

# **Long-term trends of heavy metal atmospheric deposition to the North-East Atlantic**

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## Executive summary

Lead (Pb) and copper (Cu) are hazardous pollutants due to their toxicity, persistence, and potential long-term effects on human health and marine ecosystems. Both metals are harmful at low concentrations, particularly in aquatic environments where they can accumulate in food webs. Lead is non-essential and highly toxic, affecting growth, reproduction, and behaviour, and can persist in sediments as a long-term contamination source. Copper, an essential trace element, becomes toxic at elevated concentrations, especially to early life stages of aquatic organisms, and sustained inputs can adversely impact marine ecosystems.

This report presents a model-based assessment of atmospheric inputs of Pb and Cu to the OSPAR maritime area, conducted by Meteorological Synthesizing Centre – East (MSC-E). The study evaluates long-term trends in emissions and deposition from 1990 to 2023, analyses source attribution for 2023, and evaluates modelling results against observations.

The assessment shows that Pb emissions in OSPAR countries decreased sharply by 96% between 1990 and 2023, largely due to the phase-out of leaded petrol. Over the same period, industrial sources became the dominant contributor to Pb emissions, while road transport declined significantly. In contrast, Cu emissions remained broadly stable, with road transport continuing to dominate, and industrial sources contributing significantly in some countries.

Atmospheric Pb deposition to all OSPAR regions declined substantially, with the largest reductions observed in areas closest to major emission sources, such as the Greater North Sea. Statistical analysis confirms a significant long-term decline, although the rate of decrease slowed after the early 2000s. Pb deposition was largely influenced by non-OSPAR and secondary sources, with OSPAR countries contributing between 2% and 29% in 2023. The United Kingdom was the largest contributor in most regions, while Spain, Portugal, and Russia dominated in specific regions.

By contrast, Cu deposition showed no consistent long-term decrease, with high interannual variability masking weak trends. Statistically significant declines were limited to a few regions and were small in magnitude. In 2023, OSPAR emissions accounted for 22-80% of Cu deposition, dominated by the United Kingdom, while secondary sources, including Saharan dust, influenced deposition in remote regions. Pb deposition was dominated by industrial sources and road transport, while Cu deposition was largely driven by road transport, with solvents usage and off-road emissions as secondary contributors. Other sectors contributed minimally.

Model evaluation indicates that the model reproduces Pb air concentrations and deposition reasonably well, with some overestimation in high-emission areas and minor underestimation in Northern Europe. Cu simulations show larger deviations from observations, reflecting higher uncertainty that likely arises from a combination of factors, including emission estimates, model representation, and variability in measurement data.



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## Introduction

Lead (Pb) and copper (Cu) are hazardous substances due to their toxicity, persistence, and potential to cause long-term adverse effects on human health and the marine environment. Both metals are toxic at relatively low concentrations and can adversely affect plants, animals, and microorganisms, with particular relevance for aquatic ecosystems where they can enter and accumulate within food webs.

Lead is a non-essential metal that is highly toxic to humans and marine organisms (Wani et al., 2015; Generalova et al., 2025). In aquatic environments, it adversely affects algae, invertebrates, and fish by impairing growth, behaviour, and reproduction (Lee et al., 2019). Lead readily accumulates in sediments, where it can persist for long periods and act as a secondary source of contamination through remobilisation, resulting in sustained exposure and long-term ecological impacts in coastal and marine waters. Copper is an essential trace element; however, at elevated concentrations it becomes hazardous to human health and the environment (Gaetke et al., 2014; Rehman et al., 2019). In marine and freshwater systems, copper is highly toxic to algae, invertebrates, and fish, particularly during early life stages (Nor, 1987; Liao et al., 2023). Copper toxicity and bioavailability are strongly influenced by environmental conditions, but sustained inputs can lead to adverse effects on marine ecosystems.

This report presents a model-based assessment of atmospheric inputs of Pb and Cu to the maritime area of the Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR). The assessment was performed by the Meteorological Synthesizing Centre – East (MSC-E) of the Co-operative Programme for Monitoring and Evaluation of the Long-Range Transmission of Air Pollutants in Europe (EMEP), under contract with the OSPAR Commission. It includes an evaluation of long-term trends in Pb and Cu atmospheric deposition to the North-East Atlantic Ocean over the period 1990–2023, as well as source attribution of pollutant deposition to the OSPAR maritime regions for the year 2023. In addition, the modelling results were evaluated against monitoring data from the OSPAR Comprehensive Atmospheric Monitoring Programme (CAMP) and other sites within the EMEP monitoring network.

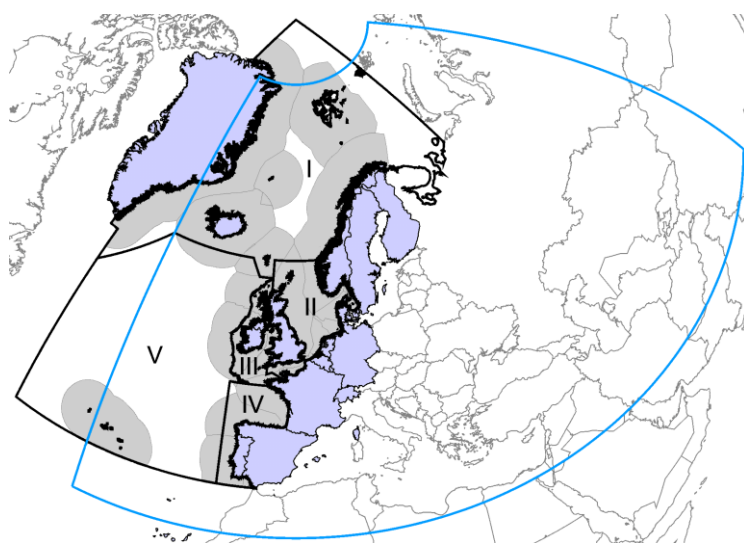
An overview of the methodology applied in the assessment is provided in Chapter 1. Chapter 2 describes the spatial distribution and long-term changes in anthropogenic emissions of Pb and Cu to the atmosphere from the OSPAR Contracting Parties. Chapter 3 analyses time series of atmospheric deposition of these metals to the OSPAR regions, together with contributions from individual countries and emission sectors. Uncertainties associated with the model estimates are discussed in Chapter 4, and the main conclusions of the study are presented in Chapter 7. Numerical data products of the assessment, in the form of tables, are provided in Annexes B-C and in the supplementary materials (Excel files).

# 1. Methodology

This chapter describes the methods and approaches used to assess long-term trends in Pb and Cu atmospheric pollution of the OSPAR maritime area. They include the definition of OSPAR regions, model setup, compilation of emissions and measurement data, and the statistical approaches used for trend analysis.

## 1.1 OSPAR regions

Assessment of airborne pollution in the OSPAR maritime area of the North-East Atlantic includes the analysis of emissions from the OSPAR Contracting Parties and the modelled atmospheric deposition to the OSPAR regions and the Exclusive Economic Zones of the Parties. The OSPAR maritime area comprises five regions: I. Arctic Waters, II. Greater North Sea, III. Celtic Seas, IV. Bay of Biscay and Iberian Coast, and V. Wider Atlantic. The geographical locations of the OSPAR regions, the Contracting Parties, and their Exclusive Economic Zones are shown in Fig. 1. Detailed lists and descriptions are provided in Tables A.1-A.3 of Annex A.



**Fig. 1.** Geographical locations of the OSPAR Contracting Parties (in purple) and Regions of the OSPAR Maritime Area; the blue line indicates the boundary of the EMEP domain.

## 1.2 Model setup

The assessment of Pb and Cu atmospheric deposition to the OSPAR maritime area was conducted using the latest stable open-source version of the GLEMOS model (v2.3.0, <https://github.com/glemos-model>). GLEMOS is a multi-scale, multi-pollutant simulation framework developed for both operational and research applications within EMEP (Tarrason and Gusev, 2008; Travníkov et al., 2009; Jonson and Travníkov, 2010; Travníkov and Jonson, 2011). The model simulates the dispersion and cycling of various classes of pollutants, including heavy metals and persistent organic pollutants, with flexible options for simulation domains ranging from global

to local scales and with varying spatial resolutions. Vertically, the model domain extends up to 10 hPa (approximately 30 km) and consists of 20 irregular terrain-following sigma layers, 10 of which cover the lowest 5 km of the troposphere. The height of the lowest layer is about 75 metres. A number of model updates were performed to improve the model performance in comparison with observations, which include refinement of parameters of the model wet deposition scheme, revision of global anthropogenic emissions of Pb and Cu (Section 1.3), and revaluation of wind resuspension of these metals on both global and regional scales.

Meteorological parameters for the model simulations were generated using ERA-Interim dataset from the European Centre for Medium-Range Weather Forecasts (ECMWF, 2025) and pre-processed with the Weather Research and Forecasting modelling system (WRF, v3.7.1) (WRF, 2025). Detailed land cover data were incorporated from the Moderate Resolution Imaging Spectroradiometer (MODIS) product – the combined Terra and Aqua MODIS Land Cover Type dataset (MCD12Q1, version 6) (Sulla-Menashe and Friedl, 2023). Data on wind re-suspension of Pb and Cu from soil and seawater were generated using the updated dust pre-processor (Ilyin et al., 2007; Travnikov et al., 2025).

The simulations covered the period 1990–2023 and employed a multi-scale nested approach, combining global- and regional-scale modelling to account for the influence of both regional and global emission sources. The regional modelling was conducted over the EMEP region (Fig. 1.1) with a spatial resolution of  $0.4^{\circ} \times 0.4^{\circ}$ . Global-scale simulations with a spatial resolution of  $3^{\circ} \times 3^{\circ}$  were performed to provide boundary conditions for the regional domain and to cover OSPAR Regions I and V, which partly fall outside the regional domain. Source attribution simulations with respect to both country contributions and emission sectors were carried out for the final year of the period, 2023.

### 1.3 Emissions data

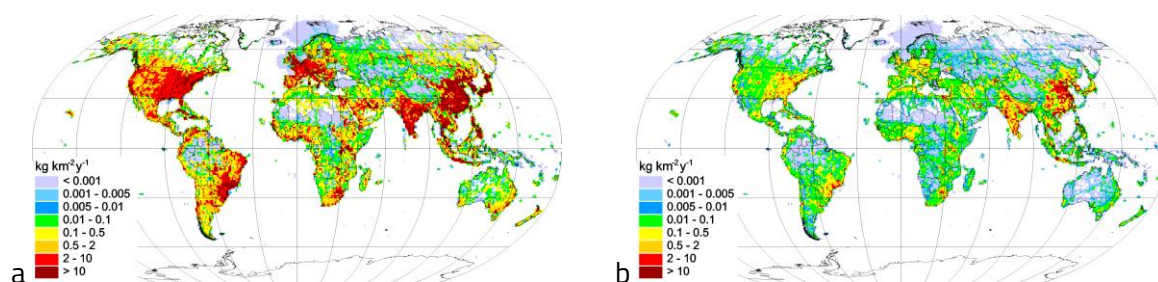
Anthropogenic emission data for Pb and Cu used in this study are based on the most recent official emissions reported by countries Parties to the LRTAP Convention (submission 2025), including the OSPAR Contracting Parties (Travnikov et al., 2025). These data are collected, quality-controlled, and made available by the EMEP Centre on Emission Inventories and Projections (CEIP) (<http://www.ceip.at/>). National data on annual total emissions of Pb and Cu are available for the period 1990–2023 for most EMEP countries. Absent or fragmented officially reported time series were supplemented with expert estimates based on the methodology provided by CEIP (Tista et al., 2019; Poupa, 2025).

In addition, the sectoral composition of emissions was compiled for each country for the entire period based on officially reported emissions data for aggregated GNFR (Gridded Nomenclature For Reporting) sectors: *A\_PublicPower*, *B\_Industry*, *C\_OtherStatComb*, *D\_Fugitive*, *E\_Solvents*, *F\_RoadTransport*, *G\_Shipping*, *H\_Aviation*, *I\_Offroad*, *J\_Waste*, *L\_AgriOther*, and *M\_Other* (Poupa,

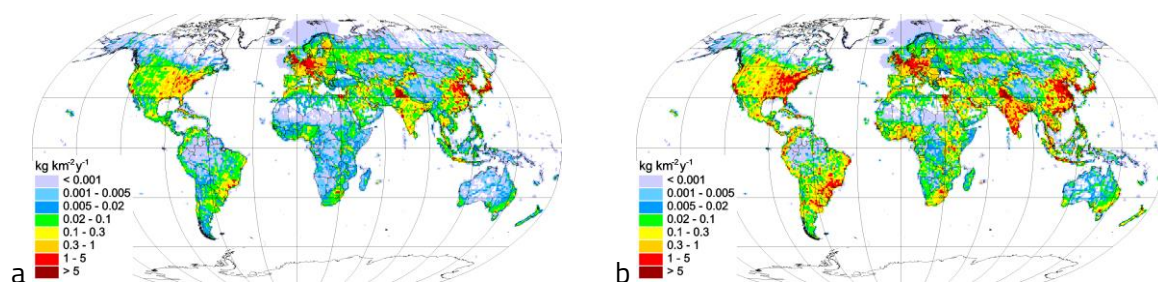
2025). A detailed description of the GNFR sectors is provided in the EMEP/EEA Air Pollutant Emission Inventory Guidebook (EMEP/EEA Guidebook, 2023). These data were used for the generation of spatially distributed emission time series and for source-attribution calculations.

Spatial distributions of emissions over the regional domain were generated for the entire period 1990–2023 based on the most recent gridded emissions data for 2023 prepared by CEIP for the EMEP domain (Travnikov et al., 2025). For Pb, sector-specific gridded emissions for 2023 were normalised by the total value for each GNFR sector in each country and subsequently scaled by total sectoral emissions in the respective countries for other years of the period. This approach provides a realistic spatial distribution of Pb emissions across the region but does not account for possible temporal changes in this distribution over the study period. A similar approach was applied for Cu, however, as no gridded Cu emissions data are available for the EMEP domain, sector-specific PM<sub>2.5</sub> emissions data were used as a proxy for the spatial distribution of Cu emissions.

No global anthropogenic emissions inventories for Pb and Cu are available so far. Therefore, simplified emission datasets were prepared for global-scale simulations of these metals in order to account for the possible influence of neighbouring regions on atmospheric pollution of the North-East Atlantic. For this purpose, the EDGAR global emissions inventory for PM<sub>2.5</sub> (EDGAR v8.1, [https://edgar.jrc.ec.europa.eu/dataset\\_ap81](https://edgar.jrc.ec.europa.eu/dataset_ap81)) was used as a proxy. To convert PM<sub>2.5</sub> emissions to heavy metal emissions, sector-specific ratios of Pb emissions to PM<sub>2.5</sub> emissions and of Cu emissions to PM<sub>2.5</sub> emissions were derived individually for each GNFR sector and each year of the 1990–2023 period and averaged across the EMEP countries. Only countries with complete and continuous emission time series were used for this analysis. The estimated ratios were then applied uniformly to the corresponding emission sectors in the EDGAR PM<sub>2.5</sub> emissions inventory to produce global gridded emission datasets for Pb and Cu for the study period. The resulting Pb and Cu emission maps are illustrated in Figs. 2 and 3.



**Fig. 2.** Global anthropogenic Pb emissions in 1990 (a) and 2023 (b)



**Fig. 3.** Global anthropogenic Pb emissions in 1990 (a) and 2023 (b)

The applied simplified method involves considerable uncertainties, particularly in remote regions with distinct economic and industrial characteristics, such as Asia, Africa, and South America. However, given the relatively short atmospheric residence time of particle-bound heavy metals, the influence of these regions on pollution levels in the North-Eastern Atlantic is expected to be insignificant.

## 1.4 Trend analysis

The simulated time series of heavy metal deposition to the OSPAR Regions were analysed for long-term changes using several statistical techniques. To reduce interannual variability associated with changing meteorological conditions and to isolate long-term trends, the time series were approximated using third-order polynomials. Normalised deposition values were used to evaluate relative changes in deposition over the entire study period.

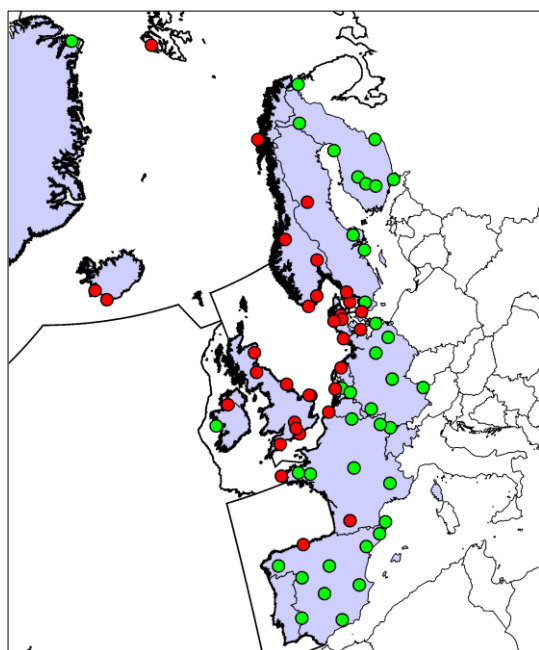
In addition, breakpoint detection was performed using the “At Most One Change point” (AMOC) algorithm (Killick and Eckley, 2014; Killick et al., 2024; R package “*change point*”). The AMOC method tests whether a time series is better represented by a single regime or by two segments separated by one changepoint, by comparing penalised cost functions across all possible split locations. A changepoint is identified only if the improvement in model fit exceeds the selected penalty. In this study, the conservative Bayesian Information Criterion (BIC) was used as the penalty function (Killick and Eckley, 2014).

Deposition trends within each sub-period were analysed using the Mann–Kendall test (Gilbert, 1987; Connor et al., 2012; Pohlert, 2023) together with Sen’s slope estimator (El-Shaarawi and Piegorsch, 2001).

## 1.5 Evaluation of modelling results

The results of the model assessment were evaluated against observations from measurement sites of the OSPAR Comprehensive Atmospheric Monitoring Programme (CAMP) and other EMEP monitoring sites within the OSPAR Contracting Parties (Fig. 4). Observations of Pb and Cu concentrations in air and precipitation were obtained for the period 1990–2023 from the EMEP monitoring database (EBAS, [ebas-data.nilu.no](http://ebas-data.nilu.no)), pre-processed, and quality-controlled.

Concentrations in precipitation were converted to wet deposition fluxes using co-located precipitation measurements. The raw data were filtered for outliers using the standard three-sigma limit and checked for temporal coverage. Model data were extracted for comparison over periods coinciding with available measurements. Annual mean wet deposition for years with incomplete coverage was estimated by normalising the available data to a full year. Finally, for aggregated analysis, average air concentrations and wet deposition fluxes were calculated over 1990-2023 and averaged across the OSPAR Contracting Parties, with standard deviations computed among monitoring sites within each country.



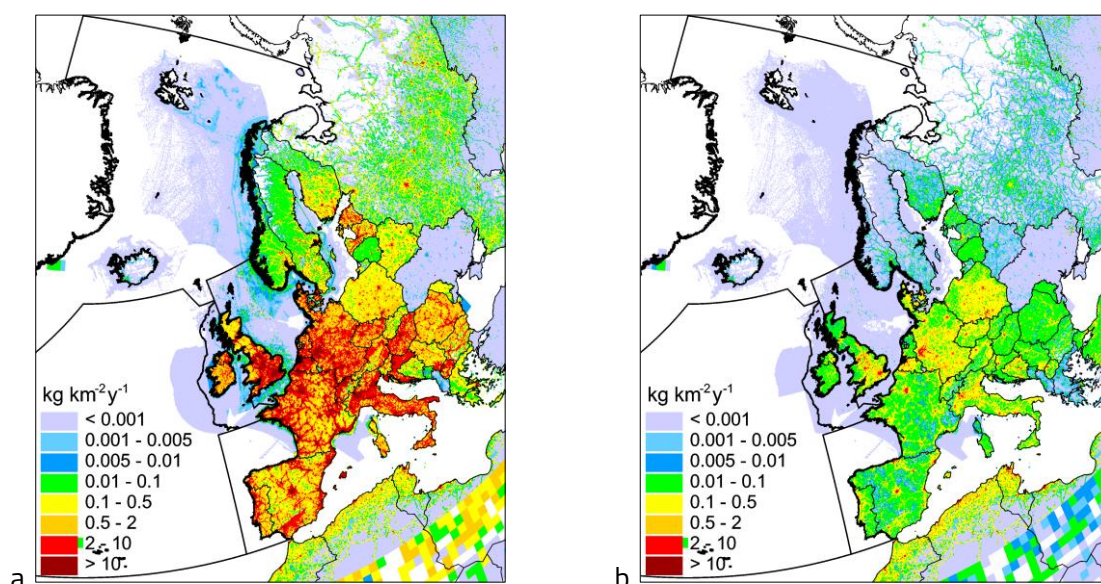
**Fig. 4.** Location of monitoring sites used for the model evaluation. Red circles show sites of the Comprehensive Atmospheric Monitoring Programme (CAMP), green circles depict other EMEP sites in the OSPAR Contracting Parties.

## 2. Heavy metal emissions in the OSPAR Contracting Parties

The spatial distribution, long-term changes, and sectoral composition of Pb and Cu emissions in the OSPAR Contracting Parties are discussed in this chapter. The data presented are based on the official EMEP reporting 2025, supplemented by expert estimates as described in Section 1.3.

### 2.1 Lead

The spatial distribution of Pb emissions in Europe is shown in Figure 5 for 1990 and 2023. Emission density differs significantly across the OSPAR and other countries, ranging in 1990 from above 2 kg km<sup>-2</sup> y<sup>-1</sup> in Western and Southern Europe to below 0.1 kg km<sup>-2</sup> y<sup>-1</sup> in Scandinavia and below 0.01 kg km<sup>-2</sup> y<sup>-1</sup> in Iceland. By 2023, emissions had largely decreased, remaining somewhat higher in Western European countries (0.01–0.1 kg km<sup>-2</sup> y<sup>-1</sup>) than in Northern Europe (below 0.005 kg km<sup>-2</sup> y<sup>-1</sup>).

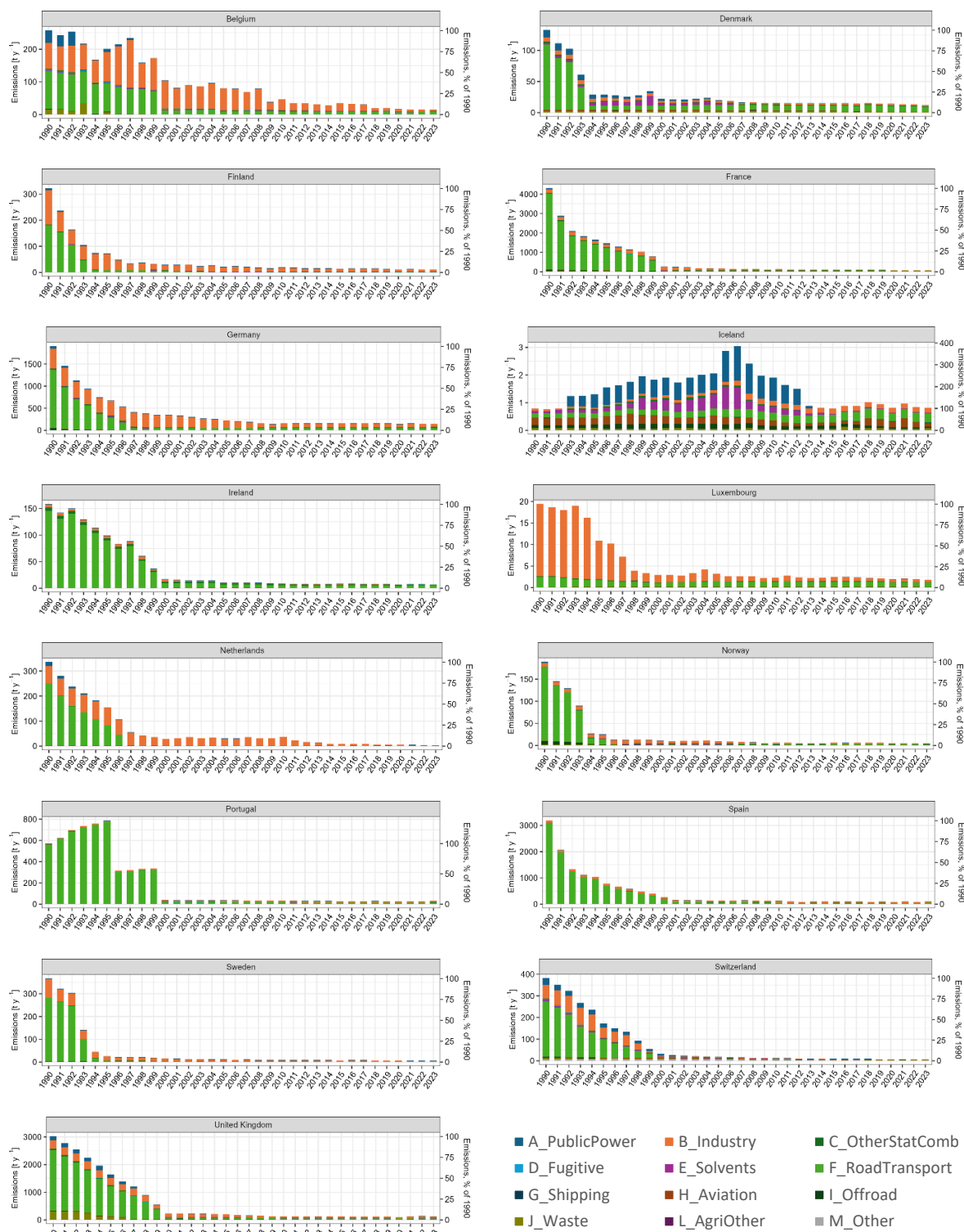


**Fig. 5.** Spatial distribution of annual anthropogenic Pb emissions to the atmosphere in Europe in 1990 (a) and 2023 (b)

Time series of annual anthropogenic Pb emissions from the OSPAR Contracting Parties are shown in Fig. 6 for the period 1990–2023, together with the contributions of GNFR emission sectors to total national emissions. Numerical data on Pb sectoral emissions for each OSPAR Contracting Party are provided in Tables B.1–B.28 of Annex B and in the supplementary materials (Excel files).

Total Pb emissions in all OSPAR countries decreased by 96%, from 15.1 kt y<sup>-1</sup> in 1990 to 582 t y<sup>-1</sup> in 2023. The largest emission declines occurred in the Netherlands (–99%), France (–98%), Sweden (–98%), and Switzerland (–98%). The smallest decreases were observed in Luxembourg (–91%), Denmark (–90%), and Germany (–92%), while almost no reduction occurred in Iceland (–8%). It should be noted that the strongest emission decrease took place during the first decade of the period. In

2023, the largest Pb emitters were Germany (151 t y<sup>-1</sup>), Spain (112 t y<sup>-1</sup>), and France (87 t y<sup>-1</sup>), contributing 26%, 19%, and 15%, respectively.

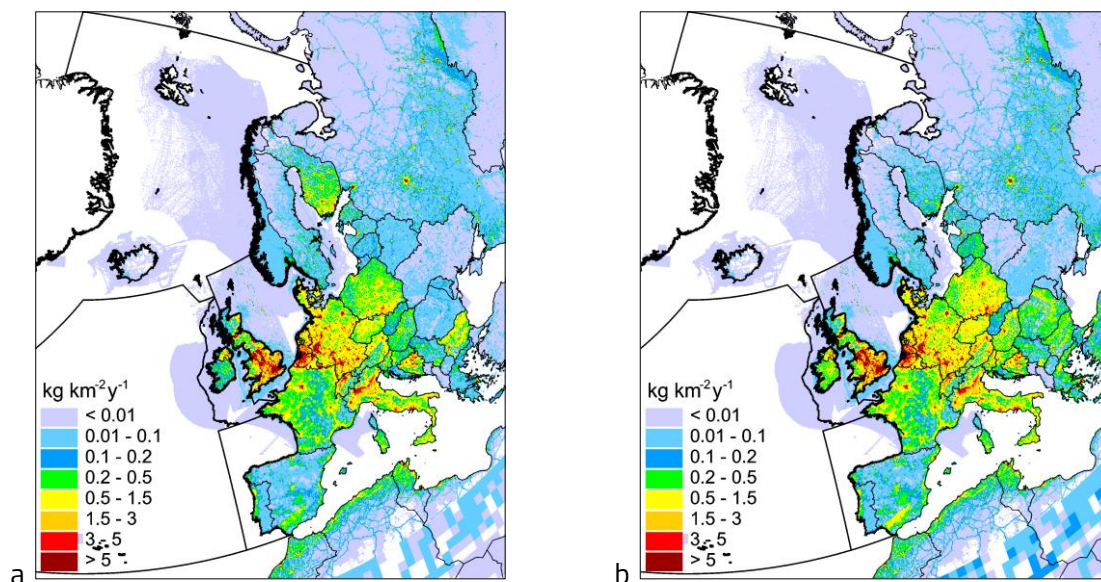


**Fig. 6.** Time series of anthropogenic Pb emissions from the OSPAR Contracting Parties for the period 1990–2023, according to official EMEP reporting. Coloured bars show the contribution of GNFR sectors to the total emissions from these countries.

The contributions of emission sectors vary among countries and changed significantly over the study period. At the beginning of the period, the largest Pb emissions originated from the *F\_RoadTransport* sector, which dominated in most OSPAR countries. The contribution of this sector decreased drastically during the first decade of the period due to the phase-out of leaded petrol in European countries, leading to a considerable reduction in Pb emissions across the region. The second-largest emission sector over the period was *B\_Industry*, which became dominant in many countries during the second half of the period. In 2023, this sector contributed 40% of total Pb emissions from the OSPAR countries. A similar share was contributed by the *F\_RoadTransport* sector, which still dominates in some countries, namely Ireland (69%), Denmark (61%), Luxembourg (54%), and Belgium (53%). The third-largest sector was *C\_OtherStatComb*, contributing 9% of total Pb emissions in the OSPAR countries.

## 2.2 Copper

The spatial distribution of Cu anthropogenic emissions did not change significantly between 1990 and 2023 (Fig. 7). Emission density is highest in a few OSPAR countries – Germany, Belgium, the Netherlands and the United Kingdom, where it exceeded  $1.5 \text{ kg km}^{-2} \text{ y}^{-1}$  both in 1990 and 2023. It is lower in Southern Europe (below  $0.5 \text{ kg km}^{-2} \text{ y}^{-1}$ ) and Northern Europe (below  $0.1 \text{ kg km}^{-2} \text{ y}^{-1}$ ), and the lowest in Iceland, where it is mostly below  $0.01 \text{ kg km}^{-2} \text{ y}^{-1}$ .



**Fig. 7.** Spatial distribution of annual anthropogenic Cu emissions to the atmosphere in Europe in 1990 (a) and 2023 (b)

Figure 8 presents time series of annual anthropogenic Cu emissions from the OSPAR Contracting Parties for the period 1990–2023, along with the contributions of GNFR emission sectors to total national emissions. Numerical data on sectoral Cu emissions for each OSPAR Contracting Party are provided in Tables A#–A# of Annex A and in the supplementary materials (Excel files).

Total Cu emissions in all OSPAR countries remained broadly unchanged between 1990 and 2023, at approximately  $2.2 \text{ kt y}^{-1}$ . This overall stability reflects the compensation of substantial changes in national emissions across several countries. Emissions decreased markedly in Sweden ( $-36\%$ ) and Finland ( $-76\%$ ), offsetting significant increases in Ireland ( $139\%$ ), Iceland ( $97\%$ ), Portugal ( $72\%$ ), and Spain ( $47\%$ ). In other countries, emissions did not change significantly over the study period. In 2023, the largest Cu emitters among the OSPAR countries were the United Kingdom ( $702 \text{ t y}^{-1}$ ), Germany ( $586 \text{ t y}^{-1}$ ), and France ( $316 \text{ t y}^{-1}$ ), contributing 32%, 26%, and 14%, respectively.



**Fig. 8.** Time series of anthropogenic Cu emissions from the OSPAR Contracting Parties for the period 1990–2023, according to official EMEP reporting. Coloured bars show the contribution of GNFR sectors to the total emissions from these countries. Official emissions data are not available for Luxembourg and Switzerland.

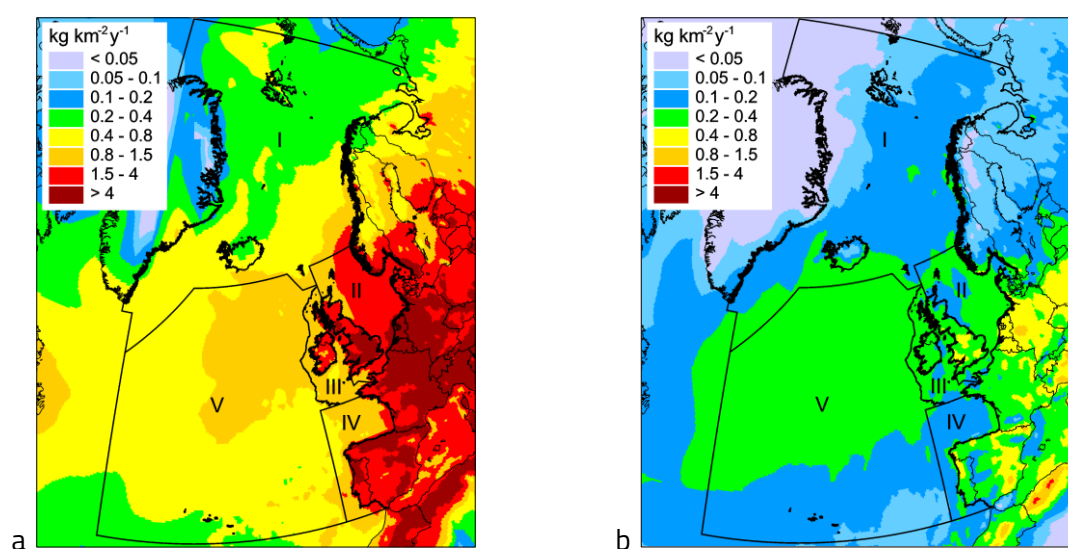
Over the period 1990-2023, the *F\_RoadTransport* sector was the largest contributor to Cu emissions in most OSPAR countries, and its trends largely determined changes in total emissions. Notable exceptions were Sweden and Finland, where emissions during the first decade of the period were strongly influenced by industrial sources (*B\_Industry*). Another exception was the Netherlands, where emissions were dominated by the *I\_Offroad* sector throughout the entire period. The *E\_Solvents* sector also made a substantial contribution to Cu emissions in the United Kingdom and France. In 2023, three main sectors accounted for 95% of total Cu emissions in the OSPAR countries: *F\_RoadTransport* (63%), *E\_Solvents* (20%), and *I\_Offroad* (12%). The share of the largest contributor, *F\_RoadTransport*, varied widely among countries, ranging from 20% in the Netherlands to 90% in Denmark.

### 3. Heavy metal deposition to the OSPAR maritime area

This chapter provides an overview of the spatial distribution, long-term changes, and source attribution of Pb and Cu deposition in the OSPAR maritime area. Numerical data on simulated trends and source attribution of pollutant deposition to the five OSPAR regions and the Exclusive Economic Zones of the OSPAR Contracting Parties are presented in Annex C and in the supplementary materials (Excel files).

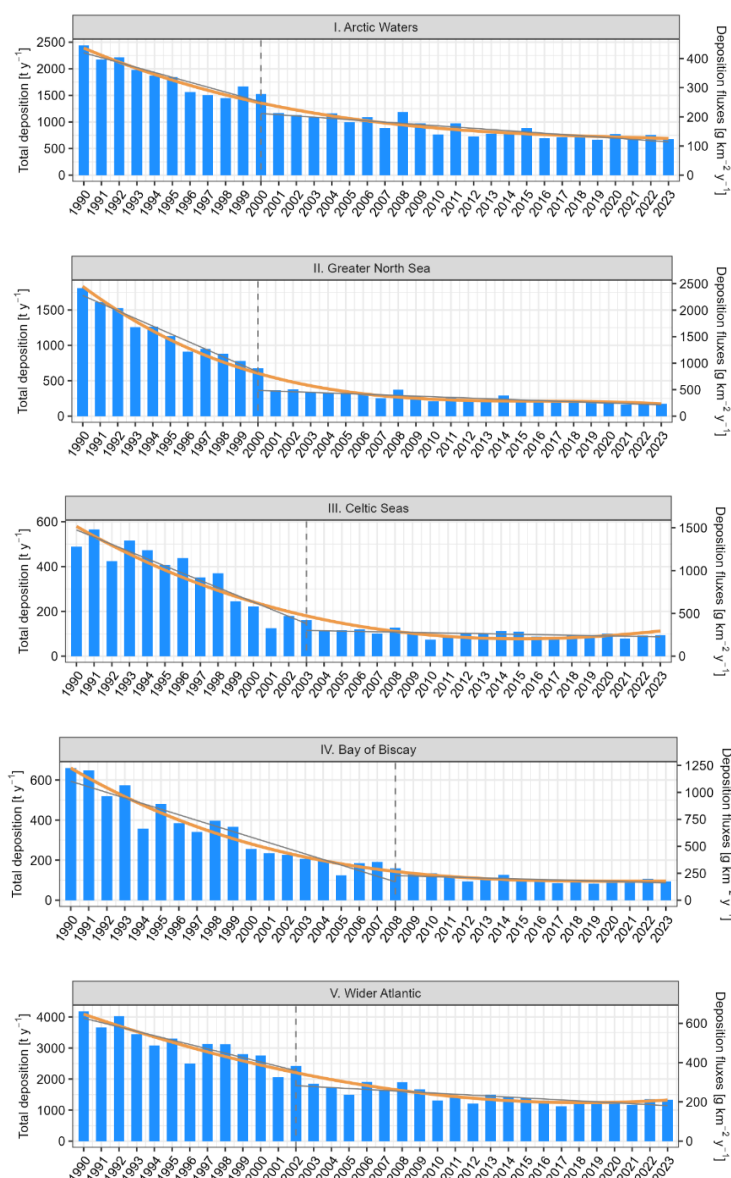
#### 3.1 Lead

Figure 9 shows the spatial distribution of annual total Pb deposition fluxes over the North-East Atlantic within the OSPAR maritime area in 1990 and 2023. Deposition levels decreased significantly over the study period while retaining a similar spatial pattern. The highest fluxes occurred at both the beginning and the end of the period in the Greater North Sea, close to European emission sources (above  $1.5 \text{ kg km}^{-2} \text{ y}^{-1}$  in 1990 and  $0.2 \text{ kg km}^{-2} \text{ y}^{-1}$  in 2023). The lowest deposition levels (below  $0.05 \text{ kg km}^{-2} \text{ y}^{-1}$  in 2023) were observed at high latitudes in the Arctic Waters. Somewhat elevated deposition is also predicted in the Wider Atlantic due to high precipitation amounts.



