33	18.15	35.90	43.46	10.75	10.34	0.49	6.26	3.26	7.24
NO0090R	na	na	na	na	na	na	na	na	2.06	8.70	4.16	2.99
NO0554R	2.41	4.27	91.13	82.48	8.91	20.87	83.29	15.62	35.38	23.57	4.30	6.03
NO0572R	12.83	12.63	88.83	118.37	54.21	42.36	112.30	21.61	27.42	83.03	18.13	10.99
NO0655R	7.27	na	44.02	52.52	40.93	8.48	17.30	4.62	5.22	46.50	10.04	15.94
SE0014R	0.88	18.20	39.42	18.76	5.98	76.79	50.92	42.93	47.18	7.34	10.31	11.78

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ABSTRACT
This reports summarises the observations of the deposition of pollutants from the atmosphere to the OSPAR area during 2010. Priority is given to the metals arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc, the organic pollutant lindane, and to oxidised and reduced forms of nitrogen. A number of voluntarily monitored pollutants are also reported by OSPAR countries. As well as providing estimates of deposition observed in 2010, the report summarises the temporal trends in deposition of lead.

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