**Fig. 9.** Spatial distribution of annual mean Pb deposition over the OSPAR maritime area in 1990 (a) and 2023 (b).

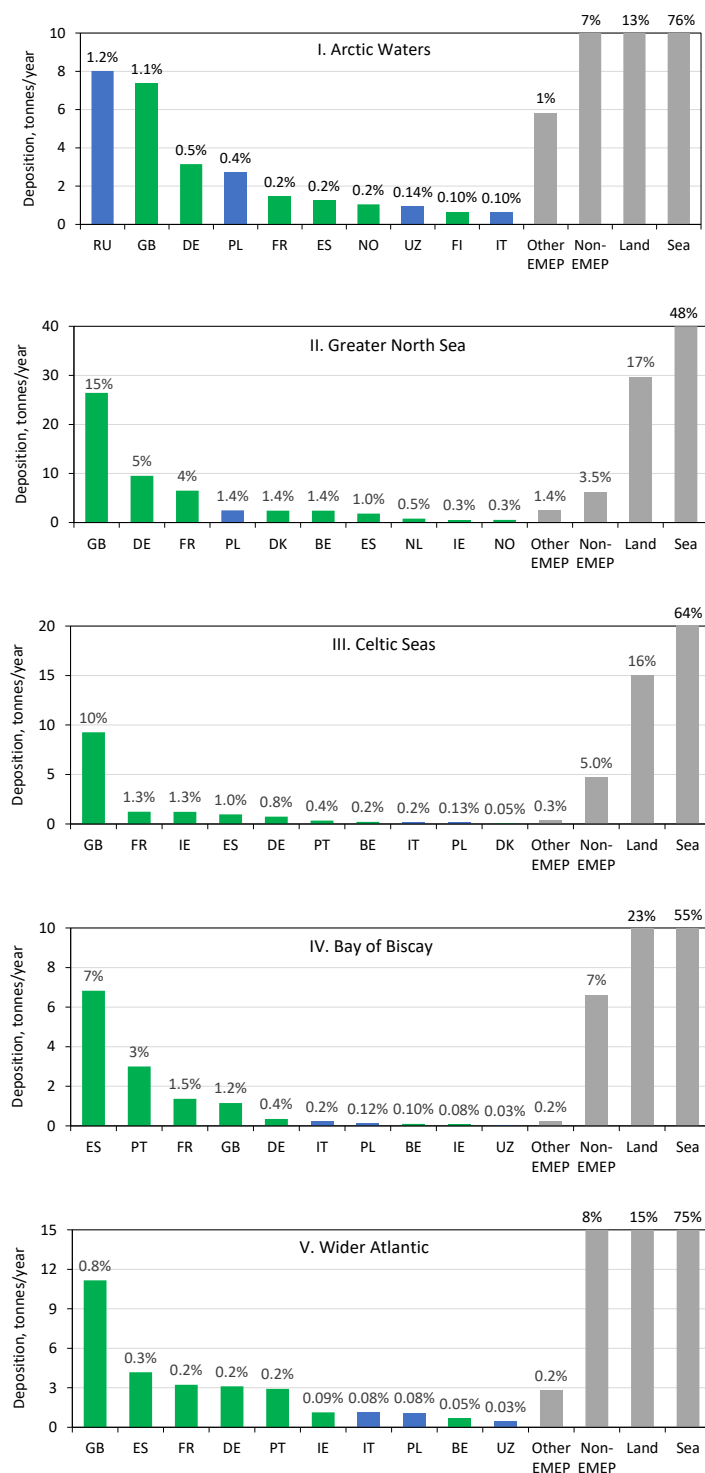
Model simulations show that atmospheric Pb deposition to the OSPAR regions declined substantially between 1990 and 2023 (normalised deposition; Figure 10, Table C.1). The largest reductions occurred in the Greater North Sea ( $\sim 90\%$ ) and in the Bay of Biscay and Iberian Coast ( $86\%$ ). The smallest decline was observed in the Wider Atlantic ( $\sim 68\%$ ). In all regions, the decrease in deposition was uneven, with higher reduction rates during the first half of the period, followed by a slowdown towards the end of the period. Time series of Pb deposition to the Exclusive Economic Zones of the OSPAR Contracting Parties are also presented in the supplementary materials (Excel files).



**Fig. 10.** Time series of total annual atmospheric deposition of Pb to the OSPAR regions (left axis) and average deposition fluxes (right axis) for the period 1990-2023. Blue bars represent calculated values; the orange line depicts the polynomial approximated trend; and the grey dashed and solid lines show the estimated breakpoint of the trend and the piecewise linear approximation, respectively.

For each region, breakpoint detection was performed, and deposition trends in the resulting sub-periods were analysed using the Mann-Kendall test with the Sen's slope estimator for the periods before and after the breakpoint. Statistical parameters describing deposition trends for all regions are provided in Table C.2. The identified breakpoints vary among the regions, occurring between 2000 and 2008 (Fig. 10). Between 1990 and the respective breakpoints, total deposition exhibited statistically significant declining trends in all regions ( $p < 0.001$ , 95% confidence interval). The strongest decrease was observed in the Celtic Seas, with an average annual reduction of 6.8%, while the slowest decline occurred in the Wider Atlantic, at 3.4% per year. In the subsequent period from the breakpoints to 2023, the rate of decline slowed in all regions, ranging from 1.0% to 1.4% per year, although the trends

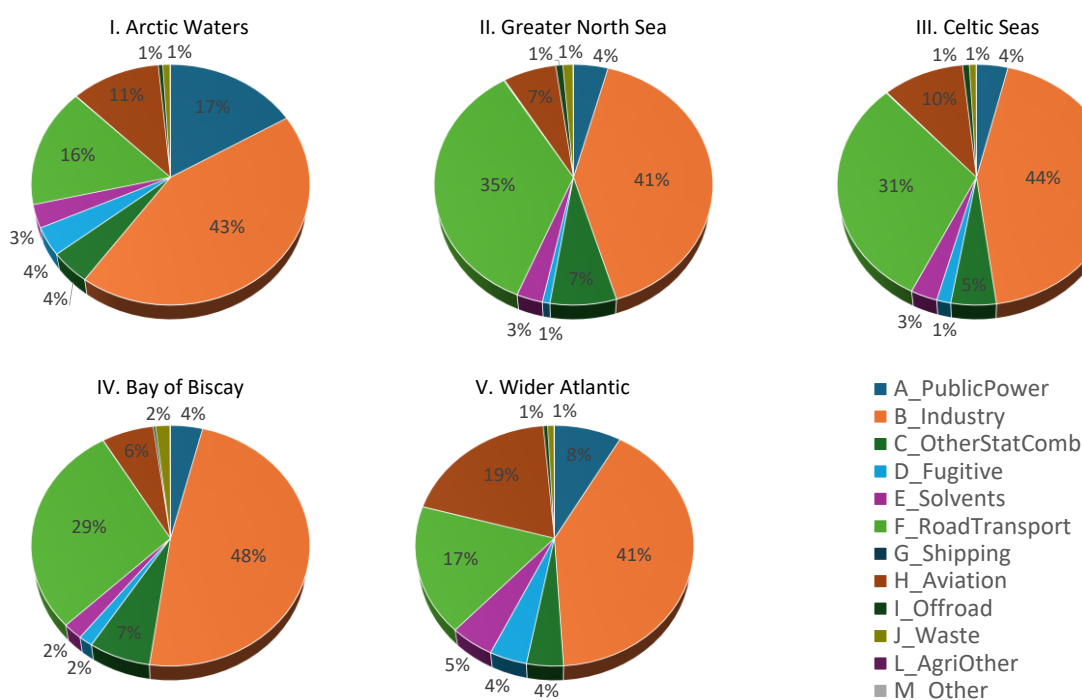
remained statistically significant ( $p < 0.05$ , 95% confidence interval). All statistical parameters confirm a continuing decline in Pb deposition, although the rate of decrease has slowed.



**Fig. 11.** Top ten countries with the highest contributions to the annual total deposition of Pb to the OSPAR regions in 2023. Coloured bars indicate contributions from anthropogenic emissions by OSPAR Contracting Parties (green) and non-OSPAR countries (blue). The bars labelled "Other EMEP" and "Non-EMEP" represent the combined contributions from anthropogenic emissions of other EMEP and non-EMEP countries. The bars labelled "Land" and "Sea" show contributions from secondary emissions from land and sea surfaces, respectively. (Note: For some regions, the contributions from non-EMEP sources or secondary emissions exceed the scale of the figure.)

In 2023, the OSPAR Contracting Parties accounted for between 2% and 29% of total Pb deposition to the OSPAR regions (Figure 11, Table C.7). The remaining deposition originated from other EMEP countries, emission sources located outside the EMEP region, and secondary emissions from land and sea surfaces. The region most strongly affected by emissions from the OSPAR Contracting Parties was the Greater North Sea (29%), whereas their contribution to deposition in the Arctic Waters and the Wider Atlantic did not exceed a few percent. Pb deposition in these and other OSPAR regions was strongly influenced by secondary emissions with sea-salt aerosol from the water surface. However, these emissions are largely deposited close to their source and therefore do not result in increased contamination of the marine environment.

The United Kingdom was the largest contributor to deposition in most regions. Exceptions include the Bay of Biscay and the Arctic Waters, where deposition was dominated by emissions from Spain and Portugal, and by Russia, respectively.



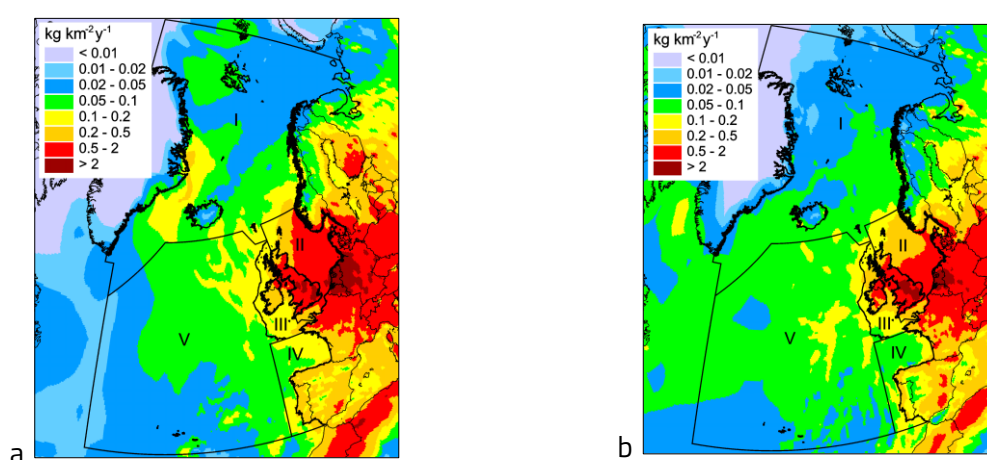
**Fig. 12.** Relative contributions of emission sectors to annual total anthropogenic Pb deposition in the OSPAR regions in 2023.

Anthropogenic Pb deposition in the OSPAR regions was dominated by the *B\_Industry* sector, which accounted for 41–48% of total deposition across the regions in 2023 (Fig. 12, Table C.8). The *F\_RoadTransport* sector was the second-largest contributor, ranging from 16–35%, with higher contributions in coastal regions (Regions II, III, and IV) and lower contributions in the open-ocean regions (Regions I and V), reflecting the influence of proximity to transport emissions. Other sectors, including *A\_PublicPower* (4–17%) and *H\_Aviation* (6–19%), played a secondary but regionally variable role. The remaining sectors collectively contributed no more than 15% of total anthropogenic Pb

deposition, highlighting that a relatively small number of sectors dominate the regional deposition patterns.

### 3.2 Copper

Figure 13 illustrates the spatial distribution of annual total Cu deposition at the beginning and end of the study period. The overall deposition pattern remained largely unchanged between 1990 and 2023. The highest deposition levels were observed over the south-eastern part of the Greater North Sea (above  $0.5 \text{ kg km}^{-2} \text{ y}^{-1}$ ). Somewhat lower levels were estimated in the Celtic Seas ( $0.1\text{--}0.5 \text{ kg km}^{-2} \text{ y}^{-1}$ ), while the lowest deposition occurred in the northernmost part of the Arctic Waters (below  $0.01 \text{ kg km}^{-2} \text{ y}^{-1}$ ).

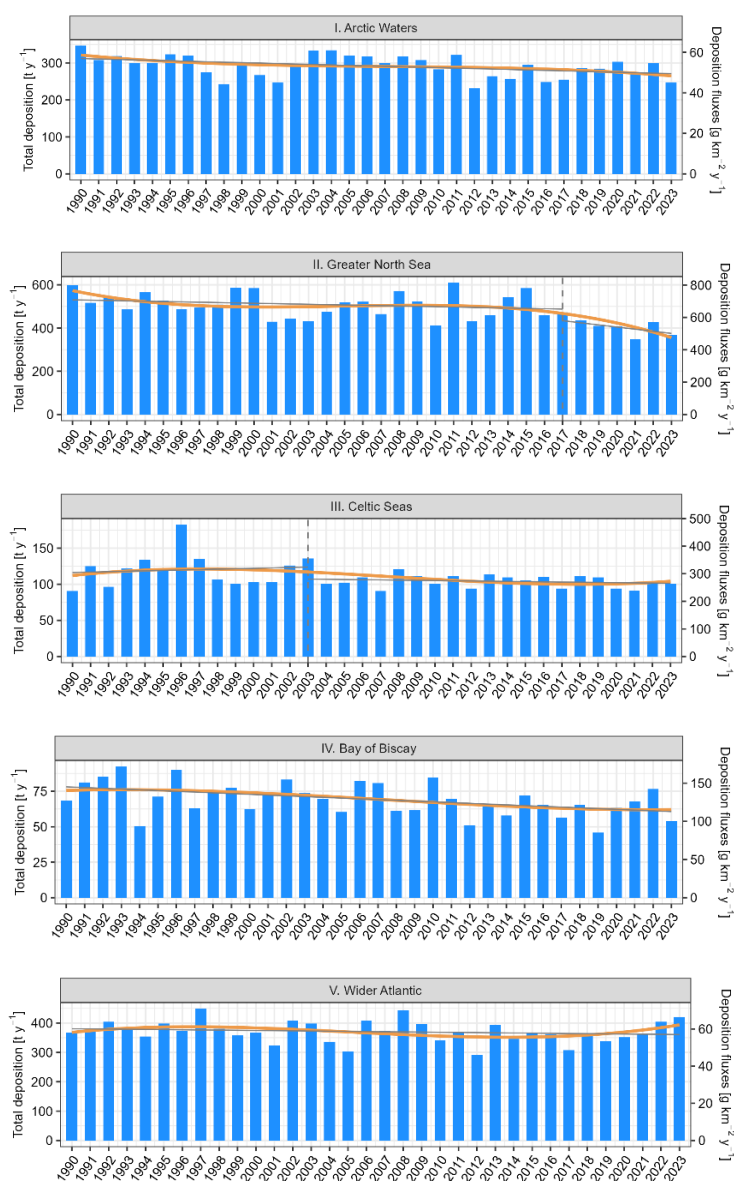


**Fig. 13.** Spatial distribution of annual mean Cu deposition over the OSPAR maritime area in 1990 (a) and 2023 (b).

According to the model simulations, no significant changes occurred in total Cu deposition to the OSPAR regions over the period 1990–2023 (normalised deposition; Figure 14, Table C.3). The most pronounced change was observed in the Greater North Sea, where deposition decreased by 38% over the period. In contrast, deposition to the Celtic Seas declined by only 7%, while deposition levels in the Wider Atlantic showed a slight increase of 7%. Overall, the time series of Cu deposition in all OSPAR regions exhibit substantial interannual variability, which obscures long-term trends. Time series of Cu deposition to the Exclusive Economic Zones of the OSPAR Contracting Parties are also presented in the supplementary materials (Excel files).

For each region, breakpoint detection was performed, and deposition trends in the resulting sub-periods were analysed using the Mann-Kendall test with Sen's slope estimator for the periods before and after the breakpoint. For regions without identified breakpoints, trend analysis was performed for the entire period. Statistical parameters describing deposition trends for all regions are provided in Table C.5. Statistically significant trends over the full period were identified only for the Arctic Waters, the Greater North Sea, and the Bay of Biscay ( $p < 0.05$ , 95% confidence interval), with small mean annual declines ranging from 0.4% to 0.8%. Breakpoints were detected in the

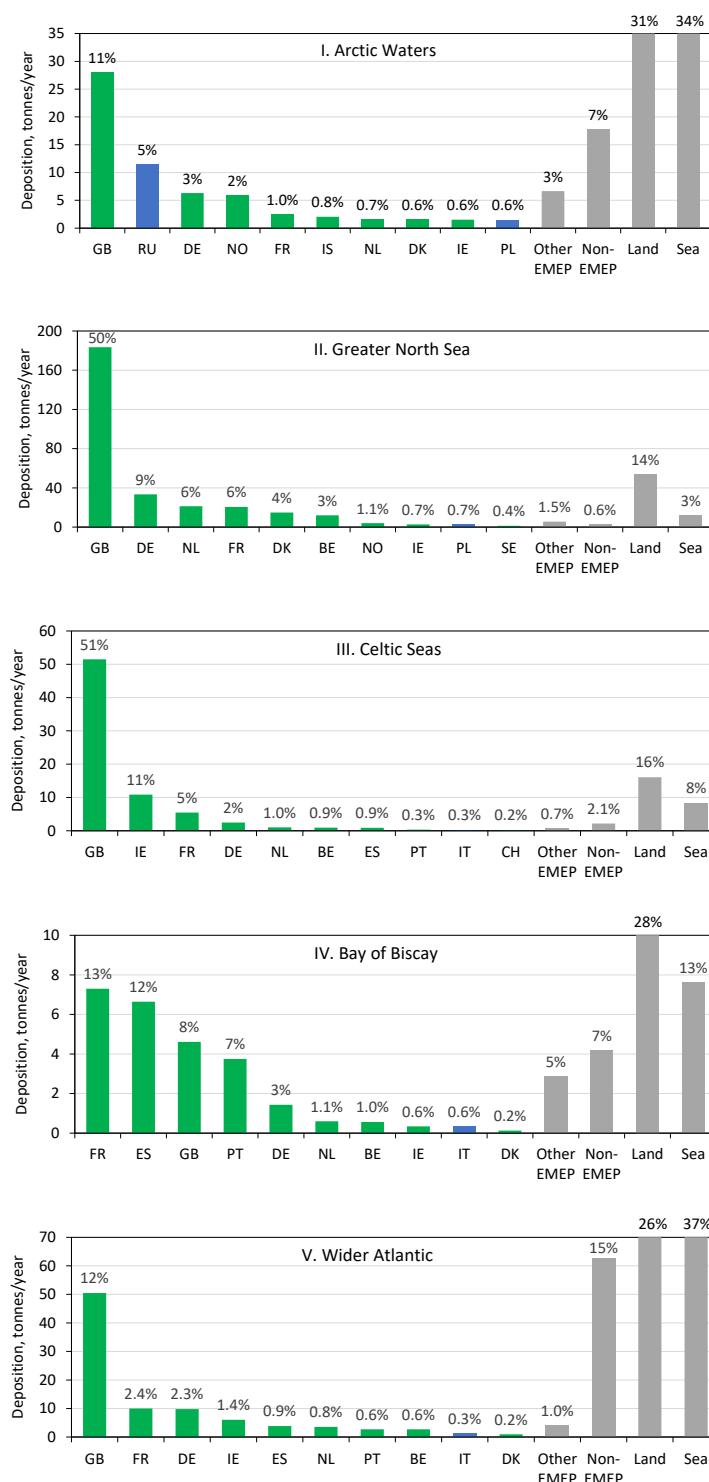
Greater North Sea and the Celtic Seas, however, trends in the corresponding sub-periods were not statistically significant ( $p > 0.1$ , 95% confidence interval). Overall, these results indicate that copper deposition did not exhibit a statistically significant decline over the study period.



**Fig. 14.** Time series of total annual atmospheric deposition of Cu to the OSPAR regions (left axis) and average deposition fluxes (right axis) for the period 1990-2023. Blue bars represent calculated values; the orange line depicts the polynomial approximated trend; and the grey dashed and solid lines show the estimated breakpoint of the trend and the piecewise linear approximation, respectively.

In 2023, Cu deposition in the OSPAR regions was largely driven by emissions from the OSPAR Contracting Parties, whose contributions varied widely, ranging from 22% to 80% across the regions (Figure 15, Table C.9). The remaining deposition originated from a combination of emissions from other EMEP countries, sources located outside the EMEP region, and secondary emissions from land

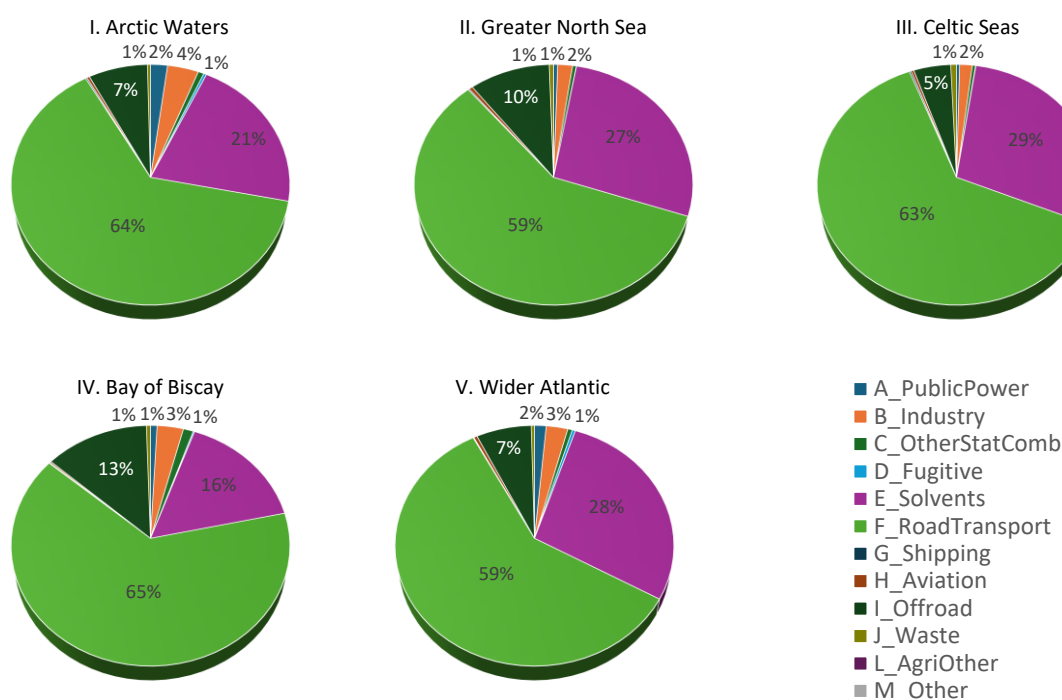
and sea surfaces. The United Kingdom was the dominant contributor in most regions, accounting for up to 50% of total Cu deposition, reflecting the influence of major national emission sources.



**Fig. 15.** Top ten countries with the highest contributions to the annual total deposition of Cu to the OSPAR regions in 2023. Coloured bars indicate contributions from anthropogenic emissions by OSPAR Contracting Parties (green) and non-OSPAR countries (blue). The bars labelled "Other EMEP" and "Non-EMEP" represent the combined contributions from anthropogenic emissions of other EMEP and non-EMEP countries. The bars labelled "Land" and "Sea" show contributions from secondary emissions from land and sea surfaces, respectively. (Note: For some regions, the contributions from non-EMEP sources or secondary emissions exceed the scale of the figure.)

An important exception was the Bay of Biscay and Iberian Coast, where deposition was more strongly affected by emissions from France and Spain. In addition to primary emissions, Cu deposition was influenced by secondary emissions, particularly in remote regions such as the Arctic Waters and the Wider Atlantic. In contrast, the contribution of the secondary sources was smaller in other regions, although Cu deposition in the Bay of Biscay was also significantly influenced by Saharan dust.

Anthropogenic Cu deposition in the OSPAR regions was largely driven by the *F\_RoadTransport* sector, accounting for 60–65% of total deposition across the regions (Figure 16, Table C.10). The *E\_Solvents* sector was the second-largest contributor, with shares ranging from 16% to 30%. A further notable contribution originated from the *I\_Offroad* sector, which accounted for 5–13% of total deposition. The combined contribution of all remaining sectors did not exceed 10% of total anthropogenic Cu deposition.



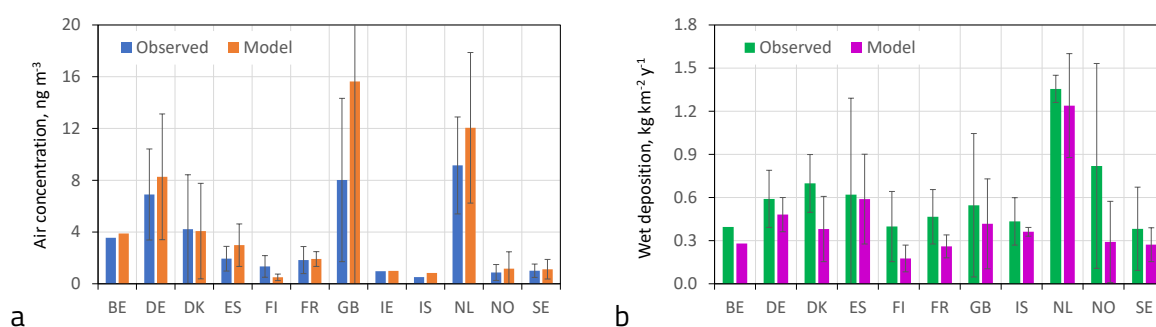
**Fig. 16.** Relative contributions of emission sectors to annual total anthropogenic Cu deposition in the OSPAR regions in 2023.

## 4. Uncertainties

The performance of the GLEMOS model in simulating atmospheric concentrations and deposition of heavy metals, including Pb, has been evaluated on a regular basis and documented in the annual EMEP Status Reports (e.g. Travnikov et al., 2004; Travnikov et al., 2025). Copper is not included in the list of priority heavy metals routinely simulated within EMEP, although it has been investigated in a number of previous projects. Consequently, model performance for copper has been evaluated less extensively and is therefore subject to higher uncertainty.

The modelling results of this study were evaluated against observations from measurement sites of the OSPAR Comprehensive Atmospheric Monitoring Programme (CAMP) and other EMEP monitoring sites located in the OSPAR Contracting Parties. The locations of the measurement sites are shown in Fig. 4. Comparisons of modelled and observed country-averaged air concentrations and wet deposition fluxes for the OSPAR Contracting Parties are presented in Figs. 17 and 18. A summary of the statistical parameters is provided in Tables D.1 and D.2 of Annex D.

Simulated average Pb air concentrations show good agreement with observations in most OSPAR countries. The model tends to overestimate elevated concentrations in several countries, including Germany, the United Kingdom, and the Netherlands, with this tendency being more pronounced in the early part of the study period. This overestimation can be partly attributed to an overestimation of secondary Pb emissions associated with dust resuspension in these countries. Modelled wet deposition fluxes well reproduce the spatial variation among countries but tend to slightly underestimate observed values. This underestimation is more pronounced in Northern Europe.

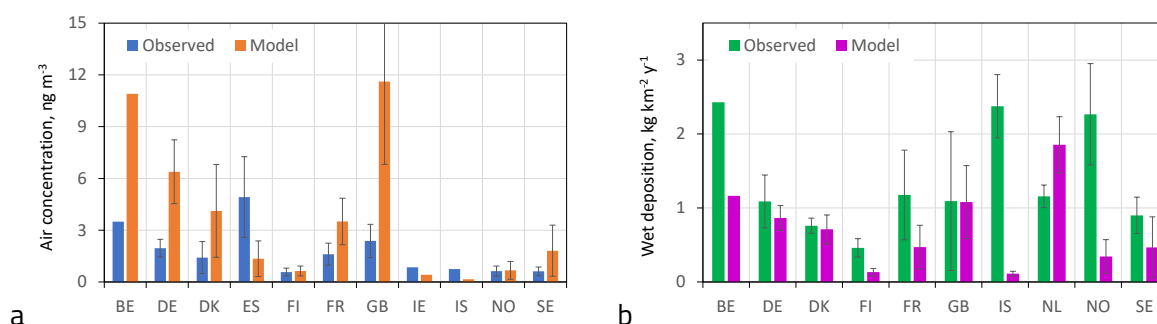


**Fig. 17.** Comparison of simulated and observed Pb air concentrations (a) and wet deposition (b), averaged over the period 1990–2023. Concentration and deposition values are aggregated for the OSPAR Contracting Parties. Bars represent mean values, and whiskers indicate the standard deviation across measurement sites within each country.

Modelled results for Cu demonstrate more pronounced deviations from observations. Simulated air concentrations significantly overestimate measurements in several countries, including Great Britain, Belgium, Germany, and Denmark. These countries are characterised by the highest estimated emission densities in Europe, as shown in Fig. 6. Given that concentration levels in these countries are largely influenced by national anthropogenic sources, the most probable reason for

the overestimation is biased high national Cu emission estimates. In contrast, emission density in Spain is an order of magnitude lower than in the countries mentioned above, which leads to a strong underestimation of measurements in this country, despite Spain being among countries with the highest observed Cu concentrations in Europe.

Model-to-measurement agreement for Cu wet deposition varies strongly among countries. Being less affected by national sources, simulated wet deposition fluxes better reproduce measurements in the United Kingdom, Germany, and Denmark, but strongly underestimate observed fluxes in Iceland and Norway, which are among the highest in Europe despite very low national emissions (Fig. 6). In summary, estimated Cu levels are subject to higher uncertainty due to multiple factors, including uncertainties in emission estimates, model formulation, and inconsistencies in measurement data.



**Fig. 18.** Comparison of simulated and observed Cu air concentrations (a) and wet deposition (b), averaged over the period 1990–2023. Concentration and deposition values are aggregated for the OSPAR Contracting Parties. Bars represent mean values, and whiskers indicate the standard deviation across measurement sites within each country.

Uncertainties in the model estimates arise from several sources, one of the most important being uncertainties in officially reported emission data. According to official reporting, uncertainties in Pb and Cu emission estimates vary widely among the OSPAR countries, ranging from 38% for Pb in Finland to 908% for Cu in Denmark (Table D.3). In addition, uncertainties related to the spatial and vertical allocation of emissions, as well as their seasonal variation, further contribute to overall emission-related uncertainty.

Another source of uncertainty arises from limitations in model formulation and the input data used for the simulations. The parameterisations of atmospheric processes implemented in GLEMOS were developed using state-of-the-art approaches and have been thoroughly evaluated for EMEP operational modelling of heavy metals (Travnikov and Ilyin, 2005), with continuous updates and improvements introduced in subsequent model versions (Gusev et al., 2006; Travnikov et al., 2009; Travnikov and Jonson, 2011; Ilyin et al., 2017, 2018). In addition, the model parameterisations were tested in intercomparison exercises and subjected to a comprehensive model review under the supervision of the EMEP Task Force on Measurements and Modelling (TFMM, 2006).

The modelling results are evaluated against observational data, which are also subject to uncertainty. To assess measurement uncertainty, annual laboratory intercomparisons are conducted within EMEP under the supervision of the Chemical Co-ordinating Centre. These intercomparison studies indicate that, for most EMEP laboratories, analytical uncertainty for Pb and Cu does not exceed 25% for low-concentration samples (CCC, 2024). In some cases, however, uncertainty can be considerably higher, particularly for Cu. It should also be noted that laboratory intercomparisons address only the analytical component of measurement uncertainty, while other sources of uncertainty, such as sampling, storage, and sample transport, are not accounted for.

## 5. Conclusions

A model assessment of atmospheric inputs of Pb and Cu to the OSPAR maritime area was conducted for the period 1990–2023. Long-term changes in national emissions of these metals in the OSPAR Contracting Parties, as well as their deposition to the five OSPAR regions and the Exclusive Economic Zones of the Parties, were estimated for the study period. In addition, contributions of individual countries and emission sectors to deposition in the OSPAR regions were assessed for 2023. The modelling results were evaluated against observational data. The main findings of the study are summarised below:

- Pb emissions declined sharply (–96%) across the OSPAR countries between 1990 and 2023, driven mainly by the phase-out of leaded petrol, whereas Cu emissions remained broadly stable, with road transport continuing to dominate Cu emissions and industrial sources becoming increasingly important for Pb.
- Atmospheric Pb deposition to all OSPAR regions declined substantially between 1990 and 2023, with the strongest reductions in regions closest to major European emission sources. Although the spatial deposition pattern remained broadly unchanged, statistical analysis confirms a significant long-term decrease in all regions, with a pronounced slowdown in the rate of decline after the early 2000s.
- In contrast, Cu deposition showed no consistent long-term decrease across the OSPAR regions, with largely stable spatial patterns and strong interannual variability masking weak trends. Statistically significant declines were limited to a few regions and were small in magnitude, indicating that atmospheric Cu inputs to the OSPAR maritime area have remained broadly unchanged over the study period.
- In 2023, Pb deposition in the OSPAR regions was largely dominated by non-OSPAR and secondary sources, with OSPAR countries contributing 2–29%. The Greater North Sea received the highest share from OSPAR emissions, while contributions to the Arctic Waters and Wider Atlantic were minimal. The United Kingdom was the main contributor in most regions, with Spain, Portugal, and Russia dominating in specific areas.
- Cu deposition was more strongly driven by OSPAR emissions, contributing 22–80% across the regions. The United Kingdom dominated in most areas, while France and Spain were important for the Bay of Biscay and Iberian Coast. Secondary sources influenced deposition mainly in remote regions, including the Arctic Waters, Wider Atlantic, and the Bay of Biscay through Saharan dust.
- Anthropogenic Pb deposition in the OSPAR regions was dominated by industrial sources (B\_Industry, 41–48%), followed by road transport (F\_RoadTransport, 16–35%), while other sectors contributed less than 20%. In contrast, Cu deposition was largely driven by road

transport (F\_RoadTransport, 60-65%), with E\_Solvents (16-30%) and I\_Offroad (5-13%) as secondary contributors, and all remaining sectors accounting for less than 10% of total deposition.

- Model evaluation indicates that GLEMOS reproduces Pb air concentrations and deposition reasonably well across the OSPAR countries, with some overestimation in high-emission areas and slight underestimation of wet deposition in Northern Europe. Cu simulations show larger deviations from observations, reflecting greater uncertainty that likely arises from a combination of factors, including emission estimates, model representation, and variability in measurement data.

## References

- CCC (2024) EMEP laboratory intercomparison. Heavy metals in precipitation 2020 - % deviation from expected value. <https://emep-ccc.nilu.no/static/intercomparison/DQO-42-H.pdf>.
- ECMWF (2025) Operational archive. <https://www.ecmwf.int/en/forecasts/dataset/operational-archive> (accessed 20.12.2025).
- El-Shaarawi A.H. and Piegorsch W.W. (2001), Encyclopedia of Environmetrics, Volume 1, John Wiley and Sons, p. 19, ISBN 978-0-471-89997-6.
- EMEP/EEA Guidebook (2023) EMEP/EEA air pollutant emission inventory guidebook 2023. European Environment Agency, 2023. doi: 10.2800/795737. <https://www.eea.europa.eu/en/analysis/publications/emep-eea-guidebook-2023>.
- Gaetke, L.M., Chow-Johnson, H.S. & Chow, C.K. (2014) Copper: toxicological relevance and mechanisms. Arch Toxicol 88, 1929–1938. <https://doi.org/10.1007/s00204-014-1355-y>.
- Generalova A, Davidova S, Satchanska G. The Mechanisms of Lead Toxicity in Living Organisms. J. Xenobiot. 2025, 15(5), 146; <https://doi.org/10.3390/jox15050146>
- Gusev A., Ilyin I., Mantseva L., Rozovskaya O., Shatalov V. and Travnikov O. [2006]. Progress in further development of MSCE-HM and MSCE-POP models (implementation of the model review recommendations). EMEP/MSCE Technical Report 4/2006. <https://doi.org/10.5281/zenodo.16759666>.
- Ilyin I., Rozovskaya O., Sokovykh V. and Travnikov O. (2007) Atmospheric modelling of heavy metal pollution in Europe: Further development and evaluation of the MSCE-HM model. EMEP/MSCE Technical Report 4/2007. 58 p. doi: 10.5281/zenodo.16759808.
- Ilyin I., Rozovskaya O., Travnikov O. and Aas W. [2017] Assessment of heavy metal transboundary pollution on regional and national scales, transition to the new EMEP grid. EMEP Status Report 2/2017, 95 p. [https://msc-east.org/wp-content/uploads/2017/02/2017\\_2-comp.pdf](https://msc-east.org/wp-content/uploads/2017/02/2017_2-comp.pdf).
- Ilyin I., Rozovskaya O., Travnikov O., Aas W. and Pfaffhuber K.A. [2018] Assessment of heavy metal transboundary pollution on global, regional and national scales. EMEP Status Report 2/2018. 70 p. [https://msc-east.org/wp-content/uploads/2024/08/2018\\_2.pdf](https://msc-east.org/wp-content/uploads/2024/08/2018_2.pdf).
- Jonson J. E. and Travnikov O. (Eds.). (2010) Development of the EMEP global modeling framework: Progress report. Joint MSC- W/MSCE Report. EMEP/MSCE Technical Report 1/2010.
- Killick R., Eckley I.A. (2014) changepoint: An R Package for Changepoint Analysis. J. Stat. Softw. 58, 1-19. <https://doi.org/10.18637/jss.v058.i03>
- Killick R., Haynes K., Eckley I.A., 2024. {changepoint}: An {R} package for changepoint analysis.
- Lee, J.-W., Choi, H., Hwang, U.-K., Kang, J.-C., Kang, Y. J., Kim, K. I., and Kim, J.-H. (2019) Toxic effects of lead exposure on bioaccumulation, oxidative stress, neurotoxicity, and immune responses in fish: A review, Environmental Toxicology and Pharmacology, 68, 101–108, <https://doi.org/10.1016/j.etap.2019.03.010>.
- Liao W., Zhu Z., Feng C., Yan Z., Hong Y., Liu D., Jin X. (2023) Toxicity mechanisms and bioavailability of copper to fish based on an adverse outcome pathway analysis. J Environ Sci., 127:495-507. doi: 10.1016/j.jes.2022.06.002.
- Nor Y.M. (1987) Ecotoxicity of copper to aquatic biota: a review. Environ Res., 43(1), 274-282. doi:10.1016/s0013-9351(87)80078-6.
- Poupa S. (2025) Methodologies applied to the CEIP GNFR gap-filling 2025. Part II: Heavy Metals (Cd, Hg, Pb) and Persistent Organic Pollutants (Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Indeno(1,2,3-cd)pyrene, Total polycyclic aromatic hydrocarbons, Dioxin and Furan, Hexachlorobenzene, Polychlorinated biphenyls) of the year 2023. Technical Report CEIP 02/2025. [https://www.ceip.at/fileadmin/inhalte/ceip/3\\_ceip\\_reports/ceip\\_hm\\_pops\\_montiert.pdf](https://www.ceip.at/fileadmin/inhalte/ceip/3_ceip_reports/ceip_hm_pops_montiert.pdf).
- Rehman M., Liu L., Wang Q., Saleem M. H., Bashir S., Ullah S., Peng D. (2019) Copper environmental toxicology, recent advances, and future outlook: a review. Environ Sci Pollut Res. 26, 18003-18016. <https://doi.org/10.1007/s11356-019-05073-6>
- Sulla-Menashe D. and Friedl M. (2023) MCD12Q1 v006. MODIS/Terra+Aqua Land Cover Type Yearly L3 Global 500 m SIN Grid (dataset), NASA EOSDIS Land Processes DAAC, doi: 10.5067/MODIS/MCD12Q1.006 (accessed 20.12.2025).

- Tarrasón L. and Gusev A. (2008) Towards the development of a common EMEP global modeling framework. MSC-W Technical Report 1/2008.
- TFMM (2006) Report of the Workshop on the Review of the EMEP MSC-E Models on Heavy Metals and Persistent Organic Pollutants. EMEP Task Force on Measurements and Modelling.  
<https://digitallibrary.un.org/record/578768?v=pdf>.
- Tista M., Matthews B. and R.Wankmueller (2019) Methodologies applied to the CEIP GNFR gap-filling 2019. Part II: Heavy Metals (Pb, Cd, Hg) of the year 2017. Technical report CEIP 2/2019.
- Travnikov O. and Ilyin I. (2005) Regional Model MSCE-HM of Heavy Metal Transboundary Air Pollution in Europe. EMEP/MSCE-E Technical Report 6/2005. <https://doi.org/10.5281/zenodo.12819468>.
- Travnikov O., J.E. Jonson, A.S Andersen, M. Gauss, A. Gusev, O. Rozovskaya, D. Simpson, V. Sokovykh, S. Valiyaveetil and P. Wind (2009) Development of the EMEP global modelling framework: Progress report. Joint MSC-E/MSCE-W Report. EMEP/MSCE-E Technical Report 7/2009.
- Travnikov O. and Jonson J. E. (Eds.). (2011) Global scale modelling within EMEP: Progress report. EMEP/MSCE-E Technical Report 1/2011.
- Travnikov O, Garcia Arevalo I., Gačnik J., Gholizadeh R., Kleimenov M., Koncz V., Poupa S., Bernhard U., Wankmüller R., Schindlbacher S., Redeyoff O., Aas W., Lunder Halvorsen H., Pfaffhuber K.A. (2025) Transboundary pollution by heavy metals and POPs. EMEP Status Report 2/2025. <https://doi.org/10.5281/zenodo.17312414>.
- Wani A.L., Ara A., Usmani J.A. (2015) Lead toxicity: a review. *Interdiscip Toxicol.*, 8(2):55-64. doi: 10.1515/intox-2015-0009.
- WRF (2025) WRF Source Codes and Graphics Software Download Page.  
[https://www2.mmm.ucar.edu/wrf/users/download/get\\_sources.html#WRF-ARW](https://www2.mmm.ucar.edu/wrf/users/download/get_sources.html#WRF-ARW) (accessed 20.12.2025).

## Annex A. Definitions

**Table A.1.** OSPAR Contracting Parties

| Name       | Code | Name           | Code |
|------------|------|----------------|------|
| Belgium    | BE   | Netherlands    | NL   |
| Denmark    | DK   | Norway         | NO   |
| Finland    | FI   | Portugal       | PT   |
| France     | FR   | Spain          | ES   |
| Germany    | DE   | Sweden         | SE   |
| Iceland    | IS   | Switzerland    | CH   |
| Ireland    | IE   | United Kingdom | GB   |
| Luxembourg | LU   |                |      |

**Table A.2.** Regions of the OSPAR Maritime Area.

| Region    | Name                            | Area, km <sup>2</sup> |
|-----------|---------------------------------|-----------------------|
| OSPAR I   | Arctic Waters                   | 5 480 370             |
| OSPAR II  | Greater North Sea               | 748 586               |
| OSPAR III | Celtic Seas                     | 381 919               |
| OSPAR IV  | Bay of Biscay and Iberian Coast | 538 114               |
| OSPAR V   | Wider Atlantic                  | 6 329 170             |

**Table A.3.** Exclusive Economic Zones (EEZs) of the OSPAR Contracting Parties (within the OSPAR Regions).

| Code    | Name                                            | Area, km <sup>2</sup> |
|---------|-------------------------------------------------|-----------------------|
| EEZ 48  | Portuguese Exclusive Economic Zone (Azores)     | 487 910               |
| EEZ 65  | Faeroe Exclusive Economic Zone                  | 262 572               |
| EEZ 71  | Icelandic Exclusive Economic Zone               | 750 705               |
| EEZ 91  | Portuguese Exclusive Economic Zone              | 269 184               |
| EEZ 99  | Joint regime area Spain / France                | 2 857                 |
| EEZ 100 | Joint regime area UK / Denmark (Faeroe Islands) | 7 895                 |
| EEZ 108 | Irish Exclusive Economic Zone                   | 425 135               |
| EEZ 109 | Guernsey Exclusive Economic Zone                | 6 504                 |
| EEZ 110 | Jersey Exclusive Economic Zone                  | 2 284                 |
| EEZ 119 | Joint regime area Iceland / Denmark (Faeroe)    | 1 264                 |
| EEZ 123 | Joint regime area Iceland / Norway (Jan Mayen)  | 45 105                |
| EEZ 185 | Swedish Exclusive Economic Zone                 | 13 424                |
| EEZ 187 | Joint regime area Sweden / Norway               | 141                   |
| EEZ 188 | Belgian Exclusive Economic Zone                 | 3 470                 |
| EEZ 189 | Dutch Exclusive Economic Zone                   | 62 043                |
| EEZ 190 | German Exclusive Economic Zone                  | 40 658                |
| EEZ 191 | Danish Exclusive Economic Zone                  | 74 638                |
| EEZ 209 | French Exclusive Economic Zone                  | 255 780               |
| EEZ 212 | Greenlandic Exclusive Economic Zone             | 634 585               |
| EEZ 213 | United Kingdom Exclusive Economic Zone          | 728 809               |
| EEZ 215 | Svalbard Exclusive Economic Zone                | 700 964               |
| EEZ 216 | Norwegian Exclusive Economic Zone               | 926 079               |
| EEZ 224 | Jan Mayen Exclusive Economic Zone               | 289 545               |
| EEZ 273 | Spanish Exclusive Economic Zone                 | 298 494               |



## Annex B. Emissions of Pb and Cu in the OSPAR Contracting Parties

**Table B.1.** Annual anthropogenic Pb emissions in Belgium, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 3.754E+01 | 7.950E+01 | 2.865E+00 | 1.984E+00  | 1.997E+00  | 1.159E+02 | 1.510E-02 | 3.866E-02 | 1.478E+00 | 1.591E+01 | 0.000E+00 | 0.000E+00 | 2.572E+02 |
| 1991 | 3.333E+01 | 7.444E+01 | 3.220E+00 | 1.744E+00  | 1.994E+00  | 1.114E+02 | 1.435E-02 | 3.866E-02 | 1.404E+00 | 1.505E+01 | 0.000E+00 | 0.000E+00 | 2.426E+02 |
| 1992 | 4.339E+01 | 8.104E+01 | 2.961E+00 | 1.529E+00  | 2.593E+00  | 1.116E+02 | 1.376E-02 | 3.866E-02 | 1.311E+00 | 1.023E+01 | 0.000E+00 | 0.000E+00 | 2.547E+02 |
| 1993 | 3.366E+00 | 7.585E+01 | 2.859E+00 | 1.274E+00  | 3.470E+00  | 9.771E+01 | 1.354E-02 | 3.866E-02 | 1.163E+00 | 3.199E+01 | 0.000E+00 | 0.000E+00 | 2.177E+02 |
| 1994 | 3.225E+00 | 6.803E+01 | 1.973E+00 | 1.129E+00  | 1.663E+00  | 9.072E+01 | 1.446E-02 | 3.866E-02 | 8.202E-01 | 9.640E-01 | 0.000E+00 | 0.000E+00 | 1.686E+02 |
| 1995 | 9.470E+00 | 9.133E+01 | 1.886E+00 | 1.227E+00  | 1.972E+00  | 8.748E+01 | 1.510E-02 | 3.866E-02 | 7.898E-01 | 7.186E+00 | 0.000E+00 | 0.000E+00 | 2.014E+02 |
| 1996 | 6.797E+00 | 1.185E+02 | 2.114E+00 | 1.179E+00  | 2.024E+00  | 8.298E+01 | 1.512E-02 | 3.866E-02 | 7.689E-01 | 5.715E-01 | 0.000E+00 | 0.000E+00 | 2.150E+02 |
| 1997 | 5.898E+00 | 1.456E+02 | 1.820E+00 | 1.022E+00  | 1.832E+00  | 7.658E+01 | 1.594E-02 | 3.866E-02 | 7.594E-01 | 5.577E-01 | 0.000E+00 | 0.000E+00 | 2.341E+02 |
| 1998 | 3.031E+00 | 7.460E+01 | 1.603E+00 | 9.259E-01  | 2.096E+00  | 7.625E+01 | 1.608E-02 | 3.866E-02 | 7.624E-01 | 2.310E-01 | 0.000E+00 | 0.000E+00 | 1.596E+02 |
| 1999 | 1.210E+00 | 9.754E+01 | 1.453E+00 | 8.584E-01  | 1.785E+00  | 6.960E+01 | 1.697E-02 | 4.170E-02 | 7.274E-01 | 1.517E-01 | 0.000E+00 | 0.000E+00 | 1.734E+02 |
| 2000 | 1.461E+00 | 8.440E+01 | 1.347E+00 | 1.927E+00  | 1.470E+00  | 1.324E+01 | 1.918E-02 | 3.676E-02 | 2.242E-01 | 3.138E-01 | 0.000E+00 | 0.000E+00 | 1.044E+02 |
| 2001 | 1.235E+00 | 6.155E+01 | 1.430E+00 | 1.978E+00  | 1.074E+00  | 1.336E+01 | 1.824E-02 | 3.227E-02 | 2.281E-01 | 1.840E-01 | 0.000E+00 | 0.000E+00 | 8.109E+01 |
| 2002 | 1.070E+00 | 7.093E+01 | 1.284E+00 | 1.866E+00  | 7.562E-01  | 1.328E+01 | 1.865E-02 | 2.147E-02 | 2.129E-01 | 2.224E-01 | 0.000E+00 | 0.000E+00 | 8.967E+01 |
| 2003 | 1.075E+00 | 6.813E+01 | 1.332E+00 | 1.861E+00  | 6.854E-01  | 1.352E+01 | 2.007E-02 | 2.417E-02 | 2.116E-01 | 1.501E-01 | 0.000E+00 | 0.000E+00 | 8.701E+01 |
| 2004 | 1.196E+00 | 7.712E+01 | 1.286E+00 | 1.916E+00  | 2.815E-01  | 1.348E+01 | 2.036E-02 | 5.803E-02 | 2.187E-01 | 5.910E-01 | 0.000E+00 | 0.000E+00 | 9.617E+01 |
| 2005 | 1.318E+00 | 6.695E+01 | 1.285E+00 | 9.247E-01  | 4.480E-01  | 8.981E+00 | 1.954E-02 | 3.605E-02 | 1.757E-01 | 6.805E-01 | 0.000E+00 | 0.000E+00 | 8.082E+01 |
| 2006 | 7.458E-01 | 6.535E+01 | 1.279E+00 | 1.025E+00  | 7.129E-01  | 9.169E+00 | 1.622E-02 | 5.280E-02 | 1.782E-01 | 6.845E-01 | 0.000E+00 | 0.000E+00 | 7.921E+01 |
| 2007 | 5.570E-01 | 5.495E+01 | 1.282E+00 | 8.243E-01  | 1.079E+00  | 9.369E+00 | 1.708E-02 | 3.811E-02 | 1.767E-01 | 5.814E-01 | 0.000E+00 | 0.000E+00 | 6.888E+01 |
| 2008 | 5.967E-01 | 6.475E+01 | 1.528E+00 | 5.904E-01  | 1.474E+00  | 9.452E+00 | 1.761E-02 | 2.154E-02 | 1.826E-01 | 8.863E-01 | 0.000E+00 | 0.000E+00 | 7.950E+01 |
| 2009 | 8.670E-01 | 2.330E+01 | 1.571E+00 | 4.093E-01  | 1.813E+00  | 9.405E+00 | 1.489E-02 | 2.296E-02 | 1.676E-01 | 6.891E-01 | 0.000E+00 | 0.000E+00 | 3.826E+01 |
| 2010 | 4.572E-01 | 3.279E+01 | 1.266E+00 | 5.317E-01  | 1.851E+00  | 9.156E+00 | 1.777E-02 | 2.878E-02 | 1.728E-01 | 4.082E-02 | 0.000E+00 | 0.000E+00 | 4.631E+01 |
| 2011 | 5.273E-01 | 2.263E+01 | 9.496E-01 | 4.590E-01  | 1.838E+00  | 9.096E+00 | 1.715E-02 | 3.652E-02 | 1.668E-01 | 4.656E-02 | 0.000E+00 | 0.000E+00 | 3.576E+01 |
| 2012 | 4.407E-01 | 2.225E+01 | 1.028E+00 | 4.789E-01  | 1.555E+00  | 8.799E+00 | 1.640E-02 | 4.351E-02 | 1.627E-01 | 2.835E-02 | 0.000E+00 | 0.000E+00 | 3.480E+01 |
| 2013 | 2.711E-01 | 1.929E+01 | 1.197E+00 | 3.817E-01  | 1.305E+00  | 8.615E+00 | 1.673E-02 | 2.101E-01 | 1.721E-01 | 2.094E-02 | 0.000E+00 | 0.000E+00 | 3.148E+01 |
| 2014 | 2.528E-01 | 1.723E+01 | 9.181E-01 | 2.705E-01  | 9.692E-01  | 8.838E+00 | 1.620E-02 | 2.805E-01 | 1.546E-01 | 2.784E-02 | 0.000E+00 | 0.000E+00 | 2.895E+01 |
| 2015 | 2.139E-01 | 2.357E+01 | 1.045E+00 | 1.865E-01  | 8.674E-01  | 9.238E+00 | 1.584E-02 | 2.642E-01 | 1.571E-01 | 2.269E-02 | 0.000E+00 | 0.000E+00 | 3.558E+01 |
| 2016 | 3.113E-01 | 2.102E+01 | 1.049E+00 | 1.737E-01  | 7.512E-01  | 9.303E+00 | 1.568E-02 | 2.742E-01 | 1.554E-01 | 4.319E-02 | 0.000E+00 | 0.000E+00 | 3.310E+01 |
| 2017 | 2.366E-01 | 1.949E+01 | 9.945E-01 | 1.633E-01  | 6.961E-01  | 9.087E+00 | 1.662E-02 | 2.868E-01 | 1.556E-01 | 2.409E-02 | 0.000E+00 | 0.000E+00 | 3.115E+01 |
| 2018 | 2.689E-01 | 7.795E+00 | 9.642E-01 | 1.475E-01  | 6.215E-01  | 9.080E+00 | 1.659E-02 | 6.608E-02 | 1.562E-01 | 6.358E-02 | 0.000E+00 | 0.000E+00 | 1.918E+01 |
| 2019 | 2.873E-01 | 9.116E+00 | 9.193E-01 | 1.825E-01  | 6.806E-01  | 8.950E+00 | 1.557E-02 | 6.607E-02 | 1.562E-01 | 3.246E-02 | 0.000E+00 | 0.000E+00 | 2.041E+01 |
| 2020 | 2.344E-01 | 7.470E+00 | 8.343E-01 | 1.424E-01  | 6.181E-01  | 7.490E+00 | 1.558E-02 | 2.556E-02 | 1.560E-01 | 2.261E-02 | 0.000E+00 | 0.000E+00 | 1.701E+01 |
| 2021 | 1.717E-01 | 6.097E+00 | 9.477E-01 | 1.716E-01  | 4.185E-01  | 7.561E+00 | 1.593E-02 | 6.044E-02 | 1.563E-01 | 1.909E-02 | 0.000E+00 | 0.000E+00 | 1.562E+01 |
| 2022 | 2.052E-01 | 5.990E+00 | 8.697E-01 | 6.214E-02  | 4.867E-01  | 8.008E+00 | 1.450E-02 | 5.110E-02 | 1.549E-01 | 1.664E-02 | 0.000E+00 | 0.000E+00 | 1.586E+01 |
| 2023 | 2.002E-01 | 5.718E+00 | 8.796E-01 | 7.229E-02  | 4.841E-01  | 8.429E+00 | 1.422E-02 | 6.808E-02 | 1.551E-01 | 1.782E-02 | 0.000E+00 | 0.000E+00 | 1.604E+01 |



**Table B.2** Annual anthropogenic Pb emissions in Denmark, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 1.201E+01 | 6.778E+00 | 1.601E+00 | 6.708E-04  | 2.854E+00  | 1.046E+02 | 3.366E-02 | 2.046E+00 | 1.080E-01 | 2.466E+00 | 1.285E-03 | 0.000E+00 | 1.325E+02 |
| 1991 | 1.155E+01 | 6.758E+00 | 1.710E+00 | 6.786E-04  | 3.760E+00  | 8.292E+01 | 3.809E-02 | 1.909E+00 | 1.262E-01 | 2.547E+00 | 1.298E-03 | 0.000E+00 | 1.113E+02 |
| 1992 | 9.862E+00 | 6.386E+00 | 1.509E+00 | 6.791E-04  | 4.076E+00  | 7.591E+01 | 3.645E-02 | 1.852E+00 | 1.063E-01 | 2.770E+00 | 1.138E-03 | 0.000E+00 | 1.025E+02 |
| 1993 | 8.580E+00 | 6.585E+00 | 1.383E+00 | 6.770E-04  | 3.596E+00  | 3.657E+01 | 3.178E-02 | 1.807E+00 | 1.638E-01 | 2.434E+00 | 1.269E-03 | 0.000E+00 | 6.115E+01 |
| 1994 | 6.665E+00 | 5.530E+00 | 1.261E+00 | 6.768E-04  | 4.352E+00  | 6.664E+00 | 2.904E-02 | 1.816E+00 | 1.286E-01 | 2.450E+00 | 1.221E-03 | 0.000E+00 | 2.890E+01 |
| 1995 | 4.547E+00 | 5.071E+00 | 1.017E+00 | 6.737E-04  | 6.638E+00  | 6.720E+00 | 3.003E-02 | 1.989E+00 | 1.470E-01 | 2.830E+00 | 1.380E-03 | 0.000E+00 | 2.899E+01 |
| 1996 | 5.118E+00 | 4.151E+00 | 9.201E-01 | 6.748E-04  | 6.103E+00  | 6.802E+00 | 3.097E-02 | 1.795E+00 | 1.409E-01 | 2.861E+00 | 1.370E-03 | 0.000E+00 | 2.792E+01 |
| 1997 | 3.816E+00 | 4.692E+00 | 8.891E-01 | 4.461E-04  | 4.829E+00  | 7.038E+00 | 2.939E-02 | 1.735E+00 | 1.635E-01 | 2.641E+00 | 1.446E-03 | 0.000E+00 | 2.583E+01 |
| 1998 | 3.538E+00 | 4.266E+00 | 7.325E-01 | 5.586E-04  | 7.806E+00  | 7.225E+00 | 2.632E-02 | 1.573E+00 | 1.565E-01 | 2.364E+00 | 1.714E-03 | 0.000E+00 | 2.769E+01 |
| 1999 | 3.155E+00 | 4.216E+00 | 7.936E-01 | 5.489E-04  | 1.474E+01  | 7.362E+00 | 2.397E-02 | 1.543E+00 | 1.194E-01 | 2.540E+00 | 1.620E-03 | 0.000E+00 | 3.449E+01 |
| 2000 | 2.939E+00 | 3.750E+00 | 8.727E-01 | 5.594E-04  | 3.304E+00  | 7.425E+00 | 2.433E-02 | 1.519E+00 | 1.601E-01 | 2.487E+00 | 1.617E-03 | 0.000E+00 | 2.248E+01 |
| 2001 | 2.870E+00 | 3.643E+00 | 9.220E-01 | 3.755E-04  | 2.610E+00  | 7.398E+00 | 2.543E-02 | 1.488E+00 | 1.345E-01 | 2.447E+00 | 1.675E-03 | 0.000E+00 | 2.154E+01 |
| 2002 | 2.631E+00 | 2.750E+00 | 7.763E-01 | 6.672E-04  | 3.239E+00  | 7.537E+00 | 2.853E-02 | 1.469E+00 | 1.519E-01 | 2.370E+00 | 1.435E-03 | 0.000E+00 | 2.096E+01 |
| 2003 | 2.233E+00 | 2.964E+00 | 1.031E+00 | 4.169E-04  | 4.132E+00  | 7.740E+00 | 2.925E-02 | 1.387E+00 | 1.239E-01 | 2.671E+00 | 1.635E-03 | 0.000E+00 | 2.231E+01 |
| 2004 | 2.094E+00 | 3.238E+00 | 9.385E-01 | 5.305E-04  | 5.841E+00  | 7.992E+00 | 2.638E-02 | 1.444E+00 | 1.272E-01 | 2.307E+00 | 1.702E-03 | 0.000E+00 | 2.401E+01 |
| 2005 | 1.736E+00 | 3.064E+00 | 1.095E+00 | 6.789E-04  | 2.529E+00  | 8.028E+00 | 2.864E-02 | 1.443E+00 | 1.046E-01 | 2.397E+00 | 1.725E-03 | 0.000E+00 | 2.043E+01 |
| 2006 | 4.726E-01 | 2.636E+00 | 1.191E+00 | 6.733E-04  | 2.901E+00  | 8.303E+00 | 2.730E-02 | 1.296E+00 | 9.283E-02 | 2.457E+00 | 1.726E-03 | 0.000E+00 | 1.938E+01 |
| 2007 | 5.383E-01 | 2.660E+00 | 1.378E+00 | 7.105E-04  | 6.057E-02  | 8.709E+00 | 2.472E-02 | 1.368E+00 | 1.272E-01 | 1.664E+00 | 1.533E-03 | 0.000E+00 | 1.653E+01 |
| 2008 | 4.080E-01 | 2.460E+00 | 1.319E+00 | 8.068E-04  | 5.257E-02  | 8.607E+00 | 2.918E-02 | 1.325E+00 | 8.504E-02 | 2.628E+00 | 1.477E-03 | 0.000E+00 | 1.692E+01 |
| 2009 | 3.530E-01 | 2.143E+00 | 1.125E+00 | 4.842E-04  | 5.802E-02  | 8.310E+00 | 2.760E-02 | 1.070E+00 | 1.073E-01 | 2.742E+00 | 1.714E-03 | 0.000E+00 | 1.594E+01 |
| 2010 | 3.612E-01 | 2.309E+00 | 1.210E+00 | 5.680E-04  | 4.100E-02  | 8.171E+00 | 2.519E-02 | 9.680E-01 | 1.235E-01 | 2.423E+00 | 1.307E-03 | 0.000E+00 | 1.564E+01 |
| 2011 | 3.692E-01 | 2.373E+00 | 1.192E+00 | 5.410E-04  | 3.570E-02  | 8.167E+00 | 2.433E-02 | 8.592E-01 | 9.092E-02 | 2.043E+00 | 1.295E-03 | 0.000E+00 | 1.516E+01 |
| 2012 | 3.256E-01 | 2.346E+00 | 1.138E+00 | 6.802E-04  | 6.887E-02  | 8.018E+00 | 2.361E-02 | 8.911E-01 | 8.803E-02 | 2.103E+00 | 1.460E-03 | 0.000E+00 | 1.501E+01 |
| 2013 | 3.819E-01 | 2.223E+00 | 1.235E+00 | 4.772E-04  | 6.769E-02  | 7.925E+00 | 2.376E-02 | 9.335E-01 | 7.300E-02 | 2.359E+00 | 1.547E-03 | 0.000E+00 | 1.522E+01 |
| 2014 | 3.537E-01 | 2.337E+00 | 1.143E+00 | 7.028E-04  | 5.504E-02  | 7.909E+00 | 1.955E-02 | 5.991E-01 | 1.157E-01 | 2.585E+00 | 1.558E-03 | 0.000E+00 | 1.512E+01 |
| 2015 | 3.352E-01 | 2.294E+00 | 1.253E+00 | 4.093E-04  | 7.729E-02  | 8.061E+00 | 1.730E-02 | 7.035E-01 | 8.806E-02 | 2.279E+00 | 1.450E-03 | 0.000E+00 | 1.511E+01 |
| 2016 | 3.599E-01 | 2.304E+00 | 1.300E+00 | 4.949E-04  | 3.631E-02  | 8.040E+00 | 1.919E-02 | 6.804E-01 | 5.627E-02 | 2.197E+00 | 1.372E-03 | 0.000E+00 | 1.499E+01 |
| 2017 | 3.695E-01 | 2.327E+00 | 1.220E+00 | 4.084E-04  | 3.846E-02  | 8.090E+00 | 2.019E-02 | 4.548E-01 | 4.018E-02 | 1.912E+00 | 1.556E-03 | 0.000E+00 | 1.447E+01 |
| 2018 | 3.225E-01 | 2.373E+00 | 1.147E+00 | 5.025E-04  | 4.040E-02  | 8.270E+00 | 1.891E-02 | 7.031E-01 | 3.860E-02 | 3.080E+00 | 1.603E-03 | 0.000E+00 | 1.600E+01 |
| 2019 | 3.058E-01 | 2.244E+00 | 1.043E+00 | 4.485E-04  | 4.488E-02  | 8.190E+00 | 1.872E-02 | 5.834E-01 | 3.803E-02 | 2.249E+00 | 1.868E-03 | 0.000E+00 | 1.472E+01 |
| 2020 | 3.210E-01 | 2.173E+00 | 9.727E-01 | 4.424E-04  | 3.329E-02  | 7.510E+00 | 1.917E-02 | 6.128E-01 | 3.727E-02 | 2.251E+00 | 1.860E-03 | 0.000E+00 | 1.393E+01 |
| 2021 | 3.452E-01 | 2.248E+00 | 1.003E+00 | 3.513E-04  | 6.318E-02  | 7.606E+00 | 2.211E-02 | 3.737E-01 | 3.873E-02 | 1.955E+00 | 1.893E-03 | 0.000E+00 | 1.366E+01 |
| 2022 | 3.097E-01 | 2.188E+00 | 8.166E-01 | 3.395E-04  | 4.449E-02  | 7.711E+00 | 1.975E-02 | 1.029E-01 | 3.883E-02 | 2.412E+00 | 2.096E-03 | 0.000E+00 | 1.365E+01 |
| 2023 | 3.050E-01 | 2.033E+00 | 8.653E-01 | 2.877E-04  | 4.406E-02  | 7.722E+00 | 1.810E-02 | 8.226E-02 | 3.843E-02 | 1.592E+00 | 1.701E-03 | 0.000E+00 | 1.270E+01 |

**Table B.3.** Annual anthropogenic Pb emissions in Finland, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 7.541E+00 | 1.306E+02 | 1.690E+00 | 2.200E-02  | 3.103E-01  | 1.809E+02 | 1.453E-02 | 2.968E-01 | 7.231E-03 | 1.032E-02 | 2.819E-03 | 0.000E+00 | 3.214E+02 |
| 1991 | 6.165E+00 | 7.517E+01 | 1.599E+00 | 2.200E-02  | 3.556E-01  | 1.536E+02 | 1.441E-02 | 2.592E-01 | 7.001E-03 | 1.033E-02 | 2.606E-03 | 0.000E+00 | 2.372E+02 |
| 1992 | 3.991E+00 | 5.289E+01 | 1.523E+00 | 2.200E-02  | 7.364E-01  | 1.057E+02 | 1.314E-02 | 2.367E-01 | 6.813E-03 | 1.031E-02 | 2.126E-03 | 0.000E+00 | 1.651E+02 |
| 1993 | 4.221E+00 | 5.269E+01 | 1.333E+00 | 2.200E-02  | 8.154E-01  | 4.580E+01 | 1.465E-02 | 2.363E-01 | 6.666E-03 | 1.131E-03 | 2.621E-03 | 0.000E+00 | 1.051E+02 |
| 1994 | 3.633E+00 | 5.975E+01 | 1.585E+00 | 2.200E-02  | 1.349E+00  | 7.377E+00 | 1.730E-02 | 2.231E-01 | 6.555E-03 | 8.233E-04 | 2.487E-03 | 0.000E+00 | 7.397E+01 |
| 1995 | 2.266E+00 | 6.101E+01 | 1.020E+00 | 2.200E-02  | 1.111E+00  | 7.025E+00 | 1.528E-02 | 2.116E-01 | 6.481E-03 | 9.288E-04 | 2.348E-03 | 0.000E+00 | 7.269E+01 |
| 1996 | 2.550E+00 | 3.763E+01 | 1.073E+00 | 2.200E-02  | 6.342E-01  | 7.075E+00 | 1.677E-02 | 2.122E-01 | 6.442E-03 | 9.630E-04 | 2.693E-03 | 0.000E+00 | 4.922E+01 |
| 1997 | 2.655E+00 | 2.212E+01 | 1.060E+00 | 2.200E-02  | 1.018E+00  | 7.223E+00 | 1.827E-02 | 2.055E-01 | 6.436E-03 | 9.235E-04 | 2.540E-03 | 0.000E+00 | 3.433E+01 |
| 1998 | 2.320E+00 | 2.530E+01 | 1.096E+00 | 2.200E-02  | 8.920E-01  | 7.388E+00 | 1.732E-02 | 2.014E-01 | 6.207E-03 | 9.402E-04 | 2.062E-03 | 0.000E+00 | 3.724E+01 |
| 1999 | 1.915E+00 | 2.186E+01 | 1.313E+00 | 2.200E-02  | 1.767E+00  | 6.579E+00 | 1.789E-02 | 1.917E-01 | 5.960E-03 | 9.040E-04 | 1.703E-03 | 0.000E+00 | 3.368E+01 |
| 2000 | 2.062E+00 | 2.058E+01 | 1.048E+00 | 2.200E-02  | 1.074E+00  | 5.636E+00 | 1.837E-02 | 2.110E-01 | 5.762E-03 | 9.617E-04 | 2.721E-03 | 0.000E+00 | 3.066E+01 |
| 2001 | 2.236E+00 | 2.038E+01 | 1.194E+00 | 2.200E-02  | 1.112E+00  | 4.659E+00 | 1.584E-02 | 1.740E-01 | 5.486E-03 | 1.032E-03 | 2.365E-03 | 0.000E+00 | 2.980E+01 |
| 2002 | 2.101E+00 | 2.197E+01 | 1.412E+00 | 2.200E-02  | 1.399E+00  | 3.668E+00 | 1.708E-02 | 1.434E-01 | 5.585E-03 | 1.056E-03 | 2.614E-03 | 0.000E+00 | 3.074E+01 |
| 2003 | 3.264E+00 | 1.626E+01 | 1.358E+00 | 2.200E-02  | 1.198E+00  | 2.651E+00 | 1.780E-02 | 1.438E-01 | 5.582E-03 | 9.922E-04 | 2.429E-03 | 0.000E+00 | 2.493E+01 |
| 2004 | 2.657E+00 | 1.925E+01 | 1.473E+00 | 2.200E-02  | 1.354E+00  | 1.589E+00 | 1.687E-02 | 1.215E-01 | 5.088E-03 | 1.086E-03 | 2.341E-03 | 0.000E+00 | 2.650E+01 |
| 2005 | 2.121E+00 | 1.579E+01 | 1.482E+00 | 1.900E-02  | 1.458E+00  | 4.982E-01 | 1.702E-02 | 9.817E-02 | 4.818E-03 | 1.150E-03 | 2.121E-03 | 0.000E+00 | 2.149E+01 |
| 2006 | 2.379E+00 | 1.874E+01 | 1.365E+00 | 2.100E-02  | 1.700E+00  | 5.021E-01 | 1.836E-02 | 1.368E-01 | 5.123E-03 | 1.220E-03 | 1.878E-03 | 0.000E+00 | 2.487E+01 |
| 2007 | 2.313E+00 | 1.555E+01 | 1.358E+00 | 2.300E-02  | 1.970E+00  | 4.869E-01 | 1.899E-02 | 1.235E-01 | 4.956E-03 | 1.265E-03 | 2.191E-03 | 0.000E+00 | 2.185E+01 |
| 2008 | 2.649E+00 | 1.327E+01 | 1.439E+00 | 6.700E-03  | 1.828E+00  | 4.847E-01 | 1.492E-02 | 1.235E-01 | 4.853E-03 | 1.361E-03 | 2.063E-03 | 0.000E+00 | 1.982E+01 |
| 2009 | 2.144E+00 | 1.117E+01 | 1.589E+00 | 1.163E-02  | 1.228E+00  | 4.783E-01 | 1.566E-02 | 1.167E-01 | 4.745E-03 | 1.084E-03 | 1.968E-03 | 0.000E+00 | 1.676E+01 |
| 2010 | 2.581E+00 | 1.402E+01 | 1.781E+00 | 2.830E-02  | 1.334E+00  | 4.824E-01 | 1.751E-02 | 1.190E-01 | 4.652E-03 | 1.138E-03 | 1.469E-03 | 0.000E+00 | 2.037E+01 |
| 2011 | 2.554E+00 | 1.329E+01 | 1.628E+00 | 2.575E-02  | 1.111E+00  | 4.829E-01 | 1.805E-02 | 1.108E-01 | 4.570E-03 | 1.108E-03 | 1.810E-03 | 0.000E+00 | 1.923E+01 |
| 2012 | 2.599E+00 | 9.895E+00 | 1.788E+00 | 2.300E-02  | 1.453E+00  | 4.783E-01 | 1.647E-02 | 7.867E-02 | 4.629E-03 | 1.118E-03 | 1.738E-03 | 0.000E+00 | 1.634E+01 |
| 2013 | 2.440E+00 | 1.027E+01 | 1.635E+00 | 2.155E-02  | 1.066E+00  | 4.834E-01 | 1.539E-02 | 6.644E-02 | 4.879E-03 | 1.137E-03 | 2.200E-03 | 0.000E+00 | 1.601E+01 |
| 2014 | 2.116E+00 | 1.108E+01 | 1.675E+00 | 2.844E-02  | 1.156E+00  | 4.897E-01 | 1.259E-02 | 8.569E-02 | 4.586E-03 | 1.135E-03 | 2.083E-03 | 0.000E+00 | 1.665E+01 |
| 2015 | 2.107E+00 | 9.240E+00 | 1.585E+00 | 2.342E-02  | 1.173E+00  | 4.902E-01 | 1.260E-02 | 5.589E-02 | 4.298E-03 | 1.135E-03 | 1.990E-03 | 0.000E+00 | 1.469E+01 |
| 2016 | 2.036E+00 | 9.959E+00 | 1.829E+00 | 1.506E-01  | 1.181E+00  | 4.946E-01 | 1.191E-02 | 4.048E-02 | 3.921E-03 | 1.218E-03 | 1.863E-03 | 0.000E+00 | 1.571E+01 |
| 2017 | 2.024E+00 | 1.023E+01 | 1.827E+00 | 3.810E-03  | 1.021E+00  | 4.901E-01 | 1.262E-02 | 3.402E-02 | 3.788E-03 | 1.233E-03 | 2.016E-03 | 0.000E+00 | 1.565E+01 |
| 2018 | 2.189E+00 | 9.984E+00 | 1.574E+00 | 4.029E-03  | 1.113E+00  | 4.932E-01 | 1.285E-02 | 5.743E-02 | 3.712E-03 | 1.254E-03 | 1.334E-03 | 0.000E+00 | 1.543E+01 |
| 2019 | 1.963E+00 | 7.679E+00 | 2.128E+00 | 4.029E-03  | 8.906E-01  | 4.906E-01 | 1.288E-02 | 4.518E-02 | 4.261E-03 | 1.296E-03 | 2.158E-03 | 0.000E+00 | 1.322E+01 |
| 2020 | 1.684E+00 | 7.337E+00 | 1.677E+00 | 2.666E-02  | 3.654E-01  | 4.728E-01 | 8.584E-03 | 5.233E-02 | 4.059E-03 | 1.374E-03 | 1.847E-03 | 0.000E+00 | 1.163E+01 |
| 2021 | 1.679E+00 | 7.435E+00 | 2.260E+00 | 1.120E-02  | 6.296E-01  | 4.709E-01 | 8.495E-03 | 5.757E-02 | 4.153E-03 | 1.444E-03 | 0.000E+00 | 0.000E+00 | 1.256E+01 |
| 2022 | 1.800E+00 | 6.611E+00 | 2.189E+00 | 1.255E-02  | 1.061E+00  | 4.644E-01 | 9.214E-03 | 4.437E-02 | 4.171E-03 | 1.561E-03 | 0.000E+00 | 0.000E+00 | 1.220E+01 |
| 2023 | 1.520E+00 | 6.882E+00 | 2.093E+00 | 1.844E-02  | 1.053E+00  | 4.604E-01 | 8.455E-03 | 4.885E-02 | 4.195E-03 | 1.538E-03 | 0.000E+00 | 0.000E+00 | 1.209E+01 |



**Table B.4.** Annual anthropogenic Pb emissions in France, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 5.411E+01 | 1.830E+02 | 4.638E+01 | 6.322E-01  | 1.916E+00  | 3.893E+03 | 8.746E-02 | 1.072E+01 | 6.493E+01 | 4.527E+01 | 4.503E-01 | 0.000E+00 | 4.301E+03 |
| 1991 | 5.840E+01 | 1.713E+02 | 4.795E+01 | 6.151E-01  | 1.916E+00  | 2.509E+03 | 9.013E-02 | 1.065E+01 | 4.539E+01 | 4.447E+01 | 4.492E-01 | 0.000E+00 | 2.890E+03 |
| 1992 | 6.205E+01 | 1.617E+02 | 4.217E+01 | 6.065E-01  | 1.913E+00  | 1.750E+03 | 7.839E-02 | 1.053E+01 | 3.058E+01 | 4.482E+01 | 4.470E-01 | 0.000E+00 | 2.105E+03 |
| 1993 | 6.015E+01 | 1.501E+02 | 3.894E+01 | 5.506E-01  | 1.913E+00  | 1.511E+03 | 8.565E-02 | 9.565E+00 | 2.808E+01 | 4.452E+01 | 4.401E-01 | 0.000E+00 | 1.845E+03 |
| 1994 | 5.631E+01 | 1.547E+02 | 3.405E+01 | 5.176E-01  | 1.910E+00  | 1.319E+03 | 7.776E-02 | 9.511E+00 | 2.605E+01 | 3.976E+01 | 4.413E-01 | 0.000E+00 | 1.642E+03 |
| 1995 | 4.960E+01 | 1.562E+02 | 3.410E+01 | 5.309E-01  | 1.911E+00  | 1.159E+03 | 7.604E-02 | 8.746E+00 | 2.432E+01 | 3.330E+01 | 4.377E-01 | 0.000E+00 | 1.468E+03 |
| 1996 | 4.778E+01 | 1.558E+02 | 3.551E+01 | 5.199E-01  | 1.976E+00  | 9.962E+02 | 7.044E-02 | 8.090E+00 | 2.198E+01 | 2.967E+01 | 4.401E-01 | 0.000E+00 | 1.298E+03 |
| 1997 | 3.341E+01 | 1.617E+02 | 3.127E+01 | 5.078E-01  | 2.113E+00  | 8.670E+02 | 6.801E-02 | 8.268E+00 | 1.986E+01 | 2.313E+01 | 4.362E-01 | 0.000E+00 | 1.148E+03 |
| 1998 | 2.774E+01 | 1.655E+02 | 3.110E+01 | 5.360E-01  | 2.481E+00  | 7.572E+02 | 6.151E-02 | 7.936E+00 | 1.780E+01 | 1.920E+01 | 4.428E-01 | 0.000E+00 | 1.030E+03 |
| 1999 | 2.288E+01 | 1.571E+02 | 2.934E+01 | 5.022E-01  | 5.048E+00  | 5.487E+02 | 6.003E-02 | 8.343E+00 | 1.318E+01 | 1.478E+01 | 4.421E-01 | 0.000E+00 | 8.003E+02 |
| 2000 | 2.390E+01 | 1.607E+02 | 2.822E+01 | 4.887E-01  | 3.832E+00  | 3.887E+01 | 6.590E-02 | 8.429E+00 | 1.908E-01 | 1.386E+01 | 4.408E-01 | 0.000E+00 | 2.790E+02 |
| 2001 | 1.841E+01 | 1.454E+02 | 2.873E+01 | 4.830E-01  | 2.523E+00  | 3.384E+01 | 6.330E-02 | 7.855E+00 | 4.488E-02 | 8.546E+00 | 4.275E-01 | 0.000E+00 | 2.463E+02 |
| 2002 | 1.488E+01 | 1.455E+02 | 2.671E+01 | 4.388E-01  | 5.193E+00  | 3.484E+01 | 6.556E-02 | 7.564E+00 | 4.689E-02 | 6.807E+00 | 4.277E-01 | 0.000E+00 | 2.425E+02 |
| 2003 | 1.143E+01 | 9.791E+01 | 2.707E+01 | 4.430E-01  | 6.212E+00  | 3.601E+01 | 6.679E-02 | 6.907E+00 | 4.702E-02 | 5.084E+00 | 4.076E-01 | 0.000E+00 | 1.916E+02 |
| 2004 | 9.325E+00 | 8.578E+01 | 2.793E+01 | 4.435E-01  | 8.922E+00  | 3.642E+01 | 4.085E-02 | 6.732E+00 | 4.758E-02 | 3.509E+00 | 4.082E-01 | 0.000E+00 | 1.796E+02 |
| 2005 | 8.717E+00 | 8.451E+01 | 2.624E+01 | 4.339E-01  | 7.862E+00  | 3.768E+01 | 3.044E-02 | 7.003E+00 | 4.575E-02 | 3.120E+00 | 4.001E-01 | 0.000E+00 | 1.761E+02 |
| 2006 | 5.249E+00 | 8.172E+01 | 2.392E+01 | 4.351E-01  | 4.757E+00  | 3.818E+01 | 2.499E-02 | 6.863E+00 | 4.560E-02 | 2.921E+00 | 3.954E-01 | 0.000E+00 | 1.645E+02 |
| 2007 | 4.605E+00 | 8.027E+01 | 2.256E+01 | 4.393E-01  | 4.580E+00  | 3.813E+01 | 2.061E-02 | 6.754E+00 | 4.546E-02 | 2.646E+00 | 3.689E-01 | 0.000E+00 | 1.604E+02 |
| 2008 | 4.399E+00 | 6.749E+01 | 2.358E+01 | 4.501E-01  | 3.318E+00  | 3.763E+01 | 3.369E-02 | 6.373E+00 | 4.725E-02 | 2.642E+00 | 3.493E-01 | 0.000E+00 | 1.463E+02 |
| 2009 | 3.828E+00 | 4.226E+01 | 2.432E+01 | 3.424E-01  | 3.751E+00  | 3.851E+01 | 2.781E-02 | 7.636E+00 | 4.807E-02 | 2.726E+00 | 3.265E-01 | 0.000E+00 | 1.238E+02 |
| 2010 | 3.224E+00 | 5.328E+01 | 2.643E+01 | 5.826E-01  | 3.282E+00  | 3.959E+01 | 2.871E-02 | 6.578E+00 | 4.775E-02 | 3.515E+00 | 3.010E-01 | 0.000E+00 | 1.369E+02 |
| 2011 | 2.520E+00 | 4.434E+01 | 2.056E+01 | 1.683E-01  | 2.740E+00  | 3.961E+01 | 3.577E-02 | 7.009E+00 | 4.685E-02 | 3.317E+00 | 2.799E-01 | 0.000E+00 | 1.206E+02 |
| 2012 | 3.066E+00 | 4.502E+01 | 2.313E+01 | 1.601E-01  | 3.301E+00  | 3.904E+01 | 3.604E-02 | 6.501E+00 | 4.997E-02 | 3.570E+00 | 2.616E-01 | 0.000E+00 | 1.241E+02 |
| 2013 | 2.808E+00 | 4.150E+01 | 2.462E+01 | 3.604E-01  | 3.391E+00  | 3.894E+01 | 3.758E-02 | 6.213E+00 | 5.034E-02 | 2.722E+00 | 2.402E-01 | 0.000E+00 | 1.209E+02 |
| 2014 | 2.194E+00 | 4.089E+01 | 1.981E+01 | 3.621E-01  | 2.864E+00  | 3.855E+01 | 3.384E-02 | 5.684E+00 | 5.066E-02 | 2.928E+00 | 2.224E-01 | 0.000E+00 | 1.136E+02 |
| 2015 | 2.302E+00 | 3.336E+01 | 2.044E+01 | 3.010E-01  | 2.592E+00  | 3.913E+01 | 3.367E-02 | 5.703E+00 | 5.104E-02 | 3.266E+00 | 2.057E-01 | 0.000E+00 | 1.074E+02 |
| 2016 | 2.535E+00 | 3.220E+01 | 2.126E+01 | 3.312E-01  | 2.507E+00  | 3.885E+01 | 2.529E-02 | 5.459E+00 | 5.121E-02 | 2.544E+00 | 1.838E-01 | 0.000E+00 | 1.060E+02 |
| 2017 | 2.410E+00 | 3.333E+01 | 1.983E+01 | 2.817E-01  | 3.009E+00  | 3.871E+01 | 2.265E-02 | 5.427E+00 | 5.155E-02 | 2.472E+00 | 1.692E-01 | 0.000E+00 | 1.057E+02 |
| 2018 | 2.235E+00 | 3.280E+01 | 1.876E+01 | 2.964E-01  | 3.435E+00  | 3.933E+01 | 2.527E-02 | 5.466E+00 | 5.190E-02 | 2.395E+00 | 1.490E-01 | 0.000E+00 | 1.049E+02 |
| 2019 | 2.420E+00 | 3.222E+01 | 1.847E+01 | 3.916E-01  | 3.276E+00  | 3.884E+01 | 2.011E-02 | 5.367E+00 | 5.241E-02 | 3.473E+00 | 1.314E-01 | 0.000E+00 | 1.047E+02 |
| 2020 | 2.295E+00 | 2.600E+01 | 1.591E+01 | 2.581E-01  | 2.140E+00  | 3.607E+01 | 1.468E-02 | 4.615E+00 | 5.257E-02 | 3.374E+00 | 1.273E-01 | 0.000E+00 | 9.086E+01 |
| 2021 | 2.783E+00 | 3.115E+01 | 1.760E+01 | 3.011E-01  | 8.327E-01  | 3.473E+01 | 1.826E-02 | 5.753E+00 | 5.289E-02 | 3.031E+00 | 1.260E-01 | 0.000E+00 | 9.638E+01 |
| 2022 | 2.204E+00 | 3.032E+01 | 1.506E+01 | 2.029E-01  | 2.189E+00  | 3.521E+01 | 2.149E-02 | 5.315E+00 | 5.254E-02 | 2.645E+00 | 1.261E-01 | 0.000E+00 | 9.334E+01 |
| 2023 | 2.634E+00 | 2.436E+01 | 1.452E+01 | 1.953E-01  | 3.104E+00  | 3.480E+01 | 1.234E-02 | 4.803E+00 | 5.221E-02 | 2.630E+00 | 1.255E-01 | 0.000E+00 | 8.724E+01 |



**Table B.5.** Annual anthropogenic Pb emissions in Germany, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 5.152E+01 | 4.485E+02 | 2.025E+01 | 0.000E+00  | 1.417E+01  | 1.319E+03 | 7.615E-02 | 2.565E+00 | 4.332E+01 | 1.469E-01 | 0.000E+00 | 0.000E+00 | 1.899E+03 |
| 1991 | 3.962E+01 | 4.085E+02 | 2.148E+01 | 0.000E+00  | 1.439E+01  | 9.403E+02 | 7.037E-02 | 2.521E+00 | 2.615E+01 | 1.459E-01 | 0.000E+00 | 0.000E+00 | 1.453E+03 |
| 1992 | 3.103E+01 | 3.633E+02 | 1.628E+01 | 0.000E+00  | 2.021E+01  | 6.747E+02 | 6.914E-02 | 1.792E+00 | 1.927E+01 | 1.448E-01 | 0.000E+00 | 0.000E+00 | 1.127E+03 |
| 1993 | 2.287E+01 | 3.355E+02 | 1.592E+01 | 0.000E+00  | 1.949E+01  | 5.364E+02 | 6.706E-02 | 1.283E+00 | 1.546E+01 | 1.438E-01 | 0.000E+00 | 0.000E+00 | 9.472E+02 |
| 1994 | 1.594E+01 | 3.408E+02 | 1.448E+01 | 0.000E+00  | 1.843E+01  | 3.498E+02 | 6.609E-02 | 1.235E+00 | 1.144E+01 | 1.427E-01 | 0.000E+00 | 0.000E+00 | 7.524E+02 |
| 1995 | 1.033E+01 | 3.353E+02 | 2.187E+01 | 0.000E+00  | 2.840E+01  | 2.717E+02 | 5.899E-02 | 1.199E+00 | 1.032E+01 | 1.416E-01 | 0.000E+00 | 0.000E+00 | 6.793E+02 |
| 1996 | 1.052E+01 | 3.068E+02 | 2.077E+01 | 0.000E+00  | 2.630E+01  | 1.648E+02 | 5.500E-02 | 9.957E-01 | 6.217E+00 | 1.405E-01 | 0.000E+00 | 0.000E+00 | 5.366E+02 |
| 1997 | 9.641E+00 | 3.147E+02 | 2.114E+01 | 0.000E+00  | 2.000E+01  | 4.141E+01 | 4.981E-02 | 1.220E+00 | 2.236E-01 | 1.394E-01 | 0.000E+00 | 0.000E+00 | 4.085E+02 |
| 1998 | 9.777E+00 | 3.004E+02 | 1.685E+01 | 0.000E+00  | 8.867E+00  | 4.079E+01 | 5.374E-02 | 1.082E+00 | 1.196E-01 | 1.383E-01 | 0.000E+00 | 0.000E+00 | 3.781E+02 |
| 1999 | 9.162E+00 | 2.748E+02 | 1.764E+01 | 0.000E+00  | 8.728E+00  | 4.200E+01 | 4.922E-02 | 1.166E+00 | 1.135E-01 | 1.372E-01 | 0.000E+00 | 0.000E+00 | 3.538E+02 |
| 2000 | 9.524E+00 | 2.766E+02 | 1.876E+01 | 0.000E+00  | 6.730E+00  | 4.230E+01 | 4.731E-02 | 1.177E+00 | 1.038E-01 | 1.361E-01 | 0.000E+00 | 0.000E+00 | 3.553E+02 |
| 2001 | 9.874E+00 | 2.568E+02 | 1.948E+01 | 0.000E+00  | 3.174E+00  | 4.297E+01 | 4.761E-02 | 1.034E+00 | 9.268E-02 | 1.347E-01 | 0.000E+00 | 0.000E+00 | 3.336E+02 |
| 2002 | 9.696E+00 | 2.272E+02 | 1.933E+01 | 0.000E+00  | 1.936E+00  | 4.347E+01 | 4.742E-02 | 8.655E-01 | 8.286E-02 | 1.338E-01 | 0.000E+00 | 0.000E+00 | 3.027E+02 |
| 2003 | 9.948E+00 | 2.081E+02 | 7.873E+00 | 0.000E+00  | 1.417E-03  | 4.327E+01 | 5.353E-02 | 8.046E-01 | 8.840E-02 | 1.338E-01 | 0.000E+00 | 0.000E+00 | 2.703E+02 |
| 2004 | 9.789E+00 | 1.906E+02 | 7.797E+00 | 0.000E+00  | 1.442E-03  | 4.391E+01 | 5.269E-02 | 6.924E-01 | 8.769E-02 | 1.309E-01 | 0.000E+00 | 0.000E+00 | 2.531E+02 |
| 2005 | 9.681E+00 | 1.678E+02 | 8.168E+00 | 0.000E+00  | 1.420E-03  | 4.301E+01 | 5.259E-02 | 7.589E-01 | 9.062E-02 | 1.297E-01 | 0.000E+00 | 0.000E+00 | 2.297E+02 |
| 2006 | 9.945E+00 | 1.475E+02 | 7.866E+00 | 0.000E+00  | 1.432E-03  | 4.361E+01 | 5.256E-02 | 6.956E-01 | 1.110E-01 | 1.292E-01 | 0.000E+00 | 0.000E+00 | 2.099E+02 |
| 2007 | 1.011E+01 | 1.263E+02 | 1.009E+01 | 0.000E+00  | 1.444E-03  | 4.426E+01 | 5.046E-02 | 6.346E-01 | 2.254E-01 | 1.278E-01 | 0.000E+00 | 0.000E+00 | 1.918E+02 |
| 2008 | 9.618E+00 | 9.809E+01 | 1.391E+01 | 0.000E+00  | 1.441E-03  | 4.406E+01 | 5.513E-02 | 6.725E-01 | 9.460E-02 | 1.272E-01 | 0.000E+00 | 0.000E+00 | 1.666E+02 |
| 2009 | 9.157E+00 | 7.507E+01 | 1.471E+01 | 0.000E+00  | 1.443E-03  | 4.364E+01 | 4.674E-02 | 6.339E-01 | 9.781E-02 | 1.256E-01 | 0.000E+00 | 0.000E+00 | 1.435E+02 |
| 2010 | 9.439E+00 | 8.736E+01 | 2.258E+01 | 0.000E+00  | 1.457E-03  | 4.423E+01 | 4.757E-02 | 6.077E-01 | 9.747E-02 | 1.244E-01 | 0.000E+00 | 0.000E+00 | 1.645E+02 |
| 2011 | 9.446E+00 | 8.736E+01 | 1.734E+01 | 0.000E+00  | 1.480E-03  | 4.505E+01 | 4.528E-02 | 6.463E-01 | 1.046E-01 | 1.242E-01 | 0.000E+00 | 0.000E+00 | 1.601E+02 |
| 2012 | 1.015E+01 | 8.327E+01 | 1.972E+01 | 0.000E+00  | 1.482E-03  | 4.504E+01 | 4.738E-02 | 5.844E-01 | 1.058E-01 | 1.229E-01 | 0.000E+00 | 0.000E+00 | 1.590E+02 |
| 2013 | 1.058E+01 | 8.322E+01 | 2.200E+01 | 0.000E+00  | 1.495E-03  | 4.572E+01 | 4.804E-02 | 5.235E-01 | 1.048E-01 | 1.215E-01 | 0.000E+00 | 0.000E+00 | 1.623E+02 |
| 2014 | 1.033E+01 | 8.205E+01 | 1.838E+01 | 0.000E+00  | 1.529E-03  | 4.644E+01 | 4.935E-02 | 5.056E-01 | 1.007E-01 | 1.207E-01 | 0.000E+00 | 0.000E+00 | 1.580E+02 |
| 2015 | 1.005E+01 | 8.371E+01 | 2.276E+01 | 0.000E+00  | 1.553E-03  | 4.722E+01 | 4.693E-02 | 6.012E-01 | 1.003E-01 | 1.200E-01 | 0.000E+00 | 0.000E+00 | 1.646E+02 |
| 2016 | 9.706E+00 | 8.095E+01 | 2.220E+01 | 0.000E+00  | 1.577E-03  | 4.812E+01 | 4.603E-02 | 4.940E-01 | 1.044E-01 | 1.182E-01 | 0.000E+00 | 0.000E+00 | 1.617E+02 |
| 2017 | 8.907E+00 | 8.579E+01 | 2.287E+01 | 0.000E+00  | 1.597E-03  | 4.871E+01 | 4.555E-02 | 4.791E-01 | 1.015E-01 | 1.185E-01 | 0.000E+00 | 0.000E+00 | 1.670E+02 |
| 2018 | 8.505E+00 | 8.116E+01 | 2.188E+01 | 0.000E+00  | 1.604E-03  | 4.914E+01 | 4.772E-02 | 4.785E-01 | 1.005E-01 | 1.197E-01 | 0.000E+00 | 0.000E+00 | 1.614E+02 |
| 2019 | 6.883E+00 | 7.957E+01 | 2.250E+01 | 0.000E+00  | 1.615E-03  | 4.928E+01 | 4.828E-02 | 3.929E-01 | 1.001E-01 | 1.131E-01 | 0.000E+00 | 0.000E+00 | 1.589E+02 |
| 2020 | 5.836E+00 | 7.183E+01 | 2.223E+01 | 0.000E+00  | 1.430E-03  | 4.387E+01 | 4.390E-02 | 2.566E-01 | 8.779E-02 | 5.377E-02 | 0.000E+00 | 0.000E+00 | 1.442E+02 |
| 2021 | 6.712E+00 | 7.910E+01 | 2.573E+01 | 0.000E+00  | 1.455E-03  | 4.437E+01 | 4.195E-02 | 3.257E-01 | 9.219E-02 | 5.256E-02 | 0.000E+00 | 0.000E+00 | 1.564E+02 |
| 2022 | 7.133E+00 | 7.468E+01 | 2.478E+01 | 0.000E+00  | 1.457E-03  | 4.525E+01 | 3.615E-02 | 3.614E-01 | 9.339E-02 | 1.145E-01 | 0.000E+00 | 0.000E+00 | 1.525E+02 |
| 2023 | 5.587E+00 | 6.950E+01 | 2.727E+01 | 0.000E+00  | 1.463E-03  | 4.827E+01 | 3.702E-02 | 2.086E-01 | 8.998E-02 | 1.138E-01 | 0.000E+00 | 0.000E+00 | 1.511E+02 |



**Table B.6.** Annual anthropogenic Pb emissions in Iceland, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 7.782E-04 | 8.273E-02 | 7.812E-04 | 0.000E+00  | 8.965E-02  | 1.627E-01 | 1.542E-03 | 2.588E-01 | 1.182E-01 | 7.482E-02 | 0.000E+00 | 0.000E+00 | 7.900E-01 |
| 1991 | 8.710E-04 | 7.689E-02 | 7.464E-04 | 0.000E+00  | 7.136E-02  | 1.699E-01 | 1.147E-03 | 2.588E-01 | 1.143E-01 | 7.420E-02 | 0.000E+00 | 0.000E+00 | 7.682E-01 |
| 1992 | 8.135E-04 | 5.942E-02 | 7.470E-04 | 0.000E+00  | 1.215E-01  | 1.747E-01 | 1.268E-03 | 2.588E-01 | 1.121E-01 | 7.377E-02 | 0.000E+00 | 0.000E+00 | 8.031E-01 |
| 1993 | 3.803E-01 | 6.641E-02 | 4.751E-02 | 0.000E+00  | 1.120E-01  | 1.752E-01 | 1.495E-03 | 2.588E-01 | 1.204E-01 | 7.174E-02 | 0.000E+00 | 0.000E+00 | 1.234E+00 |
| 1994 | 3.803E-01 | 6.591E-02 | 4.751E-02 | 0.000E+00  | 1.052E-01  | 1.784E-01 | 1.214E-03 | 2.762E-01 | 1.212E-01 | 7.174E-02 | 0.000E+00 | 0.000E+00 | 1.248E+00 |
| 1995 | 4.844E-01 | 5.090E-02 | 4.751E-02 | 0.000E+00  | 1.110E-01  | 1.760E-01 | 1.771E-03 | 2.199E-01 | 1.456E-01 | 7.049E-02 | 0.000E+00 | 0.000E+00 | 1.308E+00 |
| 1996 | 6.297E-01 | 4.420E-02 | 4.751E-02 | 0.000E+00  | 1.399E-01  | 1.721E-01 | 2.202E-03 | 2.973E-01 | 1.426E-01 | 6.826E-02 | 0.000E+00 | 0.000E+00 | 1.544E+00 |
| 1997 | 6.294E-01 | 6.260E-02 | 4.751E-02 | 0.000E+00  | 1.658E-01  | 1.828E-01 | 1.238E-03 | 3.217E-01 | 1.627E-01 | 5.964E-02 | 0.000E+00 | 0.000E+00 | 1.633E+00 |
| 1998 | 6.294E-01 | 8.265E-02 | 4.752E-02 | 0.000E+00  | 2.136E-01  | 1.864E-01 | 9.858E-04 | 3.721E-01 | 1.634E-01 | 5.847E-02 | 0.000E+00 | 0.000E+00 | 1.754E+00 |
| 1999 | 6.294E-01 | 8.941E-02 | 6.104E-02 | 0.000E+00  | 4.289E-01  | 1.955E-01 | 7.412E-04 | 3.245E-01 | 1.734E-01 | 5.858E-02 | 0.000E+00 | 0.000E+00 | 1.961E+00 |
| 2000 | 6.294E-01 | 9.225E-02 | 6.104E-02 | 0.000E+00  | 2.965E-01  | 2.003E-01 | 5.428E-04 | 3.138E-01 | 1.766E-01 | 5.871E-02 | 0.000E+00 | 0.000E+00 | 1.829E+00 |
| 2001 | 6.294E-01 | 1.103E-01 | 6.098E-02 | 0.000E+00  | 3.777E-01  | 2.040E-01 | 9.845E-04 | 2.721E-01 | 1.673E-01 | 7.678E-02 | 0.000E+00 | 0.000E+00 | 1.899E+00 |
| 2002 | 6.294E-01 | 9.860E-02 | 6.098E-02 | 0.000E+00  | 2.610E-01  | 2.078E-01 | 8.833E-04 | 2.267E-01 | 1.621E-01 | 7.589E-02 | 0.000E+00 | 0.000E+00 | 1.723E+00 |
| 2003 | 6.293E-01 | 9.525E-02 | 8.898E-02 | 0.000E+00  | 4.095E-01  | 2.348E-01 | 1.421E-03 | 2.293E-01 | 1.502E-01 | 7.397E-02 | 0.000E+00 | 0.000E+00 | 1.913E+00 |
| 2004 | 6.437E-01 | 1.174E-01 | 7.857E-02 | 0.000E+00  | 4.430E-01  | 2.472E-01 | 2.095E-03 | 2.486E-01 | 1.745E-01 | 4.805E-02 | 0.000E+00 | 0.000E+00 | 2.003E+00 |
| 2005 | 6.188E-01 | 8.963E-02 | 6.085E-02 | 0.000E+00  | 5.004E-01  | 2.566E-01 | 9.644E-04 | 2.964E-01 | 1.844E-01 | 5.443E-02 | 0.000E+00 | 0.000E+00 | 2.062E+00 |
| 2006 | 1.119E+00 | 1.148E-01 | 6.061E-02 | 0.000E+00  | 8.055E-01  | 2.933E-01 | 2.416E-03 | 2.577E-01 | 1.675E-01 | 5.090E-02 | 0.000E+00 | 0.000E+00 | 2.872E+00 |
| 2007 | 1.246E+00 | 1.760E-01 | 7.307E-02 | 0.000E+00  | 7.639E-01  | 3.055E-01 | 3.240E-03 | 2.335E-01 | 1.738E-01 | 6.264E-02 | 0.000E+00 | 0.000E+00 | 3.038E+00 |
| 2008 | 1.072E+00 | 2.313E-01 | 4.218E-02 | 0.000E+00  | 3.066E-01  | 2.899E-01 | 2.468E-03 | 2.094E-01 | 1.663E-01 | 8.818E-02 | 0.000E+00 | 0.000E+00 | 2.409E+00 |
| 2009 | 8.355E-01 | 1.983E-01 | 3.112E-02 | 0.000E+00  | 2.273E-01  | 2.881E-01 | 1.483E-03 | 2.065E-01 | 1.282E-01 | 5.723E-02 | 0.000E+00 | 0.000E+00 | 1.974E+00 |
| 2010 | 8.432E-01 | 1.757E-01 | 3.653E-02 | 0.000E+00  | 2.244E-01  | 2.774E-01 | 1.570E-03 | 2.036E-01 | 1.083E-01 | 4.240E-02 | 0.000E+00 | 0.000E+00 | 1.913E+00 |
| 2011 | 6.631E-01 | 1.875E-01 | 1.951E-02 | 0.000E+00  | 2.070E-01  | 2.742E-01 | 7.774E-04 | 1.418E-01 | 9.866E-02 | 4.414E-02 | 0.000E+00 | 0.000E+00 | 1.637E+00 |
| 2012 | 5.861E-01 | 1.650E-01 | 1.919E-02 | 0.000E+00  | 1.847E-01  | 2.725E-01 | 5.710E-04 | 1.207E-01 | 9.568E-02 | 5.207E-02 | 0.000E+00 | 0.000E+00 | 1.496E+00 |
| 2013 | 9.618E-02 | 1.689E-01 | 2.627E-04 | 0.000E+00  | 8.450E-02  | 2.768E-01 | 7.067E-04 | 1.009E-01 | 9.187E-02 | 5.765E-02 | 0.000E+00 | 0.000E+00 | 8.777E-01 |
| 2014 | 2.842E-04 | 1.954E-01 | 2.648E-04 | 0.000E+00  | 6.676E-02  | 2.755E-01 | 9.420E-04 | 1.150E-01 | 1.038E-01 | 6.688E-02 | 0.000E+00 | 0.000E+00 | 8.249E-01 |
| 2015 | 2.326E-04 | 1.850E-01 | 2.612E-04 | 0.000E+00  | 2.938E-02  | 2.860E-01 | 1.106E-03 | 1.082E-01 | 1.028E-01 | 6.790E-02 | 0.000E+00 | 0.000E+00 | 7.808E-01 |
| 2016 | 1.311E-04 | 1.907E-01 | 2.098E-04 | 0.000E+00  | 2.937E-02  | 3.177E-01 | 1.140E-03 | 1.130E-01 | 1.096E-01 | 1.203E-01 | 0.000E+00 | 0.000E+00 | 8.821E-01 |
| 2017 | 1.321E-04 | 1.780E-01 | 2.105E-04 | 0.000E+00  | 2.961E-02  | 3.373E-01 | 1.286E-03 | 1.318E-01 | 1.123E-01 | 8.947E-02 | 0.000E+00 | 0.000E+00 | 8.801E-01 |
| 2018 | 1.322E-04 | 1.769E-01 | 2.104E-04 | 0.000E+00  | 3.700E-02  | 3.490E-01 | 2.036E-03 | 2.751E-01 | 9.492E-02 | 7.158E-02 | 0.000E+00 | 0.000E+00 | 1.007E+00 |
| 2019 | 2.757E-04 | 1.692E-01 | 2.599E-04 | 0.000E+00  | 2.291E-02  | 3.491E-01 | 2.412E-03 | 2.651E-01 | 7.843E-02 | 6.960E-02 | 0.000E+00 | 0.000E+00 | 9.573E-01 |
| 2020 | 1.430E-04 | 1.677E-01 | 1.903E-04 | 0.000E+00  | 2.412E-02  | 3.067E-01 | 1.018E-03 | 2.043E-01 | 6.119E-02 | 5.293E-02 | 0.000E+00 | 0.000E+00 | 8.183E-01 |
| 2021 | 1.764E-04 | 1.690E-01 | 2.231E-04 | 0.000E+00  | 2.567E-02  | 3.268E-01 | 7.134E-04 | 3.319E-01 | 6.191E-02 | 5.114E-02 | 0.000E+00 | 0.000E+00 | 9.676E-01 |
| 2022 | 5.768E-04 | 1.732E-01 | 2.476E-04 | 0.000E+00  | 3.345E-02  | 3.413E-01 | 9.988E-04 | 1.866E-01 | 5.775E-02 | 5.210E-02 | 0.000E+00 | 0.000E+00 | 8.462E-01 |
| 2023 | 6.033E-04 | 1.758E-01 | 2.249E-04 | 0.000E+00  | 2.168E-02  | 3.398E-01 | 6.856E-04 | 1.335E-01 | 6.785E-02 | 6.913E-02 | 0.000E+00 | 0.000E+00 | 8.093E-01 |



**Table B.7** Annual anthropogenic Pb emissions in Ireland, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 8.162E-01 | 5.010E+00 | 6.278E+00 | 0.000E+00  | 3.462E-02  | 1.452E+02 | 4.510E-03 | 6.851E-01 | 3.562E-03 | 1.793E-01 | 0.000E+00 | 0.000E+00 | 1.582E+02 |
| 1991 | 8.646E-01 | 4.634E+00 | 6.120E+00 | 0.000E+00  | 3.506E-02  | 1.296E+02 | 4.330E-03 | 7.305E-01 | 3.849E-03 | 1.793E-01 | 0.000E+00 | 0.000E+00 | 1.421E+02 |
| 1992 | 9.295E-01 | 4.245E+00 | 5.172E+00 | 0.000E+00  | 3.557E-02  | 1.391E+02 | 4.820E-03 | 7.887E-01 | 4.099E-03 | 1.793E-01 | 0.000E+00 | 0.000E+00 | 1.505E+02 |
| 1993 | 8.778E-01 | 4.672E+00 | 5.012E+00 | 0.000E+00  | 3.590E-02  | 1.184E+02 | 4.820E-03 | 5.972E-01 | 4.587E-03 | 1.793E-01 | 0.000E+00 | 0.000E+00 | 1.298E+02 |
| 1994 | 9.134E-01 | 4.305E+00 | 4.428E+00 | 0.000E+00  | 3.620E-02  | 1.033E+02 | 5.540E-03 | 5.031E-01 | 4.780E-03 | 1.793E-01 | 0.000E+00 | 0.000E+00 | 1.136E+02 |
| 1995 | 9.305E-01 | 4.564E+00 | 3.975E+00 | 0.000E+00  | 3.647E-02  | 8.903E+01 | 4.870E-03 | 6.420E-01 | 6.429E-03 | 1.793E-01 | 0.000E+00 | 0.000E+00 | 9.937E+01 |
| 1996 | 9.303E-01 | 4.793E+00 | 3.968E+00 | 0.000E+00  | 3.691E-02  | 7.325E+01 | 5.340E-03 | 6.028E-01 | 5.486E-03 | 1.793E-01 | 0.000E+00 | 0.000E+00 | 8.377E+01 |
| 1997 | 9.426E-01 | 4.775E+00 | 3.460E+00 | 0.000E+00  | 3.739E-02  | 7.841E+01 | 5.520E-03 | 7.031E-01 | 4.837E-03 | 1.733E-01 | 0.000E+00 | 0.000E+00 | 8.852E+01 |
| 1998 | 9.830E-01 | 4.880E+00 | 3.599E+00 | 0.000E+00  | 3.752E-02  | 5.062E+01 | 5.910E-03 | 5.625E-01 | 5.344E-03 | 2.329E-02 | 0.000E+00 | 0.000E+00 | 6.072E+01 |
| 1999 | 9.768E-01 | 3.231E+00 | 2.756E+00 | 0.000E+00  | 3.752E-02  | 2.931E+01 | 6.480E-03 | 8.795E-01 | 4.716E-03 | 2.467E-02 | 0.000E+00 | 0.000E+00 | 3.723E+01 |
| 2000 | 9.319E-01 | 3.548E+00 | 2.733E+00 | 0.000E+00  | 3.747E-02  | 8.509E+00 | 7.479E-03 | 1.005E+00 | 4.591E-03 | 2.607E-02 | 0.000E+00 | 0.000E+00 | 1.680E+01 |
| 2001 | 1.032E+00 | 2.364E+00 | 2.585E+00 | 0.000E+00  | 3.729E-02  | 8.344E+00 | 7.218E-03 | 1.063E+00 | 4.670E-03 | 2.801E-02 | 0.000E+00 | 0.000E+00 | 1.547E+01 |
| 2002 | 9.554E-01 | 1.301E+00 | 2.528E+00 | 0.000E+00  | 3.750E-02  | 8.527E+00 | 7.497E-03 | 9.428E-01 | 4.010E-03 | 2.845E-02 | 0.000E+00 | 0.000E+00 | 1.433E+01 |
| 2003 | 8.335E-01 | 1.196E+00 | 2.513E+00 | 0.000E+00  | 3.734E-02  | 8.591E+00 | 7.956E-03 | 1.097E+00 | 5.766E-03 | 4.274E-02 | 0.000E+00 | 0.000E+00 | 1.432E+01 |
| 2004 | 7.679E-01 | 1.146E+00 | 2.437E+00 | 0.000E+00  | 3.711E-02  | 8.969E+00 | 1.013E-02 | 1.138E+00 | 6.556E-03 | 4.871E-02 | 0.000E+00 | 0.000E+00 | 1.456E+01 |
| 2005 | 8.889E-01 | 1.366E+00 | 2.532E+00 | 0.000E+00  | 3.699E-02  | 4.952E+00 | 9.489E-03 | 1.090E+00 | 5.878E-03 | 4.717E-02 | 0.000E+00 | 0.000E+00 | 1.093E+01 |
| 2006 | 7.854E-01 | 1.022E+00 | 2.443E+00 | 0.000E+00  | 3.736E-02  | 5.198E+00 | 1.014E-02 | 1.135E+00 | 5.251E-03 | 4.563E-02 | 0.000E+00 | 0.000E+00 | 1.068E+01 |
| 2007 | 7.146E-01 | 1.002E+00 | 2.341E+00 | 0.000E+00  | 3.881E-02  | 5.482E+00 | 8.005E-03 | 1.100E+00 | 4.896E-03 | 3.648E-02 | 0.000E+00 | 0.000E+00 | 1.073E+01 |
| 2008 | 7.306E-01 | 9.291E-01 | 2.472E+00 | 0.000E+00  | 3.915E-02  | 5.238E+00 | 8.297E-03 | 1.152E+00 | 4.204E-03 | 2.728E-02 | 0.000E+00 | 0.000E+00 | 1.060E+01 |
| 2009 | 6.351E-01 | 7.043E-01 | 2.426E+00 | 0.000E+00  | 3.795E-02  | 4.830E+00 | 8.086E-03 | 6.066E-01 | 3.932E-03 | 2.791E-02 | 0.000E+00 | 0.000E+00 | 9.280E+00 |
| 2010 | 6.093E-01 | 7.193E-01 | 2.290E+00 | 0.000E+00  | 3.601E-02  | 4.488E+00 | 8.110E-03 | 6.576E-01 | 3.091E-03 | 2.380E-02 | 0.000E+00 | 0.000E+00 | 8.835E+00 |
| 2011 | 6.110E-01 | 5.596E-01 | 2.079E+00 | 0.000E+00  | 3.391E-02  | 4.413E+00 | 7.040E-03 | 5.890E-01 | 2.561E-03 | 1.650E-02 | 0.000E+00 | 0.000E+00 | 8.312E+00 |
| 2012 | 7.523E-01 | 5.125E-01 | 2.065E+00 | 0.000E+00  | 3.239E-02  | 4.264E+00 | 7.440E-03 | 5.107E-01 | 2.834E-03 | 1.978E-02 | 0.000E+00 | 0.000E+00 | 8.167E+00 |
| 2013 | 6.699E-01 | 5.355E-01 | 2.219E+00 | 0.000E+00  | 3.122E-02  | 4.378E+00 | 7.278E-03 | 6.280E-01 | 3.154E-03 | 1.890E-02 | 0.000E+00 | 0.000E+00 | 8.491E+00 |
| 2014 | 6.989E-01 | 5.200E-01 | 2.005E+00 | 0.000E+00  | 2.896E-02  | 4.504E+00 | 9.111E-03 | 5.318E-01 | 3.005E-03 | 1.719E-02 | 0.000E+00 | 0.000E+00 | 8.318E+00 |
| 2015 | 7.500E-01 | 5.257E-01 | 2.054E+00 | 0.000E+00  | 2.305E-02  | 4.724E+00 | 8.986E-03 | 5.215E-01 | 2.642E-03 | 1.743E-02 | 0.000E+00 | 0.000E+00 | 8.628E+00 |
| 2016 | 7.573E-01 | 4.854E-01 | 2.089E+00 | 0.000E+00  | 2.210E-02  | 4.824E+00 | 1.080E-02 | 5.689E-01 | 2.427E-03 | 9.899E-03 | 0.000E+00 | 0.000E+00 | 8.770E+00 |
| 2017 | 6.730E-01 | 4.953E-01 | 1.777E+00 | 0.000E+00  | 2.658E-02  | 4.842E+00 | 9.535E-03 | 5.308E-01 | 2.873E-03 | 1.089E-02 | 0.000E+00 | 0.000E+00 | 8.368E+00 |
| 2018 | 5.597E-01 | 4.934E-01 | 1.909E+00 | 0.000E+00  | 2.785E-02  | 4.896E+00 | 1.055E-02 | 4.659E-01 | 3.428E-03 | 9.096E-03 | 0.000E+00 | 0.000E+00 | 8.375E+00 |
| 2019 | 4.417E-01 | 3.638E-01 | 1.707E+00 | 0.000E+00  | 3.006E-02  | 4.943E+00 | 1.123E-02 | 5.220E-01 | 2.961E-03 | 1.232E-02 | 0.000E+00 | 0.000E+00 | 8.034E+00 |
| 2020 | 3.395E-01 | 3.597E-01 | 1.763E+00 | 0.000E+00  | 7.632E-03  | 4.180E+00 | 1.374E-02 | 5.283E-01 | 2.414E-03 | 1.266E-02 | 0.000E+00 | 0.000E+00 | 7.207E+00 |
| 2021 | 4.460E-01 | 3.504E-01 | 1.692E+00 | 0.000E+00  | 1.396E-02  | 4.443E+00 | 1.469E-02 | 5.382E-01 | 2.362E-03 | 1.430E-02 | 0.000E+00 | 0.000E+00 | 7.515E+00 |
| 2022 | 3.888E-01 | 3.497E-01 | 1.350E+00 | 0.000E+00  | 3.421E-02  | 4.795E+00 | 1.239E-02 | 4.445E-01 | 2.177E-03 | 1.581E-02 | 0.000E+00 | 0.000E+00 | 7.392E+00 |
| 2023 | 2.411E-01 | 2.899E-01 | 1.137E+00 | 0.000E+00  | 3.699E-02  | 4.931E+00 | 1.162E-02 | 4.324E-01 | 2.473E-03 | 1.582E-02 | 0.000E+00 | 0.000E+00 | 7.098E+00 |



**Table B.8** Annual anthropogenic Pb emissions in Luxemburg tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 5.475E-04 | 1.677E+01 | 1.805E-01 | 0.000E+00  | 5.259E-04  | 2.376E+00 | 3.347E-07 | 5.814E-02 | 1.514E-05 | 4.274E-04 | 0.000E+00 | 0.000E+00 | 1.939E+01 |
| 1991 | 5.728E-04 | 1.596E+01 | 2.169E-01 | 0.000E+00  | 6.347E-04  | 2.350E+00 | 3.777E-07 | 8.832E-02 | 1.618E-05 | 4.297E-04 | 0.000E+00 | 0.000E+00 | 1.862E+01 |
| 1992 | 5.712E-04 | 1.555E+01 | 1.910E-01 | 0.000E+00  | 7.661E-04  | 2.077E+00 | 3.694E-07 | 1.246E-01 | 1.676E-05 | 4.174E-04 | 0.000E+00 | 0.000E+00 | 1.795E+01 |
| 1993 | 5.551E-04 | 1.694E+01 | 1.887E-01 | 0.000E+00  | 9.244E-04  | 1.746E+00 | 3.799E-07 | 1.613E-01 | 1.757E-05 | 4.168E-04 | 0.000E+00 | 0.000E+00 | 1.904E+01 |
| 1994 | 5.543E-04 | 1.428E+01 | 1.693E-01 | 0.000E+00  | 1.116E-03  | 1.575E+00 | 3.614E-07 | 1.908E-01 | 1.825E-05 | 4.145E-04 | 0.000E+00 | 0.000E+00 | 1.621E+01 |
| 1995 | 5.412E-04 | 9.013E+00 | 1.712E-01 | 0.000E+00  | 1.347E-03  | 1.540E+00 | 3.054E-07 | 2.055E-01 | 1.897E-05 | 1.179E-04 | 0.000E+00 | 0.000E+00 | 1.093E+01 |
| 1996 | 4.305E-04 | 8.634E+00 | 1.702E-01 | 0.000E+00  | 1.628E-03  | 1.219E+00 | 3.083E-07 | 2.099E-01 | 1.856E-05 | 1.274E-04 | 0.000E+00 | 0.000E+00 | 1.024E+01 |
| 1997 | 5.199E-04 | 5.687E+00 | 1.691E-01 | 0.000E+00  | 1.963E-03  | 1.160E+00 | 3.044E-07 | 2.128E-01 | 1.931E-05 | 1.275E-04 | 0.000E+00 | 0.000E+00 | 7.232E+00 |
| 1998 | 5.180E-04 | 2.307E+00 | 1.682E-01 | 0.000E+00  | 2.367E-03  | 1.233E+00 | 2.959E-07 | 1.832E-01 | 1.968E-05 | 1.340E-04 | 0.000E+00 | 0.000E+00 | 3.894E+00 |
| 1999 | 3.236E-04 | 2.003E+00 | 1.474E-01 | 0.000E+00  | 4.782E-03  | 1.020E+00 | 3.188E-07 | 1.873E-01 | 2.084E-05 | 1.526E-04 | 0.000E+00 | 0.000E+00 | 3.363E+00 |
| 2000 | 5.364E-04 | 1.719E+00 | 7.886E-02 | 0.000E+00  | 3.371E-03  | 9.167E-01 | 2.716E-07 | 1.784E-01 | 2.163E-05 | 1.494E-04 | 0.000E+00 | 0.000E+00 | 2.897E+00 |
| 2001 | 1.802E-03 | 1.739E+00 | 9.131E-02 | 0.000E+00  | 2.744E-03  | 9.635E-01 | 3.028E-07 | 1.772E-01 | 2.156E-05 | 1.540E-04 | 0.000E+00 | 0.000E+00 | 2.975E+00 |
| 2002 | 7.707E-03 | 1.565E+00 | 8.386E-02 | 0.000E+00  | 5.566E-03  | 1.002E+00 | 3.285E-07 | 1.643E-01 | 2.363E-05 | 1.609E-04 | 0.000E+00 | 0.000E+00 | 2.828E+00 |
| 2003 | 7.697E-03 | 1.997E+00 | 7.645E-02 | 0.000E+00  | 6.507E-03  | 1.092E+00 | 3.401E-07 | 1.913E-01 | 2.448E-05 | 1.939E-04 | 0.000E+00 | 0.000E+00 | 3.371E+00 |
| 2004 | 8.215E-03 | 2.697E+00 | 7.641E-02 | 0.000E+00  | 1.192E-02  | 1.224E+00 | 3.082E-07 | 1.677E-01 | 2.575E-05 | 1.658E-04 | 0.000E+00 | 0.000E+00 | 4.185E+00 |
| 2005 | 7.557E-03 | 1.663E+00 | 7.174E-02 | 0.000E+00  | 1.192E-02  | 1.262E+00 | 3.214E-07 | 1.661E-01 | 2.571E-05 | 1.612E-04 | 0.000E+00 | 0.000E+00 | 3.182E+00 |
| 2006 | 7.963E-03 | 1.246E+00 | 5.135E-02 | 0.000E+00  | 5.645E-03  | 1.212E+00 | 2.963E-07 | 1.415E-01 | 2.734E-05 | 1.803E-04 | 0.000E+00 | 0.000E+00 | 2.665E+00 |
| 2007 | 6.640E-03 | 1.201E+00 | 4.728E-02 | 0.000E+00  | 2.846E-02  | 1.206E+00 | 3.000E-07 | 1.497E-01 | 3.194E-05 | 1.670E-04 | 0.000E+00 | 0.000E+00 | 2.639E+00 |
| 2008 | 7.371E-03 | 1.194E+00 | 4.266E-02 | 0.000E+00  | 3.395E-02  | 1.229E+00 | 3.288E-07 | 1.435E-01 | 3.047E-05 | 1.900E-04 | 0.000E+00 | 0.000E+00 | 2.651E+00 |
| 2009 | 4.663E-03 | 8.216E-01 | 7.227E-02 | 0.000E+00  | 3.089E-02  | 1.163E+00 | 2.741E-07 | 1.466E-01 | 3.212E-05 | 1.923E-04 | 0.000E+00 | 0.000E+00 | 2.240E+00 |
| 2010 | 2.325E-03 | 8.634E-01 | 6.614E-02 | 0.000E+00  | 2.117E-02  | 1.212E+00 | 2.919E-07 | 1.449E-01 | 3.379E-05 | 1.822E-04 | 0.000E+00 | 0.000E+00 | 2.310E+00 |
| 2011 | 7.093E-03 | 1.262E+00 | 5.106E-02 | 0.000E+00  | 3.771E-02  | 1.297E+00 | 2.709E-07 | 1.538E-01 | 3.524E-05 | 1.943E-04 | 0.000E+00 | 0.000E+00 | 2.809E+00 |
| 2012 | 5.470E-03 | 8.677E-01 | 5.796E-02 | 0.000E+00  | 4.140E-02  | 1.260E+00 | 2.685E-07 | 1.337E-01 | 3.694E-05 | 1.902E-04 | 0.000E+00 | 0.000E+00 | 2.366E+00 |
| 2013 | 7.360E-03 | 7.110E-01 | 6.863E-02 | 0.000E+00  | 5.778E-02  | 1.231E+00 | 2.399E-07 | 1.279E-01 | 3.805E-05 | 1.789E-04 | 0.000E+00 | 0.000E+00 | 2.204E+00 |
| 2014 | 2.350E-02 | 8.544E-01 | 6.643E-02 | 0.000E+00  | 3.700E-02  | 1.204E+00 | 2.602E-07 | 1.360E-01 | 3.990E-05 | 1.802E-04 | 0.000E+00 | 0.000E+00 | 2.322E+00 |
| 2015 | 2.994E-02 | 1.001E+00 | 8.807E-02 | 0.000E+00  | 6.437E-02  | 1.152E+00 | 2.395E-07 | 1.635E-01 | 4.187E-05 | 1.990E-04 | 0.000E+00 | 0.000E+00 | 2.499E+00 |
| 2016 | 2.486E-02 | 1.064E+00 | 8.867E-02 | 0.000E+00  | 4.281E-02  | 1.129E+00 | 2.532E-07 | 1.647E-01 | 4.380E-05 | 3.050E-04 | 0.000E+00 | 0.000E+00 | 2.515E+00 |
| 2017 | 3.321E-02 | 8.511E-01 | 1.121E-01 | 0.000E+00  | 3.410E-02  | 1.160E+00 | 2.716E-07 | 1.571E-01 | 4.565E-05 | 2.062E-04 | 0.000E+00 | 0.000E+00 | 2.348E+00 |
| 2018 | 4.190E-02 | 6.563E-01 | 1.126E-01 | 0.000E+00  | 2.399E-02  | 1.232E+00 | 2.647E-07 | 1.529E-01 | 4.781E-05 | 2.053E-04 | 0.000E+00 | 0.000E+00 | 2.220E+00 |
| 2019 | 3.159E-02 | 6.256E-01 | 1.213E-01 | 0.000E+00  | 1.529E-02  | 1.260E+00 | 2.293E-07 | 1.371E-01 | 4.985E-05 | 2.089E-04 | 0.000E+00 | 0.000E+00 | 2.191E+00 |
| 2020 | 9.185E-02 | 6.498E-01 | 1.129E-01 | 0.000E+00  | 4.782E-03  | 9.869E-01 | 7.869E-08 | 1.336E-01 | 5.187E-05 | 2.150E-04 | 0.000E+00 | 0.000E+00 | 1.980E+00 |
| 2021 | 7.694E-02 | 7.517E-01 | 1.064E-01 | 0.000E+00  | 2.644E-03  | 1.061E+00 | 9.018E-08 | 1.619E-01 | 5.402E-05 | 2.191E-04 | 0.000E+00 | 0.000E+00 | 2.161E+00 |
| 2022 | 3.796E-02 | 7.200E-01 | 9.908E-02 | 0.000E+00  | 2.255E-03  | 9.909E-01 | 1.177E-07 | 1.454E-01 | 5.566E-05 | 2.520E-04 | 0.000E+00 | 0.000E+00 | 1.996E+00 |
| 2023 | 3.228E-02 | 5.662E-01 | 9.758E-02 | 0.000E+00  | 7.087E-03  | 9.909E-01 | 1.177E-07 | 1.247E-01 | 5.566E-05 | 2.517E-04 | 0.000E+00 | 0.000E+00 | 1.819E+00 |



**Table B.9.** Annual anthropogenic Pb emissions in the Netherlands, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 1.634E+01 | 6.907E+01 | 9.248E-01 | 2.752E-05  | 5.283E-02  | 2.462E+02 | 1.266E-04 | 1.884E+00 | 1.114E+00 | 4.665E-02 | 0.000E+00 | 0.000E+00 | 3.356E+02 |
| 1991 | 1.091E+01 | 6.931E+01 | 7.593E-01 | 3.060E-05  | 5.333E-02  | 1.967E+02 | 1.227E-04 | 1.951E+00 | 1.037E+00 | 4.848E-02 | 0.000E+00 | 0.000E+00 | 2.808E+02 |
| 1992 | 8.480E+00 | 6.961E+01 | 6.113E-01 | 3.002E-05  | 5.360E-02  | 1.560E+02 | 1.174E-04 | 2.035E+00 | 8.980E-01 | 4.749E-02 | 0.000E+00 | 0.000E+00 | 2.378E+02 |
| 1993 | 6.050E+00 | 6.991E+01 | 4.692E-01 | 3.397E-05  | 5.383E-02  | 1.321E+02 | 1.112E-04 | 1.950E+00 | 8.668E-01 | 4.853E-02 | 0.000E+00 | 0.000E+00 | 2.114E+02 |
| 1994 | 3.620E+00 | 7.021E+01 | 3.034E-01 | 3.489E-05  | 5.424E-02  | 1.052E+02 | 1.219E-04 | 1.977E+00 | 7.570E-01 | 4.859E-02 | 0.000E+00 | 0.000E+00 | 1.822E+02 |
| 1995 | 1.560E+00 | 7.053E+01 | 1.537E-01 | 3.312E-05  | 5.453E-02  | 7.987E+01 | 1.181E-04 | 2.003E+00 | 6.870E-01 | 4.997E-02 | 0.000E+00 | 0.000E+00 | 1.549E+02 |
| 1996 | 1.217E+00 | 6.023E+01 | 1.639E-01 | 4.090E-05  | 5.463E-02  | 4.233E+01 | 1.164E-04 | 1.797E+00 | 5.355E-01 | 5.475E-02 | 0.000E+00 | 0.000E+00 | 1.064E+02 |
| 1997 | 8.738E-01 | 4.988E+01 | 1.420E-01 | 5.304E-05  | 5.495E-02  | 2.410E+00 | 1.309E-04 | 1.861E+00 | 3.263E-01 | 5.417E-02 | 0.000E+00 | 0.000E+00 | 5.560E+01 |
| 1998 | 5.307E-01 | 3.957E+01 | 1.197E-01 | 4.844E-05  | 5.528E-02  | 7.447E-01 | 1.279E-04 | 1.797E+00 | 3.296E-01 | 5.226E-02 | 0.000E+00 | 0.000E+00 | 4.320E+01 |
| 1999 | 2.358E-01 | 3.265E+01 | 1.026E-01 | 4.962E-05  | 5.563E-02  | 7.725E-01 | 1.279E-04 | 1.852E+00 | 3.316E-01 | 5.104E-02 | 0.000E+00 | 0.000E+00 | 3.605E+01 |
| 2000 | 3.429E-01 | 2.575E+01 | 8.901E-02 | 4.945E-05  | 8.316E-02  | 7.767E-01 | 1.253E-04 | 1.686E+00 | 3.298E-01 | 5.105E-02 | 0.000E+00 | 0.000E+00 | 2.911E+01 |
| 2001 | 1.915E-01 | 2.892E+01 | 8.767E-02 | 4.853E-05  | 8.372E-02  | 7.872E-01 | 1.250E-04 | 1.531E+00 | 3.190E-01 | 5.216E-02 | 0.000E+00 | 0.000E+00 | 3.197E+01 |
| 2002 | 2.064E-01 | 3.288E+01 | 8.118E-02 | 5.618E-05  | 8.440E-02  | 8.012E-01 | 1.202E-04 | 1.496E+00 | 3.144E-01 | 5.196E-02 | 0.000E+00 | 0.000E+00 | 3.591E+01 |
| 2003 | 2.279E-01 | 2.948E+01 | 8.351E-02 | 5.707E-05  | 8.482E-02  | 8.105E-01 | 1.181E-04 | 1.341E+00 | 3.201E-01 | 5.112E-02 | 0.000E+00 | 0.000E+00 | 3.240E+01 |
| 2004 | 2.620E-01 | 3.107E+01 | 8.367E-02 | 6.010E-05  | 8.500E-02  | 8.313E-01 | 1.232E-04 | 1.182E+00 | 3.325E-01 | 4.850E-02 | 0.000E+00 | 0.000E+00 | 3.389E+01 |
| 2005 | 3.457E-01 | 2.725E+01 | 8.507E-02 | 6.623E-05  | 8.513E-02  | 8.394E-01 | 1.200E-04 | 1.160E+00 | 3.247E-01 | 4.885E-02 | 0.000E+00 | 0.000E+00 | 3.014E+01 |
| 2006 | 2.944E-01 | 2.731E+01 | 8.487E-02 | 6.996E-05  | 8.530E-02  | 8.402E-01 | 1.192E-04 | 1.185E+00 | 3.237E-01 | 5.220E-02 | 0.000E+00 | 0.000E+00 | 3.018E+01 |
| 2007 | 2.528E-01 | 3.299E+01 | 9.065E-02 | 6.908E-05  | 8.547E-02  | 8.564E-01 | 1.210E-04 | 1.152E+00 | 3.189E-01 | 5.356E-02 | 0.000E+00 | 0.000E+00 | 3.580E+01 |
| 2008 | 3.058E-01 | 2.753E+01 | 1.015E-01 | 7.269E-05  | 8.568E-02  | 8.432E-01 | 1.175E-04 | 1.273E+00 | 3.256E-01 | 5.227E-02 | 0.000E+00 | 0.000E+00 | 3.052E+01 |
| 2009 | 3.549E-01 | 2.839E+01 | 1.067E-01 | 6.918E-05  | 8.597E-02  | 8.392E-01 | 9.436E-05 | 1.344E+00 | 3.364E-01 | 5.513E-02 | 0.000E+00 | 0.000E+00 | 3.151E+01 |
| 2010 | 3.422E-01 | 3.462E+01 | 1.240E-01 | 8.174E-05  | 1.019E-01  | 8.391E-01 | 1.032E-04 | 1.258E+00 | 3.511E-01 | 5.536E-02 | 0.000E+00 | 0.000E+00 | 3.769E+01 |
| 2011 | 3.782E-01 | 1.955E+01 | 1.049E-01 | 9.625E-05  | 1.023E-01  | 8.395E-01 | 7.208E-05 | 1.163E+00 | 3.471E-01 | 5.218E-02 | 0.000E+00 | 0.000E+00 | 2.254E+01 |
| 2012 | 4.502E-01 | 1.324E+01 | 1.095E-01 | 8.866E-05  | 1.027E-01  | 8.380E-01 | 7.321E-05 | 1.044E+00 | 3.498E-01 | 5.180E-02 | 0.000E+00 | 0.000E+00 | 1.618E+01 |
| 2013 | 3.956E-01 | 1.116E+01 | 1.060E-01 | 9.017E-05  | 1.029E-01  | 8.334E-01 | 6.843E-05 | 9.290E-01 | 3.447E-01 | 5.138E-02 | 0.000E+00 | 0.000E+00 | 1.392E+01 |
| 2014 | 2.246E-01 | 6.556E+00 | 8.098E-02 | 8.924E-05  | 1.032E-01  | 8.383E-01 | 7.102E-05 | 9.016E-01 | 3.310E-01 | 5.367E-02 | 0.000E+00 | 0.000E+00 | 9.089E+00 |
| 2015 | 1.607E-01 | 6.369E+00 | 8.691E-02 | 8.088E-05  | 1.036E-01  | 8.538E-01 | 7.364E-05 | 7.757E-01 | 3.296E-01 | 5.413E-02 | 0.000E+00 | 0.000E+00 | 8.733E+00 |
| 2016 | 1.159E-01 | 6.707E+00 | 9.401E-02 | 6.815E-05  | 1.040E-01  | 8.794E-01 | 7.522E-05 | 7.601E-01 | 3.432E-01 | 5.455E-02 | 0.000E+00 | 0.000E+00 | 9.058E+00 |
| 2017 | 8.391E-02 | 6.434E+00 | 9.062E-02 | 6.512E-05  | 1.046E-01  | 8.909E-01 | 7.644E-05 | 6.994E-01 | 3.442E-01 | 5.520E-02 | 0.000E+00 | 0.000E+00 | 8.703E+00 |
| 2018 | 7.088E-02 | 3.677E+00 | 8.932E-02 | 7.733E-05  | 1.052E-01  | 9.122E-01 | 7.805E-05 | 7.495E-01 | 3.565E-01 | 5.495E-02 | 0.000E+00 | 0.000E+00 | 6.016E+00 |
| 2019 | 1.361E-01 | 2.879E+00 | 8.966E-02 | 7.639E-05  | 1.058E-01  | 9.137E-01 | 7.584E-05 | 7.151E-01 | 3.639E-01 | 5.106E-02 | 0.000E+00 | 0.000E+00 | 5.254E+00 |
| 2020 | 1.317E-01 | 3.598E+00 | 7.700E-02 | 7.601E-05  | 1.066E-01  | 8.613E-01 | 7.047E-05 | 6.953E-01 | 3.264E-01 | 4.714E-02 | 0.000E+00 | 0.000E+00 | 5.844E+00 |
| 2021 | 1.133E-01 | 2.522E+00 | 9.122E-02 | 6.718E-05  | 1.069E-01  | 8.959E-01 | 7.342E-05 | 8.214E-01 | 3.261E-01 | 4.736E-02 | 0.000E+00 | 0.000E+00 | 4.924E+00 |
| 2022 | 8.035E-02 | 2.111E+00 | 8.673E-02 | 3.069E-05  | 1.248E-01  | 9.432E-01 | 7.147E-05 | 8.587E-01 | 3.406E-01 | 5.277E-02 | 0.000E+00 | 0.000E+00 | 4.598E+00 |
| 2023 | 1.834E-01 | 1.470E+00 | 8.434E-02 | 3.667E-05  | 1.263E-01  | 9.546E-01 | 6.678E-05 | 7.864E-01 | 3.405E-01 | 5.343E-02 | 0.000E+00 | 0.000E+00 | 3.999E+00 |



**Table B.10.** Annual anthropogenic Pb emissions in Norway, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 2.025E+00 | 7.868E+00 | 5.935E-01 | 1.409E-04  | 4.368E-01  | 1.674E+02 | 6.479E-02 | 3.348E-01 | 7.901E+00 | 2.339E+00 | 4.424E-02 | 0.000E+00 | 1.890E+02 |
| 1991 | 2.026E+00 | 7.672E+00 | 5.253E-01 | 9.093E-05  | 4.474E-01  | 1.265E+02 | 5.713E-02 | 2.910E-01 | 6.135E+00 | 2.303E+00 | 3.477E-02 | 0.000E+00 | 1.460E+02 |
| 1992 | 2.026E+00 | 7.876E+00 | 5.209E-01 | 7.874E-05  | 4.559E-01  | 1.114E+02 | 6.302E-02 | 2.751E-01 | 5.531E+00 | 2.306E+00 | 1.893E-02 | 0.000E+00 | 1.305E+02 |
| 1993 | 2.026E+00 | 7.823E+00 | 5.616E-01 | 9.115E-05  | 4.850E-01  | 7.303E+01 | 6.503E-02 | 2.599E-01 | 3.696E+00 | 2.316E+00 | 2.616E-02 | 0.000E+00 | 9.029E+01 |
| 1994 | 2.029E+00 | 8.317E+00 | 5.934E-01 | 9.535E-05  | 4.199E-01  | 1.301E+01 | 6.341E-02 | 2.537E-01 | 6.949E-01 | 2.336E+00 | 1.878E-02 | 0.000E+00 | 2.773E+01 |
| 1995 | 9.926E-01 | 7.985E+00 | 5.833E-01 | 1.053E-04  | 7.337E-01  | 1.278E+01 | 8.474E-02 | 2.545E-01 | 7.890E-01 | 7.283E-01 | 2.326E-02 | 0.000E+00 | 2.495E+01 |
| 1996 | 1.051E+00 | 8.215E+00 | 6.297E-01 | 1.216E-04  | 6.941E-01  | 1.426E+00 | 9.094E-02 | 2.725E-01 | 1.894E-01 | 7.624E-01 | 2.539E-02 | 0.000E+00 | 1.336E+01 |
| 1997 | 9.345E-01 | 7.869E+00 | 6.451E-01 | 1.126E-04  | 8.549E-01  | 1.289E+00 | 1.057E-01 | 2.708E-01 | 1.873E-01 | 7.624E-01 | 1.827E-02 | 0.000E+00 | 1.294E+01 |
| 1998 | 1.096E+00 | 8.045E+00 | 6.034E-01 | 1.227E-04  | 1.170E+00  | 1.312E+00 | 9.785E-02 | 2.485E-01 | 2.027E-01 | 7.664E-01 | 1.918E-02 | 0.000E+00 | 1.356E+01 |
| 1999 | 6.238E-01 | 6.991E+00 | 6.158E-01 | 1.747E-04  | 1.999E+00  | 1.336E+00 | 9.351E-02 | 2.908E-01 | 1.769E-01 | 7.713E-01 | 1.723E-02 | 0.000E+00 | 1.292E+01 |
| 2000 | 4.228E-01 | 5.819E+00 | 6.194E-01 | 1.877E-04  | 1.736E+00  | 1.354E+00 | 7.406E-02 | 2.946E-01 | 1.562E-01 | 7.036E-01 | 1.836E-02 | 0.000E+00 | 1.120E+01 |
| 2001 | 3.058E-01 | 5.038E+00 | 7.000E-01 | 1.465E-04  | 1.459E+00  | 1.391E+00 | 7.249E-02 | 2.879E-01 | 1.486E-01 | 4.283E-01 | 1.447E-02 | 0.000E+00 | 9.846E+00 |
| 2002 | 1.485E-01 | 5.157E+00 | 8.225E-01 | 1.138E-04  | 1.788E+00  | 1.418E+00 | 7.062E-02 | 4.501E-01 | 1.418E-01 | 5.160E-01 | 1.085E-02 | 0.000E+00 | 1.052E+01 |
| 2003 | 1.490E-01 | 5.156E+00 | 8.516E-01 | 1.155E-04  | 2.089E+00  | 1.439E+00 | 1.226E-01 | 3.800E-01 | 1.206E-01 | 4.787E-01 | 9.107E-03 | 0.000E+00 | 1.080E+01 |
| 2004 | 4.612E-02 | 5.680E+00 | 7.776E-01 | 1.250E-04  | 1.938E+00  | 1.481E+00 | 1.231E-01 | 4.575E-01 | 1.272E-01 | 3.104E-01 | 1.022E-02 | 0.000E+00 | 1.095E+01 |
| 2005 | 7.011E-02 | 4.535E+00 | 8.087E-01 | 2.207E-04  | 1.990E+00  | 1.569E+00 | 9.387E-02 | 2.592E-01 | 1.034E-01 | 3.470E-01 | 8.572E-03 | 0.000E+00 | 9.785E+00 |
| 2006 | 7.663E-02 | 4.196E+00 | 8.691E-01 | 1.123E-04  | 1.624E+00  | 1.642E+00 | 1.398E-01 | 2.104E-01 | 1.221E-01 | 3.502E-01 | 7.164E-03 | 0.000E+00 | 9.237E+00 |
| 2007 | 6.903E-02 | 4.762E+00 | 8.285E-01 | 2.712E-04  | 1.963E-04  | 1.771E+00 | 1.395E-01 | 1.915E-01 | 1.228E-01 | 3.108E-01 | 6.800E-03 | 0.000E+00 | 8.203E+00 |
| 2008 | 6.879E-02 | 3.792E+00 | 8.488E-01 | 2.375E-04  | 2.004E-04  | 1.805E+00 | 1.434E-01 | 2.049E-01 | 1.043E-01 | 3.281E-01 | 7.183E-03 | 0.000E+00 | 7.303E+00 |
| 2009 | 4.954E-02 | 1.768E+00 | 8.443E-01 | 1.328E-04  | 2.030E-04  | 1.797E+00 | 1.112E-01 | 2.093E-01 | 1.039E-01 | 3.127E-01 | 4.958E-03 | 0.000E+00 | 5.202E+00 |
| 2010 | 5.846E-02 | 2.065E+00 | 7.823E-01 | 1.233E-04  | 1.908E-04  | 1.814E+00 | 9.377E-02 | 4.592E-01 | 1.289E-01 | 6.174E-01 | 5.117E-03 | 0.000E+00 | 6.024E+00 |
| 2011 | 4.927E-02 | 2.568E+00 | 6.823E-01 | 1.211E-04  | 1.657E-04  | 1.832E+00 | 1.084E-01 | 5.634E-01 | 1.719E-01 | 2.232E-01 | 3.870E-03 | 0.000E+00 | 6.202E+00 |
| 2012 | 9.546E-02 | 2.026E+00 | 7.381E-01 | 1.169E-04  | 1.453E-04  | 1.879E+00 | 1.011E-01 | 3.934E-01 | 1.517E-01 | 1.822E-01 | 4.099E-03 | 0.000E+00 | 5.571E+00 |
| 2013 | 5.240E-02 | 2.358E+00 | 6.780E-01 | 1.293E-04  | 1.356E-04  | 1.884E+00 | 1.202E-01 | 3.092E-01 | 1.432E-01 | 1.971E-01 | 3.632E-03 | 0.000E+00 | 5.747E+00 |
| 2014 | 5.963E-02 | 2.185E+00 | 6.831E-01 | 1.142E-04  | 1.449E-04  | 1.890E+00 | 1.097E-01 | 3.905E-01 | 1.150E-01 | 1.630E-01 | 4.653E-03 | 0.000E+00 | 5.601E+00 |
| 2015 | 4.729E-02 | 2.653E+00 | 6.666E-01 | 4.975E-03  | 1.435E-04  | 1.917E+00 | 7.899E-02 | 7.483E-01 | 1.457E-01 | 1.241E-01 | 5.117E-03 | 0.000E+00 | 6.391E+00 |
| 2016 | 5.900E-02 | 2.223E+00 | 7.015E-01 | 4.204E-03  | 1.317E-04  | 1.943E+00 | 7.517E-02 | 4.666E-01 | 1.369E-01 | 2.170E-01 | 4.998E-03 | 0.000E+00 | 5.832E+00 |
| 2017 | 6.791E-02 | 2.101E+00 | 7.227E-01 | 6.582E-03  | 1.297E-04  | 1.963E+00 | 7.504E-02 | 6.463E-01 | 1.356E-01 | 2.122E-01 | 4.928E-03 | 0.000E+00 | 5.935E+00 |
| 2018 | 6.891E-02 | 2.081E+00 | 7.501E-01 | 9.945E-03  | 1.150E-04  | 1.985E+00 | 7.463E-02 | 7.295E-01 | 1.494E-01 | 2.191E-01 | 2.805E-03 | 0.000E+00 | 6.071E+00 |
| 2019 | 9.163E-02 | 2.428E+00 | 7.022E-01 | 2.507E-03  | 1.034E-04  | 1.962E+00 | 8.348E-02 | 4.662E-01 | 1.423E-01 | 2.068E-01 | 4.905E-03 | 0.000E+00 | 6.090E+00 |
| 2020 | 1.198E-01 | 1.709E+00 | 7.512E-01 | 3.318E-04  | 1.347E-04  | 1.873E+00 | 7.816E-02 | 4.480E-01 | 1.128E-01 | 1.982E-01 | 4.960E-03 | 0.000E+00 | 5.296E+00 |
| 2021 | 7.709E-02 | 1.707E+00 | 7.393E-01 | 1.156E-02  | 1.291E-04  | 1.941E+00 | 7.618E-02 | 4.996E-01 | 1.177E-01 | 2.079E-01 | 4.260E-03 | 0.000E+00 | 5.382E+00 |
| 2022 | 1.038E-01 | 1.602E+00 | 6.967E-01 | 1.022E-02  | 9.811E-05  | 1.949E+00 | 7.822E-02 | 4.106E-01 | 1.129E-01 | 2.095E-01 | 5.012E-03 | 0.000E+00 | 5.178E+00 |
| 2023 | 1.258E-01 | 1.232E+00 | 6.560E-01 | 5.722E-05  | 9.136E-05  | 1.942E+00 | 8.118E-02 | 3.941E-01 | 1.193E-01 | 2.070E-01 | 2.936E-03 | 0.000E+00 | 4.760E+00 |

**Table B.11.** Annual anthropogenic Pb emissions in Portugal, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 1.024E+00 | 8.136E+00 | 1.459E+00 | 8.872E-02  | 8.708E-02  | 5.574E+02 | 1.403E-02 | 1.514E+00 | 3.808E-01 | 5.040E-01 | 9.533E-03 | 0.000E+00 | 5.706E+02 |
| 1991 | 1.084E+00 | 7.522E+00 | 1.393E+00 | 9.286E-02  | 9.001E-02  | 6.133E+02 | 1.383E-02 | 1.401E+00 | 4.142E-01 | 5.048E-01 | 8.588E-03 | 0.000E+00 | 6.258E+02 |
| 1992 | 1.252E+00 | 9.105E+00 | 1.346E+00 | 1.038E-01  | 9.284E-02  | 6.838E+02 | 1.358E-02 | 1.248E+00 | 5.019E-01 | 5.058E-01 | 7.053E-03 | 0.000E+00 | 6.980E+02 |
| 1993 | 1.135E+00 | 9.032E+00 | 1.317E+00 | 1.042E-01  | 9.221E-02  | 7.208E+02 | 1.330E-02 | 9.694E-01 | 4.755E-01 | 5.067E-01 | 6.252E-03 | 0.000E+00 | 7.345E+02 |
| 1994 | 1.065E+00 | 9.400E+00 | 1.303E+00 | 3.499E-01  | 9.359E-02  | 7.454E+02 | 1.306E-02 | 1.148E+00 | 4.804E-01 | 5.051E-01 | 6.409E-03 | 0.000E+00 | 7.598E+02 |
| 1995 | 1.248E+00 | 9.881E+00 | 1.304E+00 | 5.852E-01  | 9.575E-02  | 7.702E+02 | 1.215E-02 | 1.531E+00 | 5.045E-01 | 5.053E-01 | 7.963E-03 | 0.000E+00 | 7.859E+02 |
| 1996 | 9.949E-01 | 1.031E+01 | 1.308E+00 | 5.253E-01  | 1.109E-01  | 3.012E+02 | 1.269E-02 | 1.233E+00 | 2.094E-01 | 5.573E-01 | 8.368E-03 | 0.000E+00 | 3.165E+02 |
| 1997 | 1.043E+00 | 1.096E+01 | 1.273E+00 | 6.450E-01  | 1.845E-01  | 3.041E+02 | 1.315E-02 | 1.501E+00 | 2.114E-01 | 6.382E-01 | 8.790E-03 | 0.000E+00 | 3.205E+02 |
| 1998 | 1.109E+00 | 1.067E+01 | 1.242E+00 | 6.086E-01  | 1.952E-01  | 3.168E+02 | 1.344E-02 | 1.540E+00 | 2.097E-01 | 4.978E-01 | 8.446E-03 | 0.000E+00 | 3.329E+02 |
| 1999 | 1.341E+00 | 1.147E+01 | 1.207E+00 | 5.973E-01  | 1.834E-01  | 3.205E+02 | 1.209E-02 | 1.571E+00 | 1.787E-01 | 4.483E-01 | 8.081E-03 | 0.000E+00 | 3.375E+02 |
| 2000 | 1.239E+00 | 1.200E+01 | 1.173E+00 | 5.463E-01  | 3.304E-01  | 2.172E+01 | 1.077E-02 | 1.883E+00 | 2.190E-02 | 3.309E-01 | 6.790E-03 | 0.000E+00 | 3.927E+01 |
| 2001 | 1.229E+00 | 1.036E+01 | 1.139E+00 | 5.314E-01  | 4.374E-01  | 2.111E+01 | 1.040E-02 | 1.843E+00 | 2.197E-02 | 1.933E-01 | 6.679E-03 | 0.000E+00 | 3.688E+01 |
| 2002 | 1.418E+00 | 1.012E+01 | 1.102E+00 | 4.957E-01  | 3.529E-01  | 2.186E+01 | 1.091E-02 | 1.867E+00 | 1.788E-02 | 1.824E-01 | 6.637E-03 | 0.000E+00 | 3.744E+01 |
| 2003 | 1.199E+00 | 1.039E+01 | 1.065E+00 | 5.801E-01  | 5.566E-01  | 2.133E+01 | 1.098E-02 | 1.589E+00 | 1.522E-02 | 1.770E-01 | 6.841E-03 | 0.000E+00 | 3.693E+01 |
| 2004 | 1.205E+00 | 1.136E+01 | 1.030E+00 | 5.886E-01  | 5.938E-01  | 2.081E+01 | 1.121E-02 | 1.478E+00 | 1.669E-02 | 1.566E-01 | 6.331E-03 | 0.000E+00 | 3.725E+01 |
| 2005 | 1.358E+00 | 1.155E+01 | 9.940E-01 | 5.464E-01  | 6.104E-01  | 1.978E+01 | 1.118E-02 | 1.754E+00 | 1.489E-02 | 9.418E-02 | 6.549E-03 | 0.000E+00 | 3.671E+01 |
| 2006 | 1.211E+00 | 1.234E+01 | 9.553E-01 | 5.423E-01  | 7.798E-01  | 1.891E+01 | 1.119E-02 | 1.743E+00 | 1.515E-02 | 9.207E-02 | 6.344E-03 | 0.000E+00 | 3.660E+01 |
| 2007 | 1.015E+00 | 1.304E+01 | 9.175E-01 | 5.448E-01  | 7.088E-01  | 1.810E+01 | 1.119E-02 | 1.669E+00 | 1.336E-02 | 9.694E-02 | 6.723E-03 | 0.000E+00 | 3.612E+01 |
| 2008 | 9.354E-01 | 1.342E+01 | 8.804E-01 | 4.436E-01  | 7.836E-01  | 1.736E+01 | 1.142E-02 | 1.824E+00 | 1.313E-02 | 9.672E-02 | 6.929E-03 | 0.000E+00 | 3.577E+01 |
| 2009 | 1.055E+00 | 1.209E+01 | 8.448E-01 | 4.110E-01  | 2.417E-01  | 1.734E+01 | 1.210E-02 | 1.824E+00 | 1.424E-02 | 7.095E-02 | 7.118E-03 | 0.000E+00 | 3.392E+01 |
| 2010 | 7.355E-01 | 1.205E+01 | 8.089E-01 | 4.588E-01  | 6.763E-01  | 1.693E+01 | 1.225E-02 | 2.295E+00 | 1.315E-02 | 6.119E-02 | 7.326E-03 | 0.000E+00 | 3.404E+01 |
| 2011 | 9.005E-01 | 1.243E+01 | 1.054E+00 | 4.313E-01  | 6.248E-01  | 1.536E+01 | 1.088E-02 | 1.807E+00 | 1.024E-02 | 6.060E-02 | 7.839E-03 | 0.000E+00 | 3.270E+01 |
| 2012 | 1.101E+00 | 1.257E+01 | 9.757E-01 | 4.552E-01  | 5.901E-01  | 1.408E+01 | 1.215E-02 | 1.015E+00 | 1.061E-02 | 6.903E-02 | 7.856E-03 | 0.000E+00 | 3.089E+01 |
| 2013 | 1.019E+00 | 1.291E+01 | 9.918E-01 | 3.523E-01  | 4.026E-01  | 1.364E+01 | 1.333E-02 | 9.343E-01 | 1.203E-02 | 5.486E-02 | 7.685E-03 | 0.000E+00 | 3.034E+01 |
| 2014 | 1.037E+00 | 1.302E+01 | 1.007E+00 | 2.665E-01  | 4.789E-01  | 1.379E+01 | 1.408E-02 | 1.067E+00 | 9.037E-03 | 5.582E-02 | 7.250E-03 | 0.000E+00 | 3.076E+01 |
| 2015 | 1.214E+00 | 1.270E+01 | 9.740E-01 | 3.423E-01  | 4.170E-01  | 1.347E+01 | 1.511E-02 | 1.006E+00 | 1.033E-02 | 5.209E-02 | 6.904E-03 | 0.000E+00 | 3.021E+01 |
| 2016 | 1.077E+00 | 1.242E+01 | 9.634E-01 | 3.097E-01  | 6.500E-01  | 1.338E+01 | 1.400E-02 | 1.005E+00 | 1.171E-02 | 5.759E-02 | 6.548E-03 | 0.000E+00 | 2.990E+01 |
| 2017 | 1.189E+00 | 1.256E+01 | 9.694E-01 | 3.379E-01  | 6.697E-01  | 1.332E+01 | 1.433E-02 | 9.694E-01 | 6.609E-03 | 6.400E-02 | 6.705E-03 | 0.000E+00 | 3.011E+01 |
| 2018 | 1.060E+00 | 1.338E+01 | 9.628E-01 | 2.554E-01  | 7.046E-01  | 1.335E+01 | 1.405E-02 | 6.436E-01 | 6.826E-03 | 7.033E-02 | 6.291E-03 | 0.000E+00 | 3.045E+01 |
| 2019 | 6.286E-01 | 1.278E+01 | 9.548E-01 | 3.622E-01  | 7.543E-01  | 1.378E+01 | 1.442E-02 | 8.811E-01 | 7.593E-03 | 7.326E-02 | 6.271E-03 | 0.000E+00 | 3.024E+01 |
| 2020 | 4.109E-01 | 1.288E+01 | 9.478E-01 | 2.548E-01  | 1.971E-01  | 1.158E+01 | 1.079E-02 | 8.581E-01 | 9.469E-03 | 7.795E-02 | 5.460E-03 | 0.000E+00 | 2.723E+01 |
| 2021 | 2.928E-01 | 1.270E+01 | 9.536E-01 | 4.796E-01  | 2.205E-01  | 1.256E+01 | 1.106E-02 | 9.464E-01 | 1.126E-02 | 7.223E-02 | 6.746E-03 | 0.000E+00 | 2.826E+01 |
| 2022 | 2.384E-01 | 1.279E+01 | 9.668E-01 | 1.836E-01  | 6.297E-01  | 1.354E+01 | 1.485E-02 | 1.286E+00 | 8.552E-03 | 7.139E-02 | 6.052E-03 | 0.000E+00 | 2.973E+01 |
| 2023 | 2.422E-01 | 1.299E+01 | 9.876E-01 | 1.739E-01  | 7.121E-01  | 1.470E+01 | 1.564E-02 | 1.149E+00 | 9.952E-03 | 6.447E-02 | 6.623E-03 | 0.000E+00 | 3.105E+01 |



**Table B.12.** Annual anthropogenic Pb emissions in Spain, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 2.860E+00 | 8.124E+01 | 5.868E+00 | 1.218E-03  | 1.442E-03  | 3.084E+03 | 1.828E-01 | 7.171E-01 | 7.669E-01 | 6.044E+00 | 7.728E-01 | 0.000E+00 | 3.182E+03 |
| 1991 | 2.769E+00 | 8.190E+01 | 6.875E+00 | 1.264E-03  | 1.442E-03  | 1.964E+03 | 1.988E-01 | 7.823E-01 | 6.419E-01 | 5.697E+00 | 7.814E-01 | 0.000E+00 | 2.063E+03 |
| 1992 | 3.918E+00 | 6.804E+01 | 7.436E+00 | 1.379E-03  | 1.441E-03  | 1.245E+03 | 1.957E-01 | 5.882E-01 | 4.825E-01 | 6.068E+00 | 7.140E-01 | 0.000E+00 | 1.333E+03 |
| 1993 | 2.225E+00 | 6.817E+01 | 6.529E+00 | 1.428E-03  | 1.441E-03  | 1.031E+03 | 1.979E-01 | 5.882E-01 | 4.520E-01 | 5.278E+00 | 6.725E-01 | 0.000E+00 | 1.115E+03 |
| 1994 | 2.234E+00 | 7.366E+01 | 6.295E+00 | 1.553E-03  | 1.440E-03  | 9.462E+02 | 1.932E-01 | 8.451E-05 | 2.313E-01 | 5.639E+00 | 5.986E-01 | 0.000E+00 | 1.035E+03 |
| 1995 | 3.118E+00 | 8.483E+01 | 5.264E+00 | 1.491E-03  | 1.440E-03  | 6.914E+02 | 1.767E-01 | 9.252E-05 | 2.017E-01 | 4.870E+00 | 5.099E-01 | 0.000E+00 | 7.903E+02 |
| 1996 | 2.372E+00 | 8.357E+01 | 5.213E+00 | 1.502E-03  | 1.735E-03  | 5.783E+02 | 1.782E-01 | 5.549E-01 | 3.564E-01 | 7.900E+00 | 6.759E-01 | 0.000E+00 | 6.791E+02 |
| 1997 | 5.167E+00 | 8.054E+01 | 5.215E+00 | 1.509E-03  | 1.695E-03  | 4.812E+02 | 1.357E-01 | 6.507E-01 | 3.814E-01 | 9.405E+00 | 5.792E-01 | 0.000E+00 | 5.833E+02 |
| 1998 | 3.844E+00 | 7.886E+01 | 4.960E+00 | 1.611E-03  | 2.222E-03  | 3.931E+02 | 1.427E-01 | 6.758E-01 | 3.880E-01 | 8.281E+00 | 6.093E-01 | 0.000E+00 | 4.909E+02 |
| 1999 | 4.501E+00 | 8.284E+01 | 4.521E+00 | 1.624E-03  | 2.095E-03  | 3.054E+02 | 1.352E-01 | 5.621E-01 | 3.538E-01 | 8.496E+00 | 5.829E-01 | 0.000E+00 | 4.074E+02 |
| 2000 | 4.322E+00 | 7.534E+01 | 4.640E+00 | 1.615E-03  | 2.621E-03  | 1.842E+02 | 1.125E-01 | 5.992E-01 | 3.489E-01 | 9.796E+00 | 2.558E-01 | 0.000E+00 | 2.796E+02 |
| 2001 | 4.641E+00 | 6.505E+01 | 4.943E+00 | 1.595E-03  | 2.429E-03  | 7.344E+01 | 1.187E-01 | 6.765E-01 | 3.562E-01 | 1.001E+01 | 4.154E-02 | 0.000E+00 | 1.593E+02 |
| 2002 | 5.645E+00 | 6.596E+01 | 4.999E+00 | 1.551E-03  | 2.542E-03  | 6.328E+01 | 1.224E-01 | 7.032E-01 | 3.990E-01 | 9.419E+00 | 5.402E-02 | 0.000E+00 | 1.506E+02 |
| 2003 | 3.962E+00 | 6.487E+01 | 4.937E+00 | 1.441E-03  | 3.094E-03  | 6.442E+01 | 1.416E-01 | 6.957E-01 | 3.509E-01 | 1.181E+01 | 4.792E-02 | 0.000E+00 | 1.512E+02 |
| 2004 | 4.283E+00 | 6.683E+01 | 5.202E+00 | 1.608E-03  | 3.916E-03  | 6.179E+01 | 1.386E-01 | 6.137E-01 | 3.268E-01 | 8.611E+00 | 0.000E+00 | 0.000E+00 | 1.478E+02 |
| 2005 | 4.440E+00 | 6.516E+01 | 5.277E+00 | 1.551E-03  | 4.057E-03  | 6.103E+01 | 1.332E-01 | 5.634E-01 | 3.263E-01 | 7.794E+00 | 0.000E+00 | 0.000E+00 | 1.447E+02 |
| 2006 | 3.380E+00 | 6.580E+01 | 5.080E+00 | 1.634E-03  | 4.808E-03  | 6.252E+01 | 1.463E-01 | 6.188E-01 | 3.214E-01 | 8.462E+00 | 0.000E+00 | 0.000E+00 | 1.463E+02 |
| 2007 | 2.583E+00 | 6.755E+01 | 4.766E+00 | 1.593E-03  | 5.102E-03  | 6.233E+01 | 1.309E-01 | 6.798E-01 | 3.470E-01 | 1.085E+01 | 0.000E+00 | 0.000E+00 | 1.492E+02 |
| 2008 | 1.930E+00 | 6.607E+01 | 4.845E+00 | 1.557E-03  | 4.953E-03  | 5.696E+01 | 1.120E-01 | 6.566E-01 | 2.230E-01 | 1.026E+01 | 0.000E+00 | 0.000E+00 | 1.411E+02 |
| 2009 | 1.702E+00 | 5.354E+01 | 5.452E+00 | 1.568E-03  | 3.438E-03  | 5.595E+01 | 9.263E-02 | 6.459E-01 | 2.115E-01 | 9.573E+00 | 0.000E+00 | 0.000E+00 | 1.272E+02 |
| 2010 | 1.559E+00 | 6.069E+01 | 5.166E+00 | 1.503E-03  | 3.586E-03  | 5.358E+01 | 8.160E-02 | 5.299E-01 | 2.264E-01 | 9.953E+00 | 0.000E+00 | 0.000E+00 | 1.318E+02 |
| 2011 | 1.715E+00 | 5.884E+01 | 4.885E+00 | 1.440E-03  | 3.700E-03  | 2.581E+01 | 6.559E-02 | 4.527E-01 | 2.022E-01 | 1.048E+01 | 0.000E+00 | 0.000E+00 | 1.025E+02 |
| 2012 | 2.188E+00 | 5.385E+01 | 4.735E+00 | 1.297E-03  | 3.021E-03  | 2.407E+01 | 6.932E-02 | 4.032E-01 | 2.078E-01 | 8.677E+00 | 0.000E+00 | 0.000E+00 | 9.420E+01 |
| 2013 | 1.952E+00 | 5.397E+01 | 4.539E+00 | 1.374E-03  | 3.035E-03  | 3.161E+01 | 3.861E-02 | 3.635E-01 | 2.270E-01 | 1.071E+01 | 0.000E+00 | 0.000E+00 | 1.034E+02 |
| 2014 | 1.862E+00 | 5.657E+01 | 4.392E+00 | 1.475E-03  | 2.990E-03  | 3.178E+01 | 2.683E-02 | 2.223E-01 | 2.403E-01 | 8.619E+00 | 0.000E+00 | 0.000E+00 | 1.037E+02 |
| 2015 | 2.308E+00 | 6.171E+01 | 4.217E+00 | 1.512E-03  | 2.998E-03  | 3.187E+01 | 3.722E-02 | 2.616E-01 | 2.381E-01 | 9.848E+00 | 0.000E+00 | 0.000E+00 | 1.105E+02 |
| 2016 | 1.732E+00 | 5.774E+01 | 3.427E+00 | 1.600E-03  | 3.203E-03  | 3.309E+01 | 5.748E-02 | 2.619E-01 | 2.304E-01 | 9.352E+00 | 0.000E+00 | 0.000E+00 | 1.059E+02 |
| 2017 | 1.734E+00 | 5.416E+01 | 3.791E+00 | 1.497E-03  | 2.986E-03  | 3.385E+01 | 9.538E-02 | 2.881E-01 | 2.727E-01 | 9.043E+00 | 0.000E+00 | 0.000E+00 | 1.032E+02 |
| 2018 | 1.713E+00 | 5.547E+01 | 3.838E+00 | 1.504E-03  | 3.274E-03  | 2.236E+01 | 9.651E-02 | 2.883E-01 | 2.625E-01 | 1.133E+01 | 0.000E+00 | 0.000E+00 | 9.537E+01 |
| 2019 | 7.600E-01 | 5.419E+01 | 3.517E+00 | 1.386E-03  | 3.212E-03  | 3.503E+01 | 9.964E-02 | 3.194E-01 | 3.264E-01 | 8.759E+00 | 0.000E+00 | 0.000E+00 | 1.030E+02 |
| 2020 | 5.399E-01 | 4.273E+01 | 3.363E+00 | 1.132E-03  | 1.549E-03  | 2.863E+01 | 6.360E-02 | 2.491E-01 | 3.075E-01 | 1.007E+01 | 0.000E+00 | 0.000E+00 | 8.595E+01 |
| 2021 | 4.346E-01 | 5.315E+01 | 2.967E+00 | 1.251E-03  | 1.143E-03  | 3.210E+01 | 7.724E-02 | 3.292E-01 | 3.854E-01 | 1.029E+01 | 1.895E-03 | 0.000E+00 | 9.974E+01 |
| 2022 | 5.981E-01 | 5.044E+01 | 2.978E+00 | 1.423E-03  | 3.443E-03  | 3.432E+01 | 1.002E-01 | 3.101E-01 | 3.838E-01 | 7.290E+00 | 0.000E+00 | 0.000E+00 | 9.642E+01 |
| 2023 | 3.622E-01 | 4.784E+01 | 2.921E+00 | 1.216E-03  | 3.921E-03  | 5.312E+01 | 8.478E-02 | 3.169E-01 | 1.408E-01 | 7.296E+00 | 2.026E-03 | 0.000E+00 | 1.121E+02 |

**Table B.13.** Annual anthropogenic Pb emissions in Sweden, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 2.747E+00 | 8.083E+01 | 1.144E+00 | 1.406E-03  | 4.237E-04  | 2.792E+02 | 2.226E-02 | 9.484E-01 | 1.937E+00 | 9.017E-03 | 0.000E+00 | 0.000E+00 | 3.669E+02 |
| 1991 | 2.157E+00 | 5.461E+01 | 1.137E+00 | 9.069E-04  | 4.197E-04  | 2.616E+02 | 2.284E-02 | 9.079E-01 | 2.132E+00 | 9.279E-03 | 0.000E+00 | 0.000E+00 | 3.226E+02 |
| 1992 | 1.987E+00 | 5.439E+01 | 1.038E+00 | 9.708E-04  | 4.379E-04  | 2.435E+02 | 2.343E-02 | 7.549E-01 | 2.328E+00 | 9.230E-03 | 0.000E+00 | 0.000E+00 | 3.041E+02 |
| 1993 | 1.955E+00 | 3.611E+01 | 1.057E+00 | 1.213E-03  | 3.559E-04  | 9.945E+01 | 2.402E-02 | 8.229E-01 | 1.574E+00 | 9.271E-03 | 0.000E+00 | 0.000E+00 | 1.410E+02 |
| 1994 | 1.977E+00 | 2.509E+01 | 1.015E+00 | 9.956E-04  | 3.555E-04  | 1.502E+01 | 2.462E-02 | 9.439E-01 | 9.495E-01 | 9.051E-03 | 0.000E+00 | 0.000E+00 | 4.502E+01 |
| 1995 | 1.738E+00 | 1.797E+01 | 1.001E+00 | 1.220E-03  | 3.344E-04  | 4.266E+00 | 2.521E-02 | 1.060E+00 | 5.493E-01 | 9.077E-03 | 0.000E+00 | 0.000E+00 | 2.662E+01 |
| 1996 | 2.616E+00 | 1.318E+01 | 1.001E+00 | 5.995E-04  | 3.396E-04  | 3.334E+00 | 2.386E-02 | 9.319E-01 | 4.792E-01 | 2.740E-01 | 0.000E+00 | 0.000E+00 | 2.184E+01 |
| 1997 | 1.832E+00 | 1.439E+01 | 9.340E-01 | 7.885E-04  | 2.636E-04  | 3.347E+00 | 2.442E-02 | 8.511E-01 | 4.733E-01 | 3.156E-01 | 0.000E+00 | 0.000E+00 | 2.217E+01 |
| 1998 | 2.015E+00 | 1.365E+01 | 8.384E-01 | 9.275E-04  | 2.468E-04  | 3.270E+00 | 2.394E-02 | 7.887E-01 | 2.602E-01 | 2.838E-01 | 0.000E+00 | 0.000E+00 | 2.113E+01 |
| 1999 | 1.505E+00 | 1.261E+01 | 8.260E-01 | 9.452E-04  | 2.750E-04  | 3.074E+00 | 2.444E-02 | 8.198E-01 | 1.714E-01 | 2.192E-01 | 0.000E+00 | 0.000E+00 | 1.925E+01 |
| 2000 | 1.305E+00 | 1.091E+01 | 8.303E-01 | 1.089E-03  | 2.799E-04  | 2.534E+00 | 2.393E-02 | 8.720E-01 | 5.859E-02 | 1.521E-01 | 0.000E+00 | 0.000E+00 | 1.669E+01 |
| 2001 | 1.591E+00 | 9.771E+00 | 7.755E-01 | 1.105E-03  | 2.857E-04  | 2.221E+00 | 2.323E-02 | 8.661E-01 | 6.382E-02 | 1.663E-01 | 0.000E+00 | 0.000E+00 | 1.548E+01 |
| 2002 | 1.722E+00 | 7.595E+00 | 7.961E-01 | 1.438E-03  | 2.903E-04  | 1.794E+00 | 2.363E-02 | 7.812E-01 | 1.746E-01 | 1.873E-01 | 0.000E+00 | 0.000E+00 | 1.308E+01 |
| 2003 | 1.896E+00 | 8.307E+00 | 8.548E-01 | 1.487E-03  | 2.839E-04  | 1.302E+00 | 2.426E-02 | 6.499E-01 | 9.156E-02 | 1.628E-01 | 0.000E+00 | 0.000E+00 | 1.329E+01 |
| 2004 | 1.763E+00 | 8.435E+00 | 8.277E-01 | 1.378E-03  | 2.719E-04  | 7.679E-01 | 2.302E-02 | 6.043E-01 | 6.343E-02 | 1.308E-01 | 0.000E+00 | 0.000E+00 | 1.262E+01 |
| 2005 | 1.785E+00 | 7.495E+00 | 8.179E-01 | 1.425E-03  | 2.860E-04  | 2.562E-01 | 2.139E-02 | 5.655E-01 | 6.176E-02 | 4.295E-01 | 0.000E+00 | 0.000E+00 | 1.143E+01 |
| 2006 | 1.877E+00 | 6.999E+00 | 7.529E-01 | 3.847E-03  | 2.699E-04  | 2.420E-01 | 2.084E-02 | 5.439E-01 | 6.781E-02 | 4.930E-01 | 0.000E+00 | 0.000E+00 | 1.100E+01 |
| 2007 | 2.123E+00 | 7.577E+00 | 8.060E-01 | 1.327E-03  | 2.441E-04  | 2.571E-01 | 2.003E-02 | 4.898E-01 | 8.604E-02 | 4.140E-01 | 0.000E+00 | 0.000E+00 | 1.177E+01 |
| 2008 | 2.199E+00 | 6.013E+00 | 8.034E-01 | 5.770E-04  | 2.081E-04  | 2.522E-01 | 1.922E-02 | 4.674E-01 | 2.977E-02 | 4.131E-01 | 0.000E+00 | 0.000E+00 | 1.020E+01 |
| 2009 | 1.946E+00 | 5.529E+00 | 8.404E-01 | 7.786E-04  | 2.163E-04  | 2.551E-01 | 1.902E-02 | 4.681E-01 | 2.800E-02 | 3.380E-01 | 0.000E+00 | 0.000E+00 | 9.424E+00 |
| 2010 | 2.701E+00 | 5.722E+00 | 8.329E-01 | 7.173E-04  | 2.162E-04  | 2.623E-01 | 2.000E-02 | 4.408E-01 | 2.168E-02 | 2.465E-01 | 0.000E+00 | 0.000E+00 | 1.025E+01 |
| 2011 | 2.227E+00 | 4.879E+00 | 8.423E-01 | 6.540E-04  | 2.209E-04  | 2.663E-01 | 1.998E-02 | 4.871E-01 | 1.534E-02 | 3.416E-01 | 0.000E+00 | 0.000E+00 | 9.080E+00 |
| 2012 | 2.244E+00 | 5.076E+00 | 8.257E-01 | 7.331E-04  | 2.077E-04  | 2.545E-01 | 1.789E-02 | 3.556E-01 | 2.926E-02 | 2.393E-01 | 0.000E+00 | 0.000E+00 | 9.043E+00 |
| 2013 | 2.215E+00 | 4.488E+00 | 7.977E-01 | 1.471E-03  | 1.997E-04  | 2.647E-01 | 1.802E-02 | 3.752E-01 | 1.014E-02 | 3.835E-01 | 0.000E+00 | 0.000E+00 | 8.554E+00 |
| 2014 | 1.965E+00 | 5.433E+00 | 7.388E-01 | 9.124E-04  | 2.034E-04  | 2.621E-01 | 1.688E-02 | 2.910E-01 | 1.051E-02 | 7.489E-02 | 0.000E+00 | 0.000E+00 | 8.793E+00 |
| 2015 | 1.955E+00 | 4.788E+00 | 7.353E-01 | 7.860E-04  | 1.932E-04  | 2.939E-01 | 1.625E-02 | 2.326E-01 | 1.187E-02 | 1.290E-01 | 0.000E+00 | 0.000E+00 | 8.163E+00 |
| 2016 | 2.124E+00 | 5.490E+00 | 7.550E-01 | 9.041E-04  | 1.913E-04  | 3.004E-01 | 1.710E-02 | 2.165E-01 | 2.625E-02 | 1.063E-01 | 0.000E+00 | 0.000E+00 | 9.036E+00 |
| 2017 | 2.146E+00 | 5.458E+00 | 7.658E-01 | 6.239E-04  | 1.824E-04  | 2.982E-01 | 1.673E-02 | 1.977E-01 | 5.332E-02 | 1.356E-01 | 0.000E+00 | 0.000E+00 | 9.073E+00 |
| 2018 | 2.134E+00 | 4.455E+00 | 6.706E-01 | 5.964E-04  | 1.789E-04  | 3.110E-01 | 1.878E-02 | 1.717E-01 | 1.044E-02 | 2.052E-01 | 0.000E+00 | 0.000E+00 | 7.978E+00 |
| 2019 | 2.142E+00 | 4.817E+00 | 6.596E-01 | 1.155E-03  | 1.743E-04  | 3.021E-01 | 1.704E-02 | 1.331E-01 | 1.013E-02 | 1.691E-01 | 0.000E+00 | 0.000E+00 | 8.252E+00 |
| 2020 | 1.941E+00 | 3.813E+00 | 6.534E-01 | 8.220E-04  | 1.679E-04  | 2.847E-01 | 1.481E-02 | 1.306E-01 | 9.921E-03 | 8.609E-01 | 0.000E+00 | 0.000E+00 | 7.709E+00 |
| 2021 | 2.441E+00 | 2.954E+00 | 6.552E-01 | 0.000E+00  | 1.610E-04  | 3.100E-01 | 1.492E-02 | 1.264E-01 | 1.080E-02 | 1.992E-01 | 0.000E+00 | 0.000E+00 | 6.712E+00 |
| 2022 | 2.369E+00 | 3.009E+00 | 6.257E-01 | 0.000E+00  | 1.626E-04  | 3.122E-01 | 1.862E-02 | 1.268E-01 | 1.099E-02 | 8.922E-02 | 0.000E+00 | 0.000E+00 | 6.562E+00 |
| 2023 | 2.281E+00 | 3.359E+00 | 6.257E-01 | 0.000E+00  | 1.512E-04  | 3.078E-01 | 2.043E-02 | 1.150E-01 | 1.046E-02 | 1.067E-01 | 0.000E+00 | 0.000E+00 | 6.826E+00 |

**Table B.14.** Annual anthropogenic Pb emissions in Switzerland, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 2.982E+01 | 6.582E+01 | 1.281E+00 | 3.536E+00  | 7.273E+00  | 2.552E+02 | 1.168E+00 | 2.082E+00 | 2.854E+00 | 4.334E+00 | 0.000E+00 | 7.612E+00 | 3.810E+02 |
| 1991 | 2.626E+01 | 6.957E+01 | 1.392E+00 | 3.046E+00  | 6.598E+00  | 2.273E+02 | 1.001E+00 | 1.930E+00 | 2.481E+00 | 4.114E+00 | 0.000E+00 | 8.321E+00 | 3.520E+02 |
| 1992 | 2.415E+01 | 7.552E+01 | 1.297E+00 | 2.496E+00  | 6.029E+00  | 1.970E+02 | 8.385E-01 | 1.947E+00 | 2.108E+00 | 3.886E+00 | 0.000E+00 | 8.442E+00 | 3.237E+02 |
| 1993 | 2.187E+01 | 7.816E+01 | 1.252E+00 | 1.703E+00  | 5.428E+00  | 1.423E+02 | 6.797E-01 | 1.919E+00 | 1.735E+00 | 3.597E+00 | 0.000E+00 | 7.975E+00 | 2.666E+02 |
| 1994 | 1.961E+01 | 7.646E+01 | 1.134E+00 | 1.091E+00  | 4.873E+00  | 1.168E+02 | 5.249E-01 | 1.869E+00 | 1.362E+00 | 3.190E+00 | 0.000E+00 | 7.882E+00 | 2.348E+02 |
| 1995 | 1.777E+01 | 4.924E+01 | 1.172E+00 | 4.651E-01  | 4.558E+00  | 8.493E+01 | 3.741E-01 | 1.872E+00 | 9.892E-01 | 2.940E+00 | 0.000E+00 | 7.473E+00 | 1.718E+02 |
| 1996 | 1.608E+01 | 4.795E+01 | 1.207E+00 | 3.821E-01  | 4.212E+00  | 6.524E+01 | 2.996E-01 | 1.814E+00 | 8.004E-01 | 2.793E+00 | 0.000E+00 | 8.924E+00 | 1.497E+02 |
| 1997 | 1.423E+01 | 4.882E+01 | 1.036E+00 | 2.977E-01  | 3.613E+00  | 5.287E+01 | 2.265E-01 | 1.745E+00 | 6.123E-01 | 2.725E+00 | 0.000E+00 | 8.063E+00 | 1.342E+02 |
| 1998 | 1.265E+01 | 2.800E+01 | 1.016E+00 | 2.004E-01  | 4.048E+00  | 3.420E+01 | 1.547E-01 | 1.685E+00 | 4.251E-01 | 2.647E+00 | 0.000E+00 | 7.221E+00 | 9.225E+01 |
| 1999 | 1.105E+01 | 6.840E+00 | 9.851E-01 | 1.042E-01  | 4.587E+00  | 1.967E+01 | 8.434E-02 | 1.657E+00 | 2.387E-01 | 2.700E+00 | 0.000E+00 | 7.750E+00 | 5.567E+01 |
| 2000 | 9.406E+00 | 3.535E+00 | 8.967E-01 | 1.180E-03  | 3.792E+00  | 3.970E+00 | 1.536E-02 | 1.576E+00 | 5.305E-02 | 2.649E+00 | 0.000E+00 | 7.691E+00 | 3.359E+01 |
| 2001 | 7.142E+00 | 3.572E+00 | 9.241E-01 | 1.250E-03  | 3.203E+00  | 1.325E-01 | 1.246E-02 | 1.429E+00 | 4.506E-02 | 2.539E+00 | 0.000E+00 | 8.380E+00 | 2.738E+01 |
| 2002 | 4.668E+00 | 2.963E+00 | 8.612E-01 | 1.249E-03  | 3.904E+00  | 1.325E-01 | 9.585E-03 | 1.266E+00 | 3.723E-02 | 2.479E+00 | 0.000E+00 | 7.598E+00 | 2.392E+01 |
| 2003 | 1.953E+00 | 2.973E+00 | 8.949E-01 | 1.179E-03  | 3.415E+00  | 1.351E-01 | 6.725E-03 | 1.213E+00 | 2.954E-02 | 2.403E+00 | 0.000E+00 | 8.095E+00 | 2.112E+01 |
| 2004 | 1.940E+00 | 2.983E+00 | 9.206E-01 | 1.324E-03  | 3.000E+00  | 1.377E-01 | 3.882E-03 | 1.217E+00 | 2.201E-02 | 2.373E+00 | 0.000E+00 | 7.347E+00 | 1.995E+01 |
| 2005 | 1.926E+00 | 2.935E+00 | 9.323E-01 | 1.073E-03  | 1.850E+00  | 1.406E-01 | 1.058E-03 | 1.063E+00 | 1.463E-02 | 2.317E+00 | 0.000E+00 | 6.837E+00 | 1.802E+01 |
| 2006 | 2.012E+00 | 2.159E+00 | 9.239E-01 | 5.009E-04  | 1.711E+00  | 1.432E-01 | 1.068E-03 | 1.029E+00 | 1.475E-02 | 2.422E+00 | 0.000E+00 | 6.011E+00 | 1.643E+01 |
| 2007 | 1.923E+00 | 2.294E+00 | 8.346E-01 | 4.962E-04  | 1.514E+00  | 1.478E-01 | 1.077E-03 | 9.674E-01 | 1.487E-02 | 2.379E+00 | 0.000E+00 | 5.698E+00 | 1.577E+01 |
| 2008 | 1.844E+00 | 2.214E+00 | 9.006E-01 | 6.019E-04  | 1.252E+00  | 1.530E-01 | 1.086E-03 | 9.359E-01 | 1.499E-02 | 2.427E+00 | 0.000E+00 | 4.630E+00 | 1.437E+01 |
| 2009 | 1.768E+00 | 1.957E+00 | 8.682E-01 | 4.270E-04  | 8.703E-01  | 1.519E-01 | 1.094E-03 | 9.363E-01 | 1.511E-02 | 2.267E+00 | 0.000E+00 | 4.788E+00 | 1.362E+01 |
| 2010 | 1.763E+00 | 2.041E+00 | 8.957E-01 | 4.261E-04  | 4.289E-01  | 1.523E-01 | 1.102E-03 | 8.542E-01 | 1.524E-02 | 2.305E+00 | 0.000E+00 | 3.769E+00 | 1.223E+01 |
| 2011 | 1.672E+00 | 1.468E+00 | 6.933E-01 | 3.536E-04  | 4.717E-01  | 1.519E-01 | 1.104E-03 | 9.395E-01 | 1.516E-02 | 2.228E+00 | 0.000E+00 | 4.008E+00 | 1.165E+01 |
| 2012 | 1.678E+00 | 1.343E+00 | 7.170E-01 | 2.345E-04  | 4.608E-01  | 1.549E-01 | 1.105E-03 | 8.356E-01 | 1.508E-02 | 2.226E+00 | 0.000E+00 | 3.320E+00 | 1.075E+01 |
| 2013 | 1.637E+00 | 1.283E+00 | 7.199E-01 | 2.780E-04  | 5.122E-01  | 1.558E-01 | 1.107E-03 | 7.929E-01 | 1.500E-02 | 2.234E+00 | 0.000E+00 | 2.863E+00 | 1.021E+01 |
| 2014 | 1.438E+00 | 1.361E+00 | 6.386E-01 | 3.311E-04  | 4.434E-01  | 1.560E-01 | 1.108E-03 | 8.211E-01 | 1.493E-02 | 2.185E+00 | 0.000E+00 | 3.000E+00 | 1.006E+01 |
| 2015 | 1.492E+00 | 1.288E+00 | 6.751E-01 | 1.867E-04  | 4.183E-01  | 1.511E-01 | 1.109E-03 | 7.865E-01 | 1.485E-02 | 2.206E+00 | 0.000E+00 | 2.595E+00 | 9.629E+00 |
| 2016 | 1.567E+00 | 1.305E+00 | 7.358E-01 | 1.058E-05  | 3.657E-01  | 1.517E-01 | 1.108E-03 | 7.456E-01 | 1.483E-02 | 2.106E+00 | 0.000E+00 | 2.436E+00 | 9.429E+00 |
| 2017 | 1.614E+00 | 1.323E+00 | 6.841E-01 | 8.647E-06  | 4.324E-01  | 1.517E-01 | 1.107E-03 | 7.589E-01 | 1.480E-02 | 1.955E+00 | 0.000E+00 | 2.602E+00 | 9.537E+00 |
| 2018 | 1.669E+00 | 1.234E+00 | 6.307E-01 | 8.807E-06  | 4.450E-01  | 1.543E-01 | 1.107E-03 | 7.372E-01 | 1.477E-02 | 1.828E+00 | 0.000E+00 | 2.238E+00 | 8.952E+00 |
| 2019 | 1.678E+00 | 1.120E+00 | 6.445E-01 | 5.670E-06  | 3.385E-01  | 1.537E-01 | 1.106E-03 | 7.052E-01 | 1.474E-02 | 1.775E+00 | 0.000E+00 | 1.801E+00 | 8.232E+00 |
| 2020 | 1.662E+00 | 1.100E+00 | 6.025E-01 | 6.488E-06  | 3.445E-01  | 1.416E-01 | 1.105E-03 | 7.246E-01 | 1.470E-02 | 1.738E+00 | 0.000E+00 | 1.651E+00 | 7.979E+00 |
| 2021 | 1.661E+00 | 1.268E+00 | 6.935E-01 | 4.860E-06  | 4.050E-01  | 1.428E-01 | 1.104E-03 | 7.849E-01 | 1.472E-02 | 1.709E+00 | 0.000E+00 | 1.839E+00 | 8.519E+00 |
| 2022 | 1.664E+00 | 1.211E+00 | 5.973E-01 | 2.091E-06  | 4.517E-01  | 1.413E-01 | 1.104E-03 | 7.306E-01 | 1.473E-02 | 1.601E+00 | 0.000E+00 | 1.784E+00 | 8.198E+00 |
| 2023 | 1.721E+00 | 1.079E+00 | 5.636E-01 | 2.114E-06  | 3.112E-01  | 1.411E-01 | 1.104E-03 | 6.953E-01 | 1.474E-02 | 1.575E+00 | 0.000E+00 | 1.701E+00 | 7.803E+00 |



**Table B.15.** Annual anthropogenic Pb emissions in the United Kingdom, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | M_Other   | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 1.429E+02 | 3.077E+02 | 3.912E+01 | 4.692E+00  | 5.883E+00  | 2.180E+03 | 3.501E-01 | 1.644E+01 | 9.080E+00 | 3.116E+02 | 3.378E-01 | 0.000E+00 | 3.018E+03 |
| 1991 | 1.385E+02 | 2.883E+02 | 4.601E+01 | 4.414E+00  | 5.883E+00  | 1.952E+03 | 3.460E-01 | 1.570E+01 | 8.379E+00 | 3.110E+02 | 2.971E-01 | 0.000E+00 | 2.771E+03 |
| 1992 | 1.434E+02 | 2.907E+02 | 4.362E+01 | 4.009E+00  | 5.883E+00  | 1.743E+03 | 3.418E-01 | 1.783E+01 | 7.654E+00 | 2.971E+02 | 2.173E-01 | 0.000E+00 | 2.554E+03 |
| 1993 | 1.348E+02 | 2.891E+02 | 3.435E+01 | 3.790E+00  | 5.884E+00  | 1.541E+03 | 3.448E-01 | 1.671E+01 | 6.983E+00 | 2.241E+02 | 7.261E-03 | 0.000E+00 | 2.257E+03 |
| 1994 | 1.552E+02 | 2.798E+02 | 3.716E+01 | 3.821E+00  | 5.884E+00  | 1.312E+03 | 3.887E-01 | 1.936E+01 | 6.351E+00 | 1.368E+02 | 0.000E+00 | 0.000E+00 | 1.957E+03 |
| 1995 | 1.260E+02 | 2.594E+02 | 3.028E+01 | 3.762E+00  | 5.884E+00  | 1.085E+03 | 4.052E-01 | 1.962E+01 | 5.657E+00 | 1.032E+02 | 0.000E+00 | 0.000E+00 | 1.639E+03 |
| 1996 | 9.867E+01 | 2.333E+02 | 2.347E+01 | 3.766E+00  | 5.884E+00  | 9.290E+02 | 4.088E-01 | 2.210E+01 | 4.960E+00 | 7.036E+01 | 0.000E+00 | 0.000E+00 | 1.392E+03 |
| 1997 | 6.446E+01 | 2.697E+02 | 1.592E+01 | 3.726E+00  | 5.212E+00  | 8.137E+02 | 3.963E-01 | 2.602E+01 | 4.566E+00 | 2.865E+00 | 0.000E+00 | 0.000E+00 | 1.207E+03 |
| 1998 | 2.181E+01 | 2.188E+02 | 7.650E+00 | 3.669E+00  | 5.677E+00  | 6.080E+02 | 4.061E-01 | 2.515E+01 | 3.722E+00 | 9.680E-01 | 0.000E+00 | 0.000E+00 | 8.959E+02 |
| 1999 | 1.662E+01 | 1.437E+02 | 7.356E+00 | 3.505E+00  | 9.675E+00  | 3.440E+02 | 4.120E-01 | 3.143E+01 | 2.534E+00 | 9.902E-01 | 0.000E+00 | 0.000E+00 | 5.603E+02 |
| 2000 | 1.750E+01 | 1.170E+02 | 6.334E+00 | 3.595E+00  | 1.059E+01  | 4.855E+01 | 3.758E-01 | 3.762E+01 | 1.219E+00 | 9.584E-01 | 0.000E+00 | 0.000E+00 | 2.438E+02 |
| 2001 | 1.466E+01 | 1.154E+02 | 6.603E+00 | 3.100E+00  | 1.031E+01  | 4.881E+01 | 3.546E-01 | 4.243E+01 | 1.222E+00 | 2.930E-01 | 0.000E+00 | 0.000E+00 | 2.432E+02 |
| 2002 | 1.208E+01 | 1.122E+02 | 4.985E+00 | 2.475E+00  | 1.217E+01  | 4.993E+01 | 3.623E-01 | 3.475E+01 | 1.277E+00 | 3.290E-01 | 0.000E+00 | 0.000E+00 | 2.306E+02 |
| 2003 | 1.166E+01 | 9.903E+01 | 4.159E+00 | 2.469E+00  | 1.932E+01  | 5.055E+01 | 3.432E-01 | 3.277E+01 | 1.295E+00 | 2.847E-01 | 0.000E+00 | 0.000E+00 | 2.219E+02 |
| 2004 | 1.279E+01 | 9.531E+01 | 3.871E+00 | 2.310E+00  | 1.396E+01  | 5.117E+01 | 3.365E-01 | 3.584E+01 | 1.389E+00 | 2.937E-01 | 0.000E+00 | 0.000E+00 | 2.173E+02 |
| 2005 | 9.963E+00 | 8.780E+01 | 3.358E+00 | 2.324E+00  | 1.536E+01  | 5.128E+01 | 3.325E-01 | 3.615E+01 | 3.067E+00 | 2.812E-01 | 0.000E+00 | 0.000E+00 | 2.099E+02 |
| 2006 | 9.817E+00 | 6.996E+01 | 2.971E+00 | 2.481E+00  | 1.488E+01  | 5.192E+01 | 3.112E-01 | 3.123E+01 | 3.165E+00 | 2.242E-01 | 0.000E+00 | 0.000E+00 | 1.870E+02 |
| 2007 | 2.329E+00 | 6.761E+01 | 2.697E+00 | 2.480E+00  | 1.318E+01  | 5.215E+01 | 3.157E-01 | 2.211E+01 | 3.205E+00 | 2.092E-01 | 0.000E+00 | 0.000E+00 | 1.663E+02 |
| 2008 | 1.901E+00 | 6.314E+01 | 2.647E+00 | 2.428E+00  | 9.184E+00  | 5.148E+01 | 2.985E-01 | 1.991E+01 | 3.174E+00 | 1.904E-01 | 0.000E+00 | 0.000E+00 | 1.544E+02 |
| 2009 | 2.195E+00 | 4.993E+01 | 2.870E+00 | 2.074E+00  | 7.463E+00  | 5.055E+01 | 2.864E-01 | 1.434E+01 | 3.171E+00 | 1.830E-01 | 0.000E+00 | 0.000E+00 | 1.331E+02 |
| 2010 | 3.055E+00 | 4.955E+01 | 2.872E+00 | 2.224E+00  | 9.353E+00  | 4.992E+01 | 2.686E-01 | 1.495E+01 | 1.944E+00 | 1.931E-01 | 0.000E+00 | 0.000E+00 | 1.343E+02 |
| 2011 | 2.520E+00 | 4.961E+01 | 2.703E+00 | 2.198E+00  | 8.948E+00  | 4.975E+01 | 2.544E-01 | 1.473E+01 | 1.458E+00 | 1.916E-01 | 0.000E+00 | 0.000E+00 | 1.324E+02 |
| 2012 | 4.845E+00 | 5.019E+01 | 2.728E+00 | 2.094E+00  | 9.865E+00  | 4.967E+01 | 2.308E-01 | 1.251E+01 | 1.544E+00 | 1.902E-01 | 0.000E+00 | 0.000E+00 | 1.339E+02 |
| 2013 | 3.733E+00 | 4.882E+01 | 2.963E+00 | 2.214E+00  | 6.694E+00  | 4.972E+01 | 2.128E-01 | 1.103E+01 | 1.721E+00 | 2.159E-01 | 0.000E+00 | 0.000E+00 | 1.273E+02 |
| 2014 | 2.644E+00 | 5.567E+01 | 2.709E+00 | 2.079E+00  | 7.968E+00  | 5.107E+01 | 2.206E-01 | 1.301E+01 | 1.345E+00 | 2.182E-01 | 0.000E+00 | 0.000E+00 | 1.369E+02 |
| 2015 | 2.897E+00 | 5.490E+01 | 2.176E+00 | 1.563E+00  | 8.616E+00  | 5.185E+01 | 2.165E-01 | 8.499E+00 | 1.450E+00 | 2.101E-01 | 0.000E+00 | 0.000E+00 | 1.324E+02 |
| 2016 | 2.566E+00 | 4.650E+01 | 2.207E+00 | 8.347E-01  | 8.291E+00  | 5.281E+01 | 2.123E-01 | 9.219E+00 | 1.439E+00 | 1.818E-01 | 0.000E+00 | 0.000E+00 | 1.243E+02 |
| 2017 | 2.377E+00 | 4.460E+01 | 2.373E+00 | 8.186E-01  | 8.127E+00  | 5.330E+01 | 2.068E-01 | 9.206E+00 | 2.233E+00 | 1.818E-01 | 0.000E+00 | 0.000E+00 | 1.234E+02 |
| 2018 | 2.088E+00 | 4.206E+01 | 2.543E+00 | 7.978E-01  | 7.972E+00  | 5.329E+01 | 2.059E-01 | 8.308E+00 | 2.187E+00 | 4.965E-01 | 0.000E+00 | 0.000E+00 | 1.199E+02 |
| 2019 | 2.089E+00 | 3.989E+01 | 2.398E+00 | 7.565E-01  | 6.396E+00  | 5.357E+01 | 2.086E-01 | 6.427E+00 | 6.728E+00 | 1.999E-01 | 0.000E+00 | 0.000E+00 | 1.187E+02 |
| 2020 | 2.158E+00 | 3.837E+01 | 2.419E+00 | 7.823E-01  | 4.217E+00  | 4.343E+01 | 1.742E-01 | 1.631E+00 | 6.521E+00 | 1.689E-01 | 0.000E+00 | 0.000E+00 | 9.987E+01 |
| 2021 | 2.044E+00 | 5.752E+01 | 2.550E+00 | 7.415E-01  | 4.841E+00  | 4.787E+01 | 1.762E-01 | 8.551E+00 | 3.140E+00 | 1.636E-01 | 0.000E+00 | 0.000E+00 | 1.276E+02 |
| 2022 | 2.267E+00 | 6.302E+01 | 2.624E+00 | 6.176E-01  | 9.687E+00  | 5.038E+01 | 1.797E-01 | 1.041E+01 | 2.058E+00 | 1.712E-01 | 0.000E+00 | 0.000E+00 | 1.414E+02 |
| 2023 | 2.233E+00 | 5.320E+01 | 2.253E+00 | 4.212E-01  | 4.574E+00  | 5.018E+01 | 1.720E-01 | 1.147E+01 | 1.865E+00 | 1.642E-01 | 0.000E+00 | 0.000E+00 | 1.265E+02 |



**Table B.16.** Annual anthropogenic Cu emissions in Belgium, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 5.593E+00 | 1.437E+01 | 5.608E-01 | 7.032E-01  | 1.022E+01  | 5.392E+01 | 5.952E-02 | 7.290E-06 | 2.709E+00 | 1.656E+00 | 0.000E+00 | 8.989E+01 |
| 1991 | 4.465E+00 | 1.125E+01 | 6.268E-01 | 6.273E-01  | 1.029E+01  | 5.436E+01 | 5.489E-02 | 8.350E-06 | 2.746E+00 | 1.547E+00 | 0.000E+00 | 8.607E+01 |
| 1992 | 4.227E+00 | 2.381E+01 | 5.828E-01 | 5.528E-01  | 1.075E+01  | 5.659E+01 | 5.291E-02 | 7.340E-06 | 2.795E+00 | 1.365E+00 | 0.000E+00 | 1.008E+02 |
| 1993 | 1.528E+00 | 1.845E+01 | 5.638E-01 | 4.888E-01  | 1.095E+01  | 5.663E+01 | 5.128E-02 | 7.750E-06 | 2.743E+00 | 3.738E-01 | 0.000E+00 | 9.187E+01 |
| 1994 | 1.052E+00 | 2.359E+01 | 4.180E-01 | 4.634E-01  | 1.113E+01  | 5.977E+01 | 5.801E-02 | 7.750E-06 | 2.773E+00 | 1.442E-01 | 0.000E+00 | 9.949E+01 |
| 1995 | 1.466E+00 | 1.832E+01 | 4.007E-01 | 4.659E-01  | 1.124E+01  | 6.034E+01 | 5.934E-02 | 8.610E-06 | 2.776E+00 | 7.035E-01 | 0.000E+00 | 9.587E+01 |
| 1996 | 1.441E+00 | 1.578E+01 | 4.476E-01 | 4.675E-01  | 1.147E+01  | 6.165E+01 | 5.960E-02 | 1.039E-05 | 2.850E+00 | 1.184E-01 | 0.000E+00 | 9.439E+01 |
| 1997 | 1.040E+00 | 1.519E+01 | 3.872E-01 | 4.196E-01  | 1.163E+01  | 6.371E+01 | 6.131E-02 | 1.495E-05 | 2.889E+00 | 9.725E-02 | 0.000E+00 | 9.553E+01 |
| 1998 | 1.146E+00 | 1.601E+01 | 3.480E-01 | 3.657E-01  | 1.185E+01  | 6.586E+01 | 6.446E-02 | 2.753E-05 | 3.061E+00 | 7.708E-02 | 0.000E+00 | 9.889E+01 |
| 1999 | 6.735E-01 | 1.616E+01 | 3.173E-01 | 3.623E-01  | 1.209E+01  | 6.712E+01 | 6.953E-02 | 3.453E-05 | 3.115E+00 | 8.318E-02 | 0.000E+00 | 1.001E+02 |
| 2000 | 7.239E-01 | 1.019E+01 | 2.938E-01 | 9.127E-01  | 1.208E+01  | 6.826E+01 | 8.260E-02 | 4.666E-05 | 6.418E+00 | 1.859E-01 | 0.000E+00 | 9.925E+01 |
| 2001 | 6.778E-01 | 8.930E+00 | 3.131E-01 | 9.337E-01  | 1.210E+01  | 7.029E+01 | 7.550E-02 | 5.684E-05 | 6.345E+00 | 1.227E-01 | 0.000E+00 | 9.989E+01 |
| 2002 | 6.439E-01 | 9.204E+00 | 3.118E-01 | 8.717E-01  | 1.204E+01  | 7.145E+01 | 7.790E-02 | 7.341E-05 | 6.061E+00 | 7.659E-02 | 0.000E+00 | 1.009E+02 |
| 2003 | 5.687E-01 | 8.666E+00 | 3.212E-01 | 8.708E-01  | 1.224E+01  | 7.302E+01 | 8.589E-02 | 9.779E-05 | 6.117E+00 | 1.097E-01 | 0.000E+00 | 1.021E+02 |
| 2004 | 6.144E-01 | 8.208E+00 | 3.138E-01 | 8.911E-01  | 1.240E+01  | 7.581E+01 | 8.527E-02 | 9.890E-05 | 6.248E+00 | 3.762E-01 | 0.000E+00 | 1.050E+02 |
| 2005 | 1.393E+00 | 6.768E+00 | 3.164E-01 | 4.390E-01  | 1.206E+01  | 7.317E+01 | 8.002E-02 | 8.601E-05 | 6.296E+00 | 5.543E-01 | 0.000E+00 | 1.012E+02 |
| 2006 | 3.336E-01 | 6.703E+00 | 3.098E-01 | 4.897E-01  | 1.250E+01  | 7.473E+01 | 7.395E-02 | 9.872E-05 | 6.216E+00 | 5.244E-01 | 0.000E+00 | 1.020E+02 |
| 2007 | 3.386E-01 | 5.522E+00 | 3.008E-01 | 4.013E-01  | 1.298E+01  | 7.636E+01 | 7.444E-02 | 1.116E-04 | 6.223E+00 | 4.655E-01 | 0.000E+00 | 1.028E+02 |
| 2008 | 5.477E-01 | 6.394E+00 | 3.488E-01 | 3.046E-01  | 1.342E+01  | 7.708E+01 | 7.737E-02 | 1.236E-04 | 6.360E+00 | 7.227E-01 | 0.000E+00 | 1.054E+02 |
| 2009 | 6.284E-01 | 2.885E+00 | 3.623E-01 | 2.236E-01  | 1.370E+01  | 7.708E+01 | 6.473E-02 | 1.339E-04 | 5.880E+00 | 5.636E-01 | 0.000E+00 | 1.015E+02 |
| 2010 | 7.847E-01 | 4.307E+00 | 3.196E-01 | 2.659E-01  | 1.358E+01  | 7.499E+01 | 7.524E-02 | 1.688E-04 | 6.028E+00 | 2.528E-02 | 0.000E+00 | 1.005E+02 |
| 2011 | 3.884E-01 | 4.163E+00 | 2.487E-01 | 2.245E-01  | 1.346E+01  | 7.450E+01 | 7.733E-02 | 1.798E-04 | 5.842E+00 | 2.198E-02 | 0.000E+00 | 9.899E+01 |
| 2012 | 3.053E-01 | 3.323E+00 | 2.646E-01 | 2.341E-01  | 1.288E+01  | 7.205E+01 | 7.354E-02 | 1.773E-04 | 6.627E+00 | 2.707E-02 | 0.000E+00 | 9.586E+01 |
| 2013 | 3.162E-01 | 2.646E+00 | 3.048E-01 | 1.900E-01  | 1.253E+01  | 7.053E+01 | 7.020E-02 | 1.858E-04 | 5.185E+00 | 4.154E-02 | 0.000E+00 | 9.188E+01 |
| 2014 | 2.719E-01 | 2.805E+00 | 2.447E-01 | 1.467E-01  | 1.267E+01  | 7.233E+01 | 6.923E-02 | 1.879E-04 | 4.177E+00 | 5.122E-02 | 0.000E+00 | 9.283E+01 |
| 2015 | 4.279E-01 | 2.795E+00 | 2.703E-01 | 4.949E-02  | 1.316E+01  | 7.558E+01 | 6.953E-02 | 1.999E-04 | 4.178E+00 | 2.904E-02 | 0.000E+00 | 9.664E+01 |
| 2016 | 0.000E+00 | 3.060E+00 | 2.755E-01 | 4.145E-02  | 1.316E+01  | 7.608E+01 | 7.279E-02 | 2.106E-04 | 4.228E+00 | 6.216E-02 | 0.000E+00 | 9.706E+01 |
| 2017 | 1.843E-01 | 2.545E+00 | 2.635E-01 | 5.546E-02  | 1.279E+01  | 7.428E+01 | 7.754E-02 | 2.346E-04 | 4.334E+00 | 3.804E-02 | 0.000E+00 | 9.464E+01 |
| 2018 | 2.021E-01 | 1.687E+00 | 2.563E-01 | 4.651E-02  | 1.272E+01  | 7.421E+01 | 7.872E-02 | 2.430E-04 | 4.456E+00 | 3.004E-02 | 0.000E+00 | 9.377E+01 |
| 2019 | 1.961E-01 | 2.125E+00 | 2.420E-01 | 5.394E-02  | 1.261E+01  | 7.314E+01 | 7.559E-02 | 2.458E-04 | 4.507E+00 | 5.384E-02 | 0.000E+00 | 9.308E+01 |
| 2020 | 4.241E-01 | 2.370E+00 | 2.276E-01 | 4.762E-02  | 1.056E+01  | 6.116E+01 | 7.624E-02 | 1.992E-04 | 4.364E+00 | 3.311E-02 | 0.000E+00 | 7.933E+01 |
| 2021 | 1.984E-01 | 2.658E+00 | 2.586E-01 | 5.052E-02  | 1.172E+01  | 6.159E+01 | 7.732E-02 | 2.427E-04 | 4.410E+00 | 3.639E-02 | 0.000E+00 | 8.108E+01 |
| 2022 | 2.195E-01 | 2.580E+00 | 2.320E-01 | 4.502E-02  | 1.201E+01  | 6.525E+01 | 7.441E-02 | 2.549E-04 | 4.397E+00 | 2.665E-02 | 0.000E+00 | 8.491E+01 |
| 2023 | 2.303E-01 | 1.831E+00 | 2.325E-01 | 4.902E-02  | 1.231E+01  | 6.867E+01 | 6.999E-02 | 2.472E-04 | 4.414E+00 | 2.758E-02 | 0.000E+00 | 8.791E+01 |



**Table B.17.** Annual anthropogenic Cu emissions in Denmark, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 2.871E+00 | 5.104E-01 | 3.086E-01 | 1.355E-03  | 5.742E-01  | 4.214E+01 | 6.157E-02 | 1.646E-01 | 2.906E+00 | 8.360E-02 | 8.528E-04 | 4.998E+01 |
| 1991 | 3.064E+00 | 5.109E-01 | 3.241E-01 | 1.356E-03  | 7.576E-01  | 4.489E+01 | 6.950E-02 | 1.592E-01 | 2.737E+00 | 8.635E-02 | 8.617E-04 | 5.289E+01 |
| 1992 | 2.582E+00 | 4.754E-01 | 2.944E-01 | 1.356E-03  | 8.190E-01  | 4.653E+01 | 6.102E-02 | 1.670E-01 | 2.614E+00 | 9.385E-02 | 7.553E-04 | 5.391E+01 |
| 1993 | 2.343E+00 | 4.664E-01 | 2.768E-01 | 1.355E-03  | 7.237E-01  | 4.756E+01 | 5.038E-02 | 1.750E-01 | 2.909E+00 | 8.255E-02 | 8.419E-04 | 5.505E+01 |
| 1994 | 2.023E+00 | 4.639E-01 | 2.584E-01 | 1.355E-03  | 8.773E-01  | 4.967E+01 | 4.410E-02 | 1.807E-01 | 3.155E+00 | 8.309E-02 | 8.101E-04 | 5.726E+01 |
| 1995 | 1.564E+00 | 4.688E-01 | 2.239E-01 | 1.355E-03  | 1.338E+00  | 5.010E+01 | 4.479E-02 | 1.926E-01 | 3.336E+00 | 9.591E-02 | 9.157E-04 | 5.787E+01 |
| 1996 | 1.694E+00 | 4.569E-01 | 2.119E-01 | 1.355E-03  | 1.228E+00  | 5.072E+01 | 3.986E-02 | 2.189E-01 | 3.712E+00 | 9.696E-02 | 9.089E-04 | 5.871E+01 |
| 1997 | 1.423E+00 | 4.473E-01 | 2.024E-01 | 8.776E-04  | 9.680E-01  | 5.248E+01 | 3.367E-02 | 2.314E-01 | 4.239E+00 | 8.954E-02 | 9.593E-04 | 6.053E+01 |
| 1998 | 1.131E+00 | 4.381E-01 | 1.690E-01 | 1.117E-03  | 1.572E+00  | 5.388E+01 | 3.367E-02 | 2.279E-01 | 5.073E+00 | 8.017E-02 | 1.137E-03 | 6.296E+01 |
| 1999 | 9.876E-01 | 4.130E-01 | 1.766E-01 | 1.068E-03  | 2.971E+00  | 5.490E+01 | 3.314E-02 | 2.391E-01 | 5.386E+00 | 8.612E-02 | 1.075E-03 | 6.556E+01 |
| 2000 | 5.675E-01 | 4.104E-01 | 1.761E-01 | 1.108E-03  | 2.164E+00  | 5.534E+01 | 3.404E-02 | 2.415E-01 | 5.582E+00 | 8.434E-02 | 1.073E-03 | 6.503E+01 |
| 2001 | 5.943E-01 | 4.024E-01 | 1.779E-01 | 7.295E-04  | 1.708E+00  | 5.515E+01 | 3.463E-02 | 2.275E-01 | 5.578E+00 | 8.298E-02 | 1.111E-03 | 6.428E+01 |
| 2002 | 5.612E-01 | 3.718E-01 | 1.759E-01 | 1.331E-03  | 2.112E+00  | 5.616E+01 | 4.161E-02 | 2.155E-01 | 5.851E+00 | 8.039E-02 | 9.524E-04 | 6.580E+01 |
| 2003 | 5.019E-01 | 3.935E-01 | 2.159E-01 | 8.191E-04  | 2.697E+00  | 5.764E+01 | 4.537E-02 | 2.099E-01 | 5.504E+00 | 9.053E-02 | 1.085E-03 | 6.756E+01 |
| 2004 | 4.499E-01 | 4.143E-01 | 2.027E-01 | 1.047E-03  | 3.847E+00  | 5.950E+01 | 4.165E-02 | 2.176E-01 | 5.765E+00 | 7.826E-02 | 1.130E-03 | 7.073E+01 |
| 2005 | 3.073E-01 | 3.824E-01 | 2.340E-01 | 1.361E-03  | 1.643E+00  | 5.975E+01 | 4.080E-02 | 2.191E-01 | 5.793E+00 | 8.128E-02 | 1.145E-03 | 6.870E+01 |
| 2006 | 2.004E-01 | 3.856E-01 | 2.543E-01 | 1.350E-03  | 1.878E+00  | 6.177E+01 | 4.086E-02 | 2.136E-01 | 5.799E+00 | 8.332E-02 | 1.145E-03 | 7.101E+01 |
| 2007 | 2.474E-01 | 3.961E-01 | 2.916E-01 | 1.426E-03  | 1.993E+00  | 6.474E+01 | 3.707E-02 | 2.201E-01 | 5.475E+00 | 5.727E-02 | 1.017E-03 | 7.388E+01 |
| 2008 | 1.896E-01 | 3.474E-01 | 2.806E-01 | 1.630E-03  | 1.946E+00  | 6.395E+01 | 4.029E-02 | 2.285E-01 | 5.851E+00 | 8.907E-02 | 9.804E-04 | 7.325E+01 |
| 2009 | 1.570E-01 | 2.325E-01 | 2.538E-01 | 9.774E-04  | 2.394E+00  | 6.171E+01 | 3.891E-02 | 2.033E-01 | 6.170E+00 | 9.272E-02 | 1.137E-03 | 7.139E+01 |
| 2010 | 1.639E-01 | 2.852E-01 | 2.710E-01 | 1.144E-03  | 2.414E+00  | 6.065E+01 | 3.715E-02 | 2.169E-01 | 6.453E+00 | 8.209E-02 | 8.672E-04 | 7.078E+01 |
| 2011 | 2.309E-01 | 2.928E-01 | 2.573E-01 | 1.094E-03  | 2.107E+00  | 6.058E+01 | 3.535E-02 | 2.359E-01 | 6.258E+00 | 6.908E-02 | 8.593E-04 | 7.029E+01 |
| 2012 | 1.350E-01 | 2.690E-01 | 2.466E-01 | 1.380E-03  | 1.554E+00  | 5.943E+01 | 3.376E-02 | 2.355E-01 | 5.996E+00 | 7.094E-02 | 9.686E-04 | 6.810E+01 |
| 2013 | 1.946E-01 | 2.548E-01 | 2.614E-01 | 9.629E-04  | 1.979E+00  | 5.870E+01 | 3.538E-02 | 2.446E-01 | 5.988E+00 | 7.952E-02 | 1.027E-03 | 6.791E+01 |
| 2014 | 1.506E-01 | 2.816E-01 | 2.463E-01 | 1.424E-03  | 1.666E+00  | 5.855E+01 | 3.019E-02 | 2.538E-01 | 5.953E+00 | 8.685E-02 | 1.034E-03 | 6.744E+01 |
| 2015 | 1.373E-01 | 2.677E-01 | 2.744E-01 | 8.239E-04  | 2.579E+00  | 5.964E+01 | 2.403E-02 | 2.582E-01 | 6.194E+00 | 7.676E-02 | 9.621E-04 | 6.962E+01 |
| 2016 | 1.573E-01 | 2.691E-01 | 2.869E-01 | 9.977E-04  | 2.001E+00  | 5.945E+01 | 2.499E-02 | 2.778E-01 | 6.583E+00 | 7.418E-02 | 9.107E-04 | 6.926E+01 |
| 2017 | 1.604E-01 | 2.812E-01 | 2.713E-01 | 8.219E-04  | 1.838E+00  | 5.981E+01 | 2.732E-02 | 2.736E-01 | 6.381E+00 | 6.466E-02 | 1.032E-03 | 6.918E+01 |
| 2018 | 1.362E-01 | 2.872E-01 | 2.566E-01 | 1.015E-03  | 2.776E+00  | 6.114E+01 | 2.446E-02 | 2.869E-01 | 6.253E+00 | 1.033E-01 | 1.064E-03 | 7.137E+01 |
| 2019 | 1.419E-01 | 2.632E-01 | 2.345E-01 | 9.063E-04  | 1.897E+00  | 6.054E+01 | 2.433E-02 | 2.682E-01 | 2.763E+00 | 7.578E-02 | 1.240E-03 | 6.640E+01 |
| 2020 | 1.498E-01 | 2.385E-01 | 2.194E-01 | 8.979E-04  | 1.890E+00  | 5.551E+01 | 2.641E-02 | 1.102E-01 | 2.815E+00 | 7.585E-02 | 1.234E-03 | 6.115E+01 |
| 2021 | 1.632E-01 | 2.598E-01 | 2.265E-01 | 7.123E-04  | 2.214E+00  | 5.623E+01 | 3.151E-02 | 1.257E-01 | 2.824E+00 | 6.605E-02 | 1.256E-03 | 6.220E+01 |
| 2022 | 1.383E-01 | 2.511E-01 | 1.842E-01 | 6.891E-04  | 3.139E+00  | 5.700E+01 | 2.643E-02 | 2.241E-01 | 2.921E+00 | 8.107E-02 | 1.391E-03 | 6.407E+01 |
| 2023 | 1.333E-01 | 2.188E-01 | 1.958E-01 | 5.835E-04  | 3.138E+00  | 5.708E+01 | 2.321E-02 | 2.549E-01 | 1.830E+00 | 5.398E-02 | 1.129E-03 | 6.306E+01 |



**Table B.18.** Annual anthropogenic Cu emissions in Finland, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 7.342E+00 | 9.770E+01 | 8.270E-01 | 4.000E-03  | 2.238E-01  | 4.926E+01 | 9.956E-02 | 0.000E+00 | 1.455E+00 | 7.890E-03 | 1.896E-03 | 1.576E+02 |
| 1991 | 3.706E+00 | 9.448E+01 | 8.179E-01 | 4.000E-03  | 2.508E-01  | 4.808E+01 | 9.869E-02 | 0.000E+00 | 1.453E+00 | 7.943E-03 | 1.752E-03 | 1.495E+02 |
| 1992 | 3.026E+00 | 7.081E+01 | 6.743E-01 | 4.000E-03  | 4.603E-01  | 4.779E+01 | 8.996E-02 | 0.000E+00 | 1.437E+00 | 7.754E-03 | 1.430E-03 | 1.251E+02 |
| 1993 | 2.472E+00 | 5.900E+01 | 6.629E-01 | 4.000E-03  | 5.040E-01  | 4.739E+01 | 1.004E-01 | 0.000E+00 | 1.423E+00 | 6.016E-03 | 1.763E-03 | 1.122E+02 |
| 1994 | 1.671E+00 | 5.413E+01 | 7.714E-01 | 4.000E-03  | 8.061E-01  | 4.729E+01 | 1.188E-01 | 0.000E+00 | 1.418E+00 | 4.006E-03 | 1.673E-03 | 1.067E+02 |
| 1995 | 1.507E+00 | 6.432E+01 | 5.833E-01 | 4.000E-03  | 6.675E-01  | 4.790E+01 | 1.048E-01 | 0.000E+00 | 1.410E+00 | 4.632E-03 | 1.579E-03 | 1.169E+02 |
| 1996 | 1.587E+00 | 5.712E+01 | 6.814E-01 | 4.000E-03  | 3.951E-01  | 4.824E+01 | 1.151E-01 | 0.000E+00 | 1.387E+00 | 4.664E-03 | 1.808E-03 | 1.100E+02 |
| 1997 | 1.838E+00 | 7.512E+01 | 6.642E-01 | 4.000E-03  | 6.133E-01  | 4.925E+01 | 1.255E-01 | 0.000E+00 | 1.416E+00 | 4.353E-03 | 1.708E-03 | 1.295E+02 |
| 1998 | 1.498E+00 | 2.984E+01 | 6.696E-01 | 4.000E-03  | 5.418E-01  | 5.037E+01 | 1.189E-01 | 0.000E+00 | 1.445E+00 | 4.299E-03 | 1.383E-03 | 8.508E+01 |
| 1999 | 1.235E+00 | 1.334E+01 | 9.424E-01 | 4.000E-03  | 1.037E+00  | 4.999E+01 | 1.226E-01 | 0.000E+00 | 1.469E+00 | 3.915E-03 | 1.146E-03 | 6.878E+01 |
| 2000 | 1.324E+00 | 1.224E+01 | 6.854E-01 | 4.000E-03  | 6.444E-01  | 4.884E+01 | 1.261E-01 | 0.000E+00 | 1.483E+00 | 4.201E-03 | 1.826E-03 | 6.610E+01 |
| 2001 | 1.186E+00 | 1.440E+01 | 8.242E-01 | 4.000E-03  | 6.659E-01  | 4.758E+01 | 1.085E-01 | 0.000E+00 | 1.483E+00 | 4.636E-03 | 1.587E-03 | 6.692E+01 |
| 2002 | 1.571E+00 | 1.781E+01 | 1.050E+00 | 4.000E-03  | 8.289E-01  | 4.642E+01 | 1.171E-01 | 0.000E+00 | 1.489E+00 | 4.613E-03 | 1.751E-03 | 7.007E+01 |
| 2003 | 2.269E+00 | 1.093E+01 | 1.056E+00 | 4.000E-03  | 7.143E-01  | 4.532E+01 | 1.221E-01 | 0.000E+00 | 1.491E+00 | 4.064E-03 | 1.628E-03 | 6.269E+01 |
| 2004 | 2.272E+00 | 1.016E+01 | 1.179E+00 | 4.000E-03  | 8.030E-01  | 4.396E+01 | 1.156E-01 | 0.000E+00 | 1.492E+00 | 4.600E-03 | 1.570E-03 | 6.063E+01 |
| 2005 | 1.983E+00 | 9.821E+00 | 1.179E+00 | 3.000E-03  | 8.625E-01  | 4.261E+01 | 1.166E-01 | 0.000E+00 | 1.483E+00 | 4.930E-03 | 1.425E-03 | 5.868E+01 |
| 2006 | 2.087E+00 | 9.940E+00 | 1.051E+00 | 4.000E-03  | 1.004E+00  | 4.295E+01 | 1.257E-01 | 0.000E+00 | 1.495E+00 | 5.357E-03 | 1.262E-03 | 5.935E+01 |
| 2007 | 2.245E+00 | 7.749E+00 | 1.048E+00 | 5.900E-03  | 1.156E+00  | 3.031E+01 | 1.301E-01 | 0.000E+00 | 1.514E+00 | 5.408E-03 | 1.470E-03 | 4.471E+01 |
| 2008 | 2.569E+00 | 5.363E+00 | 1.179E+00 | 1.790E-02  | 1.075E+00  | 3.018E+01 | 1.022E-01 | 0.000E+00 | 1.556E+00 | 6.006E-03 | 1.386E-03 | 4.253E+01 |
| 2009 | 2.401E+00 | 4.559E+00 | 1.351E+00 | 5.270E-03  | 7.359E-01  | 2.979E+01 | 1.073E-01 | 0.000E+00 | 1.482E+00 | 3.769E-03 | 1.322E-03 | 4.072E+01 |
| 2010 | 2.864E+00 | 5.126E+00 | 1.526E+00 | 1.990E-02  | 7.931E-01  | 3.005E+01 | 1.199E-01 | 0.000E+00 | 1.482E+00 | 3.852E-03 | 9.846E-04 | 4.222E+01 |
| 2011 | 3.248E+00 | 5.415E+00 | 1.438E+00 | 8.080E-03  | 6.689E-01  | 3.008E+01 | 1.236E-01 | 0.000E+00 | 1.433E+00 | 3.545E-03 | 1.211E-03 | 4.263E+01 |
| 2012 | 3.033E+00 | 4.307E+00 | 1.592E+00 | 8.100E-03  | 8.578E-01  | 2.979E+01 | 1.128E-01 | 0.000E+00 | 1.507E+00 | 3.391E-03 | 1.164E-03 | 4.134E+01 |
| 2013 | 2.912E+00 | 5.694E+00 | 1.438E+00 | 1.407E-02  | 6.433E-01  | 3.012E+01 | 1.051E-01 | 0.000E+00 | 1.467E+00 | 3.311E-03 | 1.475E-03 | 4.253E+01 |
| 2014 | 2.663E+00 | 6.129E+00 | 1.492E+00 | 8.281E-02  | 6.891E-01  | 3.051E+01 | 8.569E-02 | 0.000E+00 | 1.433E+00 | 3.072E-03 | 1.396E-03 | 4.319E+01 |
| 2015 | 2.568E+00 | 4.057E+00 | 1.415E+00 | 9.160E-03  | 7.005E-01  | 3.055E+01 | 8.567E-02 | 0.000E+00 | 1.374E+00 | 2.909E-03 | 1.332E-03 | 4.111E+01 |
| 2016 | 2.517E+00 | 4.498E+00 | 1.670E+00 | 4.682E-02  | 7.048E-01  | 3.082E+01 | 8.095E-02 | 0.000E+00 | 1.315E+00 | 3.130E-03 | 1.248E-03 | 4.200E+01 |
| 2017 | 2.435E+00 | 3.917E+00 | 1.671E+00 | 1.089E-02  | 6.129E-01  | 3.054E+01 | 8.580E-02 | 0.000E+00 | 1.374E+00 | 3.066E-03 | 1.350E-03 | 4.106E+01 |
| 2018 | 2.848E+00 | 3.140E+00 | 1.404E+00 | 4.380E-03  | 6.645E-01  | 3.073E+01 | 8.731E-02 | 0.000E+00 | 1.377E+00 | 2.968E-03 | 8.956E-04 | 4.065E+01 |
| 2019 | 2.518E+00 | 3.207E+00 | 2.029E+00 | 4.380E-03  | 5.312E-01  | 3.058E+01 | 8.753E-02 | 0.000E+00 | 1.367E+00 | 3.028E-03 | 1.445E-03 | 4.072E+01 |
| 2020 | 2.103E+00 | 3.101E+00 | 1.527E+00 | 2.151E-02  | 2.330E-01  | 2.947E+01 | 5.829E-02 | 0.000E+00 | 1.365E+00 | 3.083E-03 | 1.237E-03 | 3.825E+01 |
| 2021 | 2.162E+00 | 3.284E+00 | 2.168E+00 | 2.180E-03  | 3.863E-01  | 2.935E+01 | 5.763E-02 | 0.000E+00 | 1.370E+00 | 3.249E-03 | 0.000E+00 | 3.909E+01 |
| 2022 | 2.328E+00 | 3.080E+00 | 2.137E+00 | 9.980E-03  | 2.367E-01  | 2.895E+01 | 6.250E-02 | 0.000E+00 | 1.342E+00 | 3.202E-03 | 0.000E+00 | 3.852E+01 |
| 2023 | 1.938E+00 | 2.781E+00 | 2.039E+00 | 1.446E-02  | 6.233E-01  | 2.870E+01 | 5.735E-02 | 0.000E+00 | 1.320E+00 | 3.073E-03 | 0.000E+00 | 3.778E+01 |



**Table B.19.** Annual anthropogenic Cu emissions in France, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 8.687E+00 | 3.617E+01 | 1.120E+01 | 1.311E+00  | 4.286E+01  | 1.352E+02 | 4.315E-01 | 0.000E+00 | 5.287E+01 | 6.835E+00 | 1.277E-01 | 2.985E+02 |
| 1991 | 9.248E+00 | 3.345E+01 | 1.315E+01 | 1.274E+00  | 4.407E+01  | 1.388E+02 | 4.441E-01 | 0.000E+00 | 5.371E+01 | 7.668E+00 | 1.286E-01 | 3.047E+02 |
| 1992 | 9.905E+00 | 2.965E+01 | 1.253E+01 | 1.249E+00  | 4.603E+01  | 1.447E+02 | 3.856E-01 | 0.000E+00 | 5.490E+01 | 8.581E+00 | 1.288E-01 | 3.108E+02 |
| 1993 | 9.145E+00 | 2.650E+01 | 1.205E+01 | 1.132E+00  | 4.658E+01  | 1.455E+02 | 4.226E-01 | 0.000E+00 | 5.357E+01 | 9.126E+00 | 1.259E-01 | 3.068E+02 |
| 1994 | 8.557E+00 | 2.650E+01 | 1.043E+01 | 1.042E+00  | 4.767E+01  | 1.462E+02 | 3.829E-01 | 0.000E+00 | 5.431E+01 | 8.704E+00 | 1.276E-01 | 3.063E+02 |
| 1995 | 7.934E+00 | 2.551E+01 | 1.058E+01 | 1.073E+00  | 4.839E+01  | 1.474E+02 | 3.717E-01 | 0.000E+00 | 5.214E+01 | 7.499E+00 | 1.260E-01 | 3.034E+02 |
| 1996 | 8.022E+00 | 2.344E+01 | 1.156E+01 | 1.034E+00  | 4.871E+01  | 1.490E+02 | 3.366E-01 | 0.000E+00 | 5.757E+01 | 7.093E+00 | 1.292E-01 | 3.094E+02 |
| 1997 | 6.343E+00 | 2.422E+01 | 1.014E+01 | 1.005E+00  | 5.004E+01  | 1.537E+02 | 3.235E-01 | 0.000E+00 | 5.898E+01 | 5.925E+00 | 1.283E-01 | 3.136E+02 |
| 1998 | 6.257E+00 | 2.276E+01 | 1.024E+01 | 1.070E+00  | 5.113E+01  | 1.534E+02 | 2.903E-01 | 0.000E+00 | 6.006E+01 | 5.468E+00 | 1.318E-01 | 3.139E+02 |
| 1999 | 5.149E+00 | 1.962E+01 | 9.719E+00 | 1.000E+00  | 5.451E+01  | 1.622E+02 | 2.849E-01 | 0.000E+00 | 6.169E+01 | 4.516E+00 | 1.309E-01 | 3.220E+02 |
| 2000 | 5.572E+00 | 1.857E+01 | 9.175E+00 | 9.643E-01  | 5.309E+01  | 1.555E+02 | 3.051E-01 | 0.000E+00 | 6.311E+01 | 4.203E+00 | 1.308E-01 | 3.139E+02 |
| 2001 | 4.306E+00 | 1.608E+01 | 9.335E+00 | 9.496E-01  | 5.406E+01  | 1.657E+02 | 2.971E-01 | 0.000E+00 | 6.322E+01 | 3.031E+00 | 1.201E-01 | 3.198E+02 |
| 2002 | 3.818E+00 | 1.999E+01 | 8.614E+00 | 8.574E-01  | 5.627E+01  | 1.706E+02 | 3.150E-01 | 0.000E+00 | 6.529E+01 | 2.539E+00 | 1.204E-01 | 3.310E+02 |
| 2003 | 3.561E+00 | 1.172E+01 | 9.248E+00 | 8.722E-01  | 5.766E+01  | 1.762E+02 | 3.257E-01 | 0.000E+00 | 6.267E+01 | 2.007E+00 | 1.086E-01 | 3.273E+02 |
| 2004 | 3.540E+00 | 1.528E+01 | 9.289E+00 | 8.665E-01  | 5.985E+01  | 1.782E+02 | 1.957E-01 | 0.000E+00 | 6.336E+01 | 1.430E+00 | 1.101E-01 | 3.358E+02 |
| 2005 | 4.073E+00 | 1.364E+01 | 8.965E+00 | 8.503E-01  | 5.903E+01  | 1.844E+02 | 1.458E-01 | 0.000E+00 | 6.052E+01 | 1.356E+00 | 1.031E-01 | 3.365E+02 |
| 2006 | 2.888E+00 | 1.737E+01 | 8.144E+00 | 8.391E-01  | 5.795E+01  | 1.868E+02 | 1.170E-01 | 0.000E+00 | 6.029E+01 | 1.259E+00 | 1.014E-01 | 3.393E+02 |
| 2007 | 2.759E+00 | 1.080E+01 | 7.679E+00 | 8.649E-01  | 5.823E+01  | 1.865E+02 | 9.626E-02 | 0.000E+00 | 6.005E+01 | 1.108E+00 | 9.535E-02 | 3.320E+02 |
| 2008 | 2.457E+00 | 1.063E+01 | 8.061E+00 | 8.740E-01  | 5.688E+01  | 1.843E+02 | 1.624E-01 | 0.000E+00 | 6.175E+01 | 1.104E+00 | 9.359E-02 | 3.294E+02 |
| 2009 | 2.265E+00 | 1.075E+01 | 8.034E+00 | 6.372E-01  | 5.892E+01  | 1.885E+02 | 1.321E-01 | 0.000E+00 | 5.976E+01 | 1.137E+00 | 9.027E-02 | 3.334E+02 |
| 2010 | 2.102E+00 | 1.144E+01 | 8.732E+00 | 1.527E+00  | 6.159E+01  | 1.937E+02 | 1.351E-01 | 0.000E+00 | 5.976E+01 | 1.167E+00 | 8.373E-02 | 3.433E+02 |
| 2011 | 1.525E+00 | 1.057E+01 | 6.939E+00 | 5.134E-01  | 6.175E+01  | 1.936E+02 | 1.745E-01 | 0.000E+00 | 5.946E+01 | 1.035E+00 | 7.916E-02 | 3.389E+02 |
| 2012 | 1.764E+00 | 8.615E+00 | 7.840E+00 | 1.079E-01  | 6.117E+01  | 1.907E+02 | 1.744E-01 | 0.000E+00 | 5.958E+01 | 1.026E+00 | 7.439E-02 | 3.341E+02 |
| 2013 | 1.885E+00 | 1.060E+01 | 8.373E+00 | 2.999E-01  | 6.113E+01  | 1.902E+02 | 1.842E-01 | 0.000E+00 | 5.913E+01 | 1.019E+00 | 6.604E-02 | 3.356E+02 |
| 2014 | 1.367E+00 | 1.158E+01 | 6.695E+00 | 3.540E-01  | 6.334E+01  | 1.880E+02 | 1.658E-01 | 0.000E+00 | 5.756E+01 | 9.847E-01 | 6.185E-02 | 3.325E+02 |
| 2015 | 1.595E+00 | 1.362E+01 | 6.911E+00 | 1.415E-01  | 6.521E+01  | 1.908E+02 | 1.638E-01 | 0.000E+00 | 5.870E+01 | 9.739E-01 | 5.767E-02 | 3.401E+02 |
| 2016 | 1.827E+00 | 1.106E+01 | 7.195E+00 | 5.894E-01  | 6.561E+01  | 1.893E+02 | 1.112E-01 | 0.000E+00 | 5.764E+01 | 9.527E-01 | 4.967E-02 | 3.362E+02 |
| 2017 | 1.828E+00 | 8.756E+00 | 6.702E+00 | 2.324E-01  | 6.624E+01  | 1.883E+02 | 1.064E-01 | 0.000E+00 | 5.987E+01 | 9.291E-01 | 4.744E-02 | 3.351E+02 |
| 2018 | 2.120E+00 | 7.572E+00 | 6.338E+00 | 1.155E-01  | 6.598E+01  | 1.914E+02 | 1.187E-01 | 0.000E+00 | 5.631E+01 | 9.999E-01 | 3.997E-02 | 3.334E+02 |
| 2019 | 1.805E+00 | 8.502E+00 | 6.262E+00 | 3.579E-01  | 6.830E+01  | 1.888E+02 | 9.400E-02 | 0.000E+00 | 5.564E+01 | 9.369E-01 | 3.580E-02 | 3.329E+02 |
| 2020 | 1.862E+00 | 7.564E+00 | 5.386E+00 | 3.583E-01  | 5.534E+01  | 1.758E+02 | 6.637E-02 | 0.000E+00 | 3.454E+01 | 8.926E-01 | 3.269E-02 | 2.829E+02 |
| 2021 | 1.724E+00 | 7.801E+00 | 5.968E+00 | 1.271E-01  | 6.149E+01  | 1.683E+02 | 8.261E-02 | 0.000E+00 | 4.393E+01 | 8.885E-01 | 3.176E-02 | 2.915E+02 |
| 2022 | 1.461E+00 | 7.435E+00 | 5.081E+00 | 5.899E-02  | 7.003E+01  | 1.704E+02 | 1.020E-01 | 0.000E+00 | 6.532E+01 | 8.301E-01 | 3.165E-02 | 3.221E+02 |
| 2023 | 2.029E+00 | 5.715E+00 | 4.888E+00 | 2.135E-01  | 6.913E+01  | 1.684E+02 | 5.621E-02 | 0.000E+00 | 6.309E+01 | 9.766E-01 | 3.186E-02 | 3.157E+02 |

**Table B.20.** Annual anthropogenic Cu emissions in Germany, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 7.092E+01 | 1.421E+02 | 2.279E+00 | 0.000E+00  | 3.627E+01  | 2.699E+02 | 1.387E+00 | 2.798E-05 | 9.688E+01 | 6.317E-02 | 0.000E+00 | 6.225E+02 |
| 1991 | 4.958E+01 | 1.046E+02 | 2.038E+00 | 0.000E+00  | 3.818E+01  | 2.854E+02 | 1.356E+00 | 2.749E-05 | 9.449E+01 | 6.335E-02 | 0.000E+00 | 5.779E+02 |
| 1992 | 3.752E+01 | 7.873E+01 | 1.649E+00 | 0.000E+00  | 4.351E+01  | 2.925E+02 | 1.406E+00 | 1.955E-05 | 9.227E+01 | 6.374E-02 | 0.000E+00 | 5.495E+02 |
| 1993 | 2.742E+01 | 6.759E+01 | 1.617E+00 | 0.000E+00  | 4.516E+01  | 2.972E+02 | 1.412E+00 | 1.400E-05 | 9.030E+01 | 6.406E-02 | 0.000E+00 | 5.332E+02 |
| 1994 | 1.860E+01 | 5.365E+01 | 1.741E+00 | 0.000E+00  | 4.651E+01  | 3.047E+02 | 1.384E+00 | 1.347E-05 | 8.824E+01 | 6.384E-02 | 0.000E+00 | 5.171E+02 |
| 1995 | 1.050E+01 | 4.521E+01 | 2.518E+00 | 0.000E+00  | 5.822E+01  | 3.136E+02 | 1.140E+00 | 1.308E-05 | 9.031E+01 | 6.393E-02 | 0.000E+00 | 5.237E+02 |
| 1996 | 1.100E+01 | 4.426E+01 | 2.458E+00 | 0.000E+00  | 5.998E+01  | 3.194E+02 | 1.053E+00 | 1.086E-05 | 8.215E+01 | 6.403E-02 | 0.000E+00 | 5.225E+02 |
| 1997 | 1.047E+01 | 4.240E+01 | 3.103E+00 | 0.000E+00  | 5.721E+01  | 3.253E+02 | 8.757E-01 | 1.331E-05 | 9.232E+01 | 6.406E-02 | 0.000E+00 | 5.340E+02 |
| 1998 | 1.077E+01 | 4.249E+01 | 2.966E+00 | 0.000E+00  | 4.640E+01  | 3.325E+02 | 8.578E-01 | 1.181E-05 | 9.502E+01 | 6.405E-02 | 0.000E+00 | 5.332E+02 |
| 1999 | 1.042E+01 | 3.992E+01 | 2.971E+00 | 0.000E+00  | 5.028E+01  | 3.423E+02 | 7.361E-01 | 1.271E-05 | 9.419E+01 | 6.410E-02 | 0.000E+00 | 5.431E+02 |
| 2000 | 1.096E+01 | 3.655E+01 | 2.941E+00 | 0.000E+00  | 5.085E+01  | 3.447E+02 | 6.942E-01 | 1.284E-05 | 9.621E+01 | 6.421E-02 | 0.000E+00 | 5.454E+02 |
| 2001 | 1.131E+01 | 3.536E+01 | 3.145E+00 | 0.000E+00  | 4.655E+01  | 3.503E+02 | 6.828E-01 | 1.128E-05 | 9.664E+01 | 6.200E-02 | 0.000E+00 | 5.464E+02 |
| 2002 | 1.118E+01 | 3.297E+01 | 3.015E+00 | 0.000E+00  | 4.951E+01  | 3.543E+02 | 6.359E-01 | 9.440E-06 | 9.297E+01 | 6.348E-02 | 0.000E+00 | 5.472E+02 |
| 2003 | 1.153E+01 | 2.960E+01 | 2.310E+00 | 0.000E+00  | 4.936E+01  | 3.527E+02 | 8.147E-01 | 8.775E-06 | 9.537E+01 | 7.082E-02 | 0.000E+00 | 5.446E+02 |
| 2004 | 1.127E+01 | 3.008E+01 | 2.242E+00 | 0.000E+00  | 5.247E+01  | 3.579E+02 | 8.953E-01 | 7.552E-06 | 9.552E+01 | 5.836E-02 | 0.000E+00 | 5.534E+02 |
| 2005 | 1.112E+01 | 3.120E+01 | 2.193E+00 | 0.000E+00  | 5.127E+01  | 3.505E+02 | 9.799E-01 | 8.278E-06 | 9.463E+01 | 5.774E-02 | 0.000E+00 | 5.448E+02 |
| 2006 | 1.137E+01 | 2.978E+01 | 2.431E+00 | 0.000E+00  | 5.370E+01  | 3.555E+02 | 9.852E-01 | 7.587E-06 | 9.950E+01 | 6.134E-02 | 0.000E+00 | 5.562E+02 |
| 2007 | 1.159E+01 | 3.043E+01 | 2.657E+00 | 0.000E+00  | 5.417E+01  | 3.608E+02 | 8.698E-01 | 6.922E-06 | 1.006E+02 | 5.931E-02 | 0.000E+00 | 5.647E+02 |
| 2008 | 1.087E+01 | 3.063E+01 | 3.294E+00 | 0.000E+00  | 5.444E+01  | 3.592E+02 | 9.820E-01 | 7.335E-06 | 9.983E+01 | 6.278E-02 | 0.000E+00 | 5.627E+02 |
| 2009 | 1.017E+01 | 2.918E+01 | 3.138E+00 | 0.000E+00  | 5.226E+01  | 3.557E+02 | 8.080E-01 | 6.914E-06 | 8.863E+01 | 5.922E-02 | 0.000E+00 | 5.431E+02 |
| 2010 | 1.053E+01 | 2.737E+01 | 4.104E+00 | 0.000E+00  | 5.343E+01  | 3.605E+02 | 8.996E-01 | 6.629E-06 | 9.146E+01 | 5.840E-02 | 0.000E+00 | 5.516E+02 |
| 2011 | 1.044E+01 | 2.675E+01 | 3.421E+00 | 0.000E+00  | 5.307E+01  | 3.672E+02 | 8.288E-01 | 7.049E-06 | 9.096E+01 | 6.490E-02 | 0.000E+00 | 5.558E+02 |
| 2012 | 1.120E+01 | 2.480E+01 | 4.002E+00 | 0.000E+00  | 5.480E+01  | 3.672E+02 | 8.480E-01 | 6.374E-06 | 9.259E+01 | 6.340E-02 | 0.000E+00 | 5.583E+02 |
| 2013 | 1.182E+01 | 2.421E+01 | 4.385E+00 | 0.000E+00  | 5.295E+01  | 3.727E+02 | 8.430E-01 | 5.710E-06 | 8.876E+01 | 6.156E-02 | 0.000E+00 | 5.583E+02 |
| 2014 | 1.138E+01 | 2.324E+01 | 3.529E+00 | 0.000E+00  | 5.615E+01  | 3.786E+02 | 8.449E-01 | 5.514E-06 | 9.513E+01 | 6.317E-02 | 0.000E+00 | 5.715E+02 |
| 2015 | 1.101E+01 | 2.512E+01 | 3.807E+00 | 0.000E+00  | 5.765E+01  | 3.849E+02 | 8.162E-01 | 6.557E-06 | 9.802E+01 | 6.597E-02 | 0.000E+00 | 5.838E+02 |
| 2016 | 1.057E+01 | 2.465E+01 | 3.814E+00 | 0.000E+00  | 5.741E+01  | 3.923E+02 | 7.673E-01 | 5.388E-06 | 9.921E+01 | 6.153E-02 | 0.000E+00 | 5.917E+02 |
| 2017 | 9.506E+00 | 2.537E+01 | 3.956E+00 | 0.000E+00  | 5.809E+01  | 3.971E+02 | 7.759E-01 | 5.226E-06 | 9.626E+01 | 6.989E-02 | 0.000E+00 | 5.935E+02 |
| 2018 | 9.065E+00 | 2.349E+01 | 3.910E+00 | 0.000E+00  | 5.806E+01  | 4.006E+02 | 7.878E-01 | 5.219E-06 | 9.909E+01 | 8.524E-02 | 0.000E+00 | 5.967E+02 |
| 2019 | 7.108E+00 | 2.128E+01 | 4.066E+00 | 0.000E+00  | 5.707E+01  | 4.017E+02 | 7.869E-01 | 4.285E-06 | 1.023E+02 | 7.730E-02 | 0.000E+00 | 5.956E+02 |
| 2020 | 5.814E+00 | 2.279E+01 | 3.933E+00 | 0.000E+00  | 3.786E+01  | 3.578E+02 | 7.375E-01 | 2.798E-06 | 1.069E+02 | 7.461E-02 | 0.000E+00 | 5.371E+02 |
| 2021 | 6.797E+00 | 2.259E+01 | 4.600E+00 | 0.000E+00  | 3.716E+01  | 3.618E+02 | 6.607E-01 | 3.553E-06 | 1.110E+02 | 6.797E-02 | 0.000E+00 | 5.460E+02 |
| 2022 | 7.337E+00 | 2.255E+01 | 4.701E+00 | 0.000E+00  | 5.153E+01  | 3.690E+02 | 5.357E-01 | 3.942E-06 | 1.089E+02 | 7.500E-02 | 0.000E+00 | 5.660E+02 |
| 2023 | 5.526E+00 | 2.120E+01 | 4.345E+00 | 0.000E+00  | 5.051E+01  | 3.933E+02 | 5.609E-01 | 2.275E-06 | 1.087E+02 | 7.602E-02 | 0.000E+00 | 5.855E+02 |



**Table B.21** Annual anthropogenic Cu emissions in Iceland, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 7.933E-04 | 2.435E-02 | 3.168E-04 | 0.000E+00  | 5.077E-02  | 1.339E+00 | 1.056E-02 | 0.000E+00 | 2.874E-01 | 9.496E-03 | 0.000E+00 | 1.731E+00 |
| 1991 | 8.927E-04 | 2.340E-02 | 2.974E-04 | 0.000E+00  | 4.041E-02  | 1.398E+00 | 7.888E-03 | 0.000E+00 | 2.850E-01 | 9.426E-03 | 0.000E+00 | 1.769E+00 |
| 1992 | 8.344E-04 | 2.151E-02 | 2.998E-04 | 0.000E+00  | 6.878E-02  | 1.438E+00 | 8.707E-03 | 0.000E+00 | 3.037E-01 | 9.246E-03 | 0.000E+00 | 1.857E+00 |
| 1993 | 1.120E-03 | 2.322E-02 | 3.268E-04 | 0.000E+00  | 6.345E-02  | 1.442E+00 | 1.024E-02 | 0.000E+00 | 3.232E-01 | 8.272E-03 | 0.000E+00 | 1.880E+00 |
| 1994 | 1.110E-03 | 2.369E-02 | 3.218E-04 | 0.000E+00  | 5.955E-02  | 1.469E+00 | 8.290E-03 | 0.000E+00 | 3.192E-01 | 7.849E-03 | 0.000E+00 | 1.899E+00 |
| 1995 | 1.221E-03 | 2.203E-02 | 3.268E-04 | 0.000E+00  | 6.288E-02  | 1.449E+00 | 1.214E-02 | 0.000E+00 | 3.549E-01 | 7.223E-03 | 0.000E+00 | 1.911E+00 |
| 1996 | 1.084E-03 | 2.175E-02 | 3.341E-04 | 0.000E+00  | 7.920E-02  | 1.417E+00 | 1.516E-02 | 0.000E+00 | 3.532E-01 | 6.682E-03 | 0.000E+00 | 1.900E+00 |
| 1997 | 7.868E-04 | 2.698E-02 | 3.166E-04 | 0.000E+00  | 9.389E-02  | 1.505E+00 | 8.469E-03 | 0.000E+00 | 3.634E-01 | 6.216E-03 | 0.000E+00 | 2.016E+00 |
| 1998 | 7.706E-04 | 3.628E-02 | 3.436E-04 | 0.000E+00  | 1.210E-01  | 1.533E+00 | 6.762E-03 | 0.000E+00 | 3.597E-01 | 5.586E-03 | 0.000E+00 | 2.079E+00 |
| 1999 | 7.092E-04 | 4.395E-02 | 3.553E-04 | 0.000E+00  | 2.429E-01  | 1.608E+00 | 5.018E-03 | 0.000E+00 | 3.550E-01 | 4.995E-03 | 0.000E+00 | 2.272E+00 |
| 2000 | 7.134E-04 | 4.526E-02 | 3.427E-04 | 0.000E+00  | 1.679E-01  | 1.647E+00 | 3.692E-03 | 0.000E+00 | 3.591E-01 | 4.930E-03 | 0.000E+00 | 2.245E+00 |
| 2001 | 7.023E-04 | 5.024E-02 | 3.539E-04 | 0.000E+00  | 2.139E-01  | 1.677E+00 | 6.753E-03 | 0.000E+00 | 3.139E-01 | 4.633E-03 | 0.000E+00 | 2.284E+00 |
| 2002 | 7.445E-04 | 5.089E-02 | 3.584E-04 | 0.000E+00  | 1.478E-01  | 1.708E+00 | 6.055E-03 | 0.000E+00 | 3.309E-01 | 4.424E-03 | 0.000E+00 | 2.274E+00 |
| 2003 | 6.723E-04 | 5.115E-02 | 3.042E-04 | 0.000E+00  | 2.319E-01  | 1.929E+00 | 9.636E-03 | 0.000E+00 | 3.139E-01 | 4.048E-03 | 0.000E+00 | 2.546E+00 |
| 2004 | 6.043E-04 | 5.482E-02 | 3.435E-04 | 0.000E+00  | 2.509E-01  | 2.031E+00 | 1.425E-02 | 0.000E+00 | 3.381E-01 | 3.115E-03 | 0.000E+00 | 2.699E+00 |
| 2005 | 6.120E-04 | 5.100E-02 | 3.219E-04 | 0.000E+00  | 2.834E-01  | 2.107E+00 | 6.556E-03 | 0.000E+00 | 3.320E-01 | 2.889E-03 | 0.000E+00 | 2.785E+00 |
| 2006 | 1.178E-03 | 6.365E-02 | 2.191E-04 | 0.000E+00  | 4.561E-01  | 2.411E+00 | 1.655E-02 | 0.000E+00 | 3.051E-01 | 2.827E-03 | 0.000E+00 | 3.263E+00 |
| 2007 | 1.264E-03 | 8.739E-02 | 1.709E-04 | 0.000E+00  | 4.830E-01  | 2.511E+00 | 2.239E-02 | 0.000E+00 | 3.426E-01 | 3.216E-03 | 0.000E+00 | 3.456E+00 |
| 2008 | 1.141E-03 | 1.403E-01 | 1.388E-04 | 0.000E+00  | 2.193E-01  | 2.384E+00 | 1.684E-02 | 0.000E+00 | 3.181E-01 | 3.683E-03 | 0.000E+00 | 3.101E+00 |
| 2009 | 8.542E-04 | 1.399E-01 | 1.230E-04 | 0.000E+00  | 1.872E-01  | 2.370E+00 | 1.015E-02 | 0.000E+00 | 3.064E-01 | 2.574E-03 | 0.000E+00 | 3.021E+00 |
| 2010 | 8.722E-04 | 1.368E-01 | 1.542E-04 | 0.000E+00  | 2.179E-01  | 2.282E+00 | 1.071E-02 | 0.000E+00 | 2.834E-01 | 2.077E-03 | 0.000E+00 | 2.934E+00 |
| 2011 | 6.728E-04 | 1.363E-01 | 1.183E-04 | 0.000E+00  | 2.447E-01  | 2.256E+00 | 5.273E-03 | 0.000E+00 | 2.563E-01 | 2.242E-03 | 0.000E+00 | 2.919E+00 |
| 2012 | 6.357E-04 | 1.373E-01 | 9.944E-05 | 0.000E+00  | 2.790E-01  | 2.241E+00 | 3.871E-03 | 0.000E+00 | 2.513E-01 | 2.334E-03 | 0.000E+00 | 2.925E+00 |
| 2013 | 2.134E-04 | 1.406E-01 | 8.497E-05 | 0.000E+00  | 1.767E-01  | 2.276E+00 | 4.823E-03 | 0.000E+00 | 2.404E-01 | 2.585E-03 | 0.000E+00 | 2.868E+00 |
| 2014 | 2.074E-04 | 1.401E-01 | 9.739E-05 | 0.000E+00  | 2.271E-01  | 2.265E+00 | 6.444E-03 | 0.000E+00 | 2.493E-01 | 3.377E-03 | 0.000E+00 | 2.915E+00 |
| 2015 | 1.680E-04 | 1.512E-01 | 7.980E-05 | 0.000E+00  | 2.673E-01  | 2.352E+00 | 7.498E-03 | 0.000E+00 | 2.476E-01 | 3.382E-03 | 0.000E+00 | 3.075E+00 |
| 2016 | 8.938E-05 | 1.491E-01 | 6.013E-05 | 0.000E+00  | 2.673E-01  | 2.611E+00 | 7.722E-03 | 0.000E+00 | 2.197E-01 | 5.241E-03 | 0.000E+00 | 3.321E+00 |
| 2017 | 9.148E-05 | 1.562E-01 | 6.709E-05 | 0.000E+00  | 2.697E-01  | 2.762E+00 | 8.708E-03 | 0.000E+00 | 2.266E-01 | 4.173E-03 | 0.000E+00 | 3.500E+00 |
| 2018 | 8.836E-05 | 1.586E-01 | 6.124E-05 | 0.000E+00  | 3.373E-01  | 2.858E+00 | 1.395E-02 | 0.000E+00 | 2.175E-01 | 3.574E-03 | 0.000E+00 | 3.668E+00 |
| 2019 | 1.842E-04 | 1.555E-01 | 8.142E-05 | 0.000E+00  | 2.084E-01  | 2.875E+00 | 1.648E-02 | 0.000E+00 | 1.949E-01 | 3.671E-03 | 0.000E+00 | 3.518E+00 |
| 2020 | 9.558E-05 | 1.503E-01 | 5.594E-05 | 0.000E+00  | 2.194E-01  | 2.523E+00 | 6.894E-03 | 0.000E+00 | 1.703E-01 | 2.854E-03 | 0.000E+00 | 3.094E+00 |
| 2021 | 1.179E-04 | 1.491E-01 | 6.636E-05 | 0.000E+00  | 2.337E-01  | 2.687E+00 | 4.829E-03 | 0.000E+00 | 1.862E-01 | 2.797E-03 | 0.000E+00 | 3.300E+00 |
| 2022 | 3.854E-04 | 1.495E-01 | 6.640E-05 | 0.000E+00  | 3.051E-01  | 2.805E+00 | 6.761E-03 | 0.000E+00 | 1.613E-01 | 3.342E-03 | 0.000E+00 | 3.513E+00 |
| 2023 | 4.032E-04 | 1.509E-01 | 6.360E-05 | 0.000E+00  | 1.975E-01  | 2.790E+00 | 4.641E-03 | 0.000E+00 | 1.700E-01 | 4.024E-03 | 0.000E+00 | 3.411E+00 |



**Table B.22.** Annual anthropogenic Cu emissions in Ireland, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 5.052E-01 | 4.600E-01 | 1.343E+00 | 0.000E+00  | 2.545E+00  | 1.452E+01 | 3.116E-02 | 7.257E-04 | 4.137E-01 | 3.180E-01 | 0.000E+00 | 2.016E+01 |
| 1991 | 5.489E-01 | 4.260E-01 | 1.311E+00 | 0.000E+00  | 2.674E+00  | 1.522E+01 | 2.991E-02 | 7.040E-04 | 4.258E-01 | 3.187E-01 | 0.000E+00 | 2.099E+01 |
| 1992 | 6.082E-01 | 4.041E-01 | 1.122E+00 | 0.000E+00  | 2.840E+00  | 1.644E+01 | 3.329E-02 | 6.547E-04 | 4.249E-01 | 3.203E-01 | 0.000E+00 | 2.221E+01 |
| 1993 | 5.922E-01 | 4.136E-01 | 1.085E+00 | 0.000E+00  | 2.827E+00  | 1.638E+01 | 3.329E-02 | 6.101E-04 | 4.358E-01 | 3.213E-01 | 0.000E+00 | 2.214E+01 |
| 1994 | 6.235E-01 | 4.614E-01 | 9.745E-01 | 0.000E+00  | 2.940E+00  | 1.717E+01 | 3.829E-02 | 6.418E-04 | 4.791E-01 | 3.215E-01 | 0.000E+00 | 2.305E+01 |
| 1995 | 6.481E-01 | 4.624E-01 | 8.823E-01 | 0.000E+00  | 3.091E+00  | 1.791E+01 | 3.366E-02 | 6.567E-04 | 5.423E-01 | 3.219E-01 | 0.000E+00 | 2.401E+01 |
| 1996 | 6.467E-01 | 4.680E-01 | 8.642E-01 | 0.000E+00  | 3.486E+00  | 2.088E+01 | 3.681E-02 | 7.223E-04 | 4.601E-01 | 3.233E-01 | 0.000E+00 | 2.733E+01 |
| 1997 | 6.719E-01 | 5.084E-01 | 7.619E-01 | 0.000E+00  | 3.698E+00  | 2.229E+01 | 3.806E-02 | 7.404E-04 | 4.654E-01 | 3.256E-01 | 0.000E+00 | 2.891E+01 |
| 1998 | 7.431E-01 | 5.052E-01 | 7.856E-01 | 0.000E+00  | 4.256E+00  | 2.646E+01 | 4.070E-02 | 7.992E-04 | 4.678E-01 | 3.040E-01 | 0.000E+00 | 3.373E+01 |
| 1999 | 7.407E-01 | 5.282E-01 | 6.193E-01 | 0.000E+00  | 4.668E+00  | 2.932E+01 | 4.459E-02 | 8.607E-04 | 4.808E-01 | 3.061E-01 | 0.000E+00 | 3.688E+01 |
| 2000 | 7.110E-01 | 6.429E-01 | 6.118E-01 | 0.000E+00  | 5.133E+00  | 3.295E+01 | 5.142E-02 | 9.169E-04 | 4.933E-01 | 3.089E-01 | 0.000E+00 | 4.106E+01 |
| 2001 | 7.854E-01 | 6.504E-01 | 5.803E-01 | 0.000E+00  | 5.379E+00  | 3.460E+01 | 4.949E-02 | 9.194E-04 | 5.044E-01 | 3.124E-01 | 0.000E+00 | 4.302E+01 |
| 2002 | 6.967E-01 | 5.983E-01 | 5.668E-01 | 0.000E+00  | 5.493E+00  | 3.535E+01 | 5.132E-02 | 8.671E-04 | 4.925E-01 | 3.168E-01 | 0.000E+00 | 4.371E+01 |
| 2003 | 5.833E-01 | 6.148E-01 | 5.510E-01 | 0.000E+00  | 5.566E+00  | 3.592E+01 | 5.439E-02 | 8.705E-04 | 5.124E-01 | 3.204E-01 | 0.000E+00 | 4.430E+01 |
| 2004 | 6.233E-01 | 6.075E-01 | 5.309E-01 | 0.000E+00  | 5.854E+00  | 3.809E+01 | 6.917E-02 | 8.754E-04 | 5.047E-01 | 3.239E-01 | 0.000E+00 | 4.676E+01 |
| 2005 | 6.503E-01 | 6.774E-01 | 5.508E-01 | 0.000E+00  | 6.192E+00  | 4.022E+01 | 6.480E-02 | 9.015E-04 | 5.206E-01 | 3.285E-01 | 0.000E+00 | 4.932E+01 |
| 2006 | 5.618E-01 | 6.016E-01 | 5.276E-01 | 0.000E+00  | 6.439E+00  | 4.223E+01 | 6.862E-02 | 9.663E-04 | 4.992E-01 | 3.341E-01 | 0.000E+00 | 5.141E+01 |
| 2007 | 4.867E-01 | 6.121E-01 | 5.037E-01 | 0.000E+00  | 6.706E+00  | 4.455E+01 | 5.419E-02 | 1.031E-03 | 4.820E-01 | 3.426E-01 | 0.000E+00 | 5.387E+01 |
| 2008 | 4.273E-01 | 5.368E-01 | 5.314E-01 | 0.000E+00  | 6.552E+00  | 4.257E+01 | 5.616E-02 | 1.041E-03 | 5.125E-01 | 3.483E-01 | 0.000E+00 | 5.162E+01 |
| 2009 | 3.308E-01 | 3.962E-01 | 5.249E-01 | 0.000E+00  | 6.167E+00  | 3.926E+01 | 5.473E-02 | 8.650E-04 | 4.394E-01 | 3.496E-01 | 0.000E+00 | 4.763E+01 |
| 2010 | 3.475E-01 | 3.696E-01 | 4.966E-01 | 0.000E+00  | 5.808E+00  | 3.648E+01 | 5.490E-02 | 7.709E-04 | 4.144E-01 | 3.484E-01 | 0.000E+00 | 4.446E+01 |
| 2011 | 3.523E-01 | 2.876E-01 | 4.500E-01 | 0.000E+00  | 5.745E+00  | 3.589E+01 | 4.766E-02 | 7.437E-04 | 4.263E-01 | 3.470E-01 | 0.000E+00 | 4.365E+01 |
| 2012 | 4.464E-01 | 2.968E-01 | 4.456E-01 | 0.000E+00  | 5.582E+00  | 3.469E+01 | 5.037E-02 | 7.390E-04 | 3.820E-01 | 3.462E-01 | 0.000E+00 | 4.236E+01 |
| 2013 | 3.903E-01 | 3.014E-01 | 4.809E-01 | 0.000E+00  | 5.725E+00  | 3.564E+01 | 4.926E-02 | 7.640E-04 | 3.441E-01 | 3.456E-01 | 0.000E+00 | 4.341E+01 |
| 2014 | 3.929E-01 | 3.278E-01 | 4.362E-01 | 0.000E+00  | 5.886E+00  | 3.668E+01 | 6.167E-02 | 7.977E-04 | 3.109E-01 | 3.452E-01 | 0.000E+00 | 4.457E+01 |
| 2015 | 4.443E-01 | 3.368E-01 | 4.479E-01 | 0.000E+00  | 6.085E+00  | 3.849E+01 | 6.083E-02 | 8.879E-04 | 3.010E-01 | 3.457E-01 | 0.000E+00 | 4.666E+01 |
| 2016 | 4.724E-01 | 3.462E-01 | 4.547E-01 | 0.000E+00  | 6.172E+00  | 3.951E+01 | 7.310E-02 | 9.709E-04 | 3.119E-01 | 3.466E-01 | 0.000E+00 | 4.784E+01 |
| 2017 | 3.893E-01 | 3.554E-01 | 3.896E-01 | 0.000E+00  | 6.153E+00  | 3.966E+01 | 6.454E-02 | 1.032E-03 | 3.254E-01 | 3.497E-01 | 0.000E+00 | 4.784E+01 |
| 2018 | 2.613E-01 | 3.640E-01 | 4.189E-01 | 0.000E+00  | 6.173E+00  | 4.010E+01 | 7.139E-02 | 1.125E-03 | 3.452E-01 | 3.530E-01 | 0.000E+00 | 4.825E+01 |
| 2019 | 1.589E-01 | 3.387E-01 | 3.759E-01 | 0.000E+00  | 6.269E+00  | 4.047E+01 | 7.603E-02 | 1.163E-03 | 3.540E-01 | 3.564E-01 | 0.000E+00 | 4.854E+01 |
| 2020 | 1.894E-01 | 3.266E-01 | 3.857E-01 | 0.000E+00  | 5.205E+00  | 3.421E+01 | 9.298E-02 | 3.990E-04 | 3.424E-01 | 3.600E-01 | 0.000E+00 | 4.126E+01 |
| 2021 | 3.956E-01 | 3.605E-01 | 3.720E-01 | 0.000E+00  | 5.511E+00  | 3.635E+01 | 9.943E-02 | 4.058E-04 | 3.449E-01 | 3.635E-01 | 0.000E+00 | 4.395E+01 |
| 2022 | 3.426E-01 | 3.465E-01 | 3.024E-01 | 0.000E+00  | 5.876E+00  | 3.922E+01 | 8.388E-02 | 9.802E-04 | 4.531E-01 | 3.682E-01 | 0.000E+00 | 4.712E+01 |
| 2023 | 1.933E-01 | 3.155E-01 | 2.584E-01 | 0.000E+00  | 6.104E+00  | 4.032E+01 | 7.868E-02 | 1.105E-03 | 4.191E-01 | 3.752E-01 | 0.000E+00 | 4.819E+01 |



**Table B.23.** Annual anthropogenic Cu emissions in the Netherlands, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 2.072E+00 | 5.933E+00 | 8.261E-01 | 1.395E-03  | 2.596E+00  | 1.984E+01 | 1.269E-02 | 9.702E-02 | 6.110E+01 | 1.427E-02 | 0.000E+00 | 9.289E+01 |
| 1991 | 1.442E+00 | 5.949E+00 | 7.603E-01 | 1.550E-03  | 3.164E+00  | 1.871E+01 | 1.231E-02 | 9.976E-02 | 6.467E+01 | 1.470E-02 | 0.000E+00 | 9.518E+01 |
| 1992 | 1.127E+00 | 5.968E+00 | 6.537E-01 | 1.521E-03  | 4.042E+00  | 1.951E+01 | 1.178E-02 | 1.083E-01 | 6.596E+01 | 1.449E-02 | 0.000E+00 | 9.777E+01 |
| 1993 | 8.117E-01 | 5.988E+00 | 5.902E-01 | 1.721E-03  | 4.639E+00  | 1.917E+01 | 1.115E-02 | 1.211E-01 | 6.816E+01 | 1.474E-02 | 0.000E+00 | 9.989E+01 |
| 1994 | 4.944E-01 | 6.007E+00 | 4.812E-01 | 1.768E-03  | 4.702E+00  | 1.930E+01 | 1.223E-02 | 1.320E-01 | 6.852E+01 | 1.478E-02 | 0.000E+00 | 1.001E+02 |
| 1995 | 4.650E-01 | 6.031E+00 | 4.057E-01 | 1.678E-03  | 4.982E+00  | 1.952E+01 | 1.185E-02 | 1.417E-01 | 6.995E+01 | 1.510E-02 | 0.000E+00 | 1.019E+02 |
| 1996 | 4.155E-01 | 5.703E+00 | 4.531E-01 | 2.072E-03  | 5.469E+00  | 1.936E+01 | 1.168E-02 | 1.555E-01 | 7.390E+01 | 1.618E-02 | 0.000E+00 | 1.059E+02 |
| 1997 | 3.660E-01 | 5.519E+00 | 4.166E-01 | 2.687E-03  | 5.476E+00  | 1.932E+01 | 1.313E-02 | 1.665E-01 | 7.457E+01 | 1.607E-02 | 0.000E+00 | 1.063E+02 |
| 1998 | 3.165E-01 | 5.052E+00 | 3.881E-01 | 2.454E-03  | 4.865E+00  | 1.931E+01 | 1.283E-02 | 1.719E-01 | 7.708E+01 | 1.566E-02 | 0.000E+00 | 1.077E+02 |
| 1999 | 1.613E-01 | 4.731E+00 | 3.572E-01 | 2.514E-03  | 5.814E+00  | 1.966E+01 | 1.282E-02 | 1.797E-01 | 7.695E+01 | 1.541E-02 | 0.000E+00 | 1.084E+02 |
| 2000 | 2.434E-01 | 4.426E+00 | 3.500E-01 | 2.505E-03  | 7.599E+00  | 1.934E+01 | 1.257E-02 | 1.865E-01 | 7.774E+01 | 1.543E-02 | 0.000E+00 | 1.104E+02 |
| 2001 | 2.252E-01 | 3.722E+00 | 3.677E-01 | 2.459E-03  | 6.866E+00  | 1.955E+01 | 1.254E-02 | 1.898E-01 | 7.517E+01 | 1.570E-02 | 0.000E+00 | 1.066E+02 |
| 2002 | 3.167E-01 | 4.640E+00 | 3.513E-01 | 2.846E-03  | 5.200E+00  | 1.988E+01 | 1.206E-02 | 1.927E-01 | 7.410E+01 | 1.568E-02 | 0.000E+00 | 1.052E+02 |
| 2003 | 2.671E-01 | 3.951E+00 | 3.738E-01 | 2.891E-03  | 6.201E+00  | 2.009E+01 | 1.184E-02 | 1.962E-01 | 7.519E+01 | 1.549E-02 | 0.000E+00 | 1.068E+02 |
| 2004 | 2.832E-01 | 3.375E+00 | 3.894E-01 | 3.045E-03  | 7.746E+00  | 2.058E+01 | 1.236E-02 | 2.061E-01 | 7.823E+01 | 1.491E-02 | 0.000E+00 | 1.114E+02 |
| 2005 | 3.398E-01 | 3.249E+00 | 3.935E-01 | 3.356E-03  | 7.678E+00  | 2.033E+01 | 1.203E-02 | 2.126E-01 | 7.642E+01 | 1.501E-02 | 0.000E+00 | 1.092E+02 |
| 2006 | 2.238E-01 | 3.178E+00 | 3.995E-01 | 3.545E-03  | 7.681E+00  | 2.046E+01 | 1.196E-02 | 2.200E-01 | 7.624E+01 | 1.579E-02 | 0.000E+00 | 1.090E+02 |
| 2007 | 2.238E-01 | 3.614E+00 | 3.865E-01 | 3.500E-03  | 7.909E+00  | 2.090E+01 | 1.214E-02 | 2.264E-01 | 7.527E+01 | 1.608E-02 | 0.000E+00 | 1.091E+02 |
| 2008 | 3.047E-01 | 4.208E+00 | 4.268E-01 | 3.683E-03  | 7.012E+00  | 2.091E+01 | 1.178E-02 | 2.261E-01 | 7.670E+01 | 1.577E-02 | 0.000E+00 | 1.104E+02 |
| 2009 | 1.830E-01 | 4.265E+00 | 4.384E-01 | 3.505E-03  | 6.218E+00  | 2.095E+01 | 9.463E-03 | 2.065E-01 | 7.835E+01 | 1.645E-02 | 0.000E+00 | 1.112E+02 |
| 2010 | 1.886E-01 | 4.950E+00 | 5.232E-01 | 4.141E-03  | 6.941E+00  | 2.107E+01 | 1.035E-02 | 2.130E-01 | 8.230E+01 | 1.647E-02 | 0.000E+00 | 1.165E+02 |
| 2011 | 2.089E-01 | 4.249E+00 | 4.272E-01 | 4.876E-03  | 7.102E+00  | 2.109E+01 | 3.508E-03 | 2.266E-01 | 8.136E+01 | 1.581E-02 | 0.000E+00 | 1.150E+02 |
| 2012 | 2.766E-01 | 2.841E+00 | 4.557E-01 | 4.492E-03  | 7.209E+00  | 2.094E+01 | 3.563E-03 | 2.268E-01 | 8.103E+01 | 1.575E-02 | 0.000E+00 | 1.133E+02 |
| 2013 | 2.417E-01 | 1.795E+00 | 4.783E-01 | 4.568E-03  | 8.256E+00  | 2.078E+01 | 3.330E-03 | 2.334E-01 | 7.990E+01 | 1.550E-02 | 0.000E+00 | 1.120E+02 |
| 2014 | 2.022E-01 | 1.449E+00 | 3.764E-01 | 4.522E-03  | 9.369E+00  | 2.088E+01 | 3.456E-03 | 2.430E-01 | 7.698E+01 | 1.608E-02 | 0.000E+00 | 1.098E+02 |
| 2015 | 2.038E-01 | 9.702E-01 | 4.160E-01 | 4.098E-03  | 9.589E+00  | 2.133E+01 | 3.584E-03 | 2.527E-01 | 7.696E+01 | 1.624E-02 | 0.000E+00 | 1.099E+02 |
| 2016 | 2.218E-01 | 1.076E+00 | 4.240E-01 | 3.453E-03  | 8.470E+00  | 2.200E+01 | 3.661E-03 | 2.671E-01 | 7.982E+01 | 1.639E-02 | 0.000E+00 | 1.125E+02 |
| 2017 | 1.424E-01 | 2.179E+00 | 4.053E-01 | 3.300E-03  | 8.077E+00  | 2.241E+01 | 3.720E-03 | 2.788E-01 | 7.984E+01 | 1.676E-02 | 0.000E+00 | 1.136E+02 |
| 2018 | 9.956E-02 | 1.117E+00 | 4.046E-01 | 3.918E-03  | 8.354E+00  | 2.278E+01 | 3.798E-03 | 2.865E-01 | 8.186E+01 | 1.636E-02 | 0.000E+00 | 1.152E+02 |
| 2019 | 7.158E-01 | 1.025E+00 | 3.996E-01 | 3.871E-03  | 7.292E+00  | 2.294E+01 | 3.691E-03 | 2.865E-01 | 8.309E+01 | 1.414E-02 | 0.000E+00 | 1.160E+02 |
| 2020 | 1.504E-01 | 3.055E+00 | 3.760E-01 | 3.851E-03  | 5.057E+00  | 2.016E+01 | 3.430E-03 | 1.510E-01 | 7.490E+01 | 1.080E-02 | 0.000E+00 | 1.042E+02 |
| 2021 | 1.054E-01 | 1.519E+00 | 4.440E-01 | 3.404E-03  | 2.485E+00  | 2.117E+01 | 3.573E-03 | 1.714E-01 | 7.460E+01 | 1.072E-02 | 0.000E+00 | 1.008E+02 |
| 2022 | 1.019E-01 | 6.691E-01 | 4.295E-01 | 1.555E-03  | 4.937E+00  | 2.219E+01 | 3.478E-03 | 2.349E-01 | 7.798E+01 | 1.461E-02 | 0.000E+00 | 1.068E+02 |
| 2023 | 1.423E-01 | 1.001E+00 | 4.166E-01 | 1.858E-03  | 8.000E+00  | 2.277E+01 | 3.250E-03 | 2.541E-01 | 7.842E+01 | 1.486E-02 | 0.000E+00 | 1.113E+02 |



**Table B.24.** Annual anthropogenic Cu emissions in Norway, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 2.801E-01 | 7.691E+00 | 4.333E-01 | 9.653E-03  | 1.069E-02  | 1.327E+01 | 3.280E-02 | 5.945E-03 | 1.844E+00 | 2.309E-01 | 2.936E-02 | 2.405E+01 |
| 1991 | 2.811E-01 | 8.645E+00 | 3.751E-01 | 6.366E-03  | 1.108E-02  | 1.311E+01 | 2.888E-02 | 5.708E-03 | 1.896E+00 | 2.297E-01 | 2.308E-02 | 2.478E+01 |
| 1992 | 2.805E-01 | 5.829E+00 | 3.892E-01 | 5.764E-03  | 1.125E-02  | 1.311E+01 | 3.186E-02 | 5.871E-03 | 1.909E+00 | 2.315E-01 | 1.256E-02 | 2.200E+01 |
| 1993 | 2.980E-01 | 6.047E+00 | 4.000E-01 | 6.582E-03  | 1.161E-02  | 1.334E+01 | 3.283E-02 | 5.815E-03 | 1.910E+00 | 2.315E-01 | 1.736E-02 | 2.247E+01 |
| 1994 | 3.098E-01 | 6.508E+00 | 4.232E-01 | 6.828E-03  | 1.034E-02  | 1.358E+01 | 3.198E-02 | 6.113E-03 | 2.020E+00 | 2.323E-01 | 1.246E-02 | 2.330E+01 |
| 1995 | 1.494E-01 | 5.995E+00 | 4.171E-01 | 7.359E-03  | 1.583E-02  | 1.374E+01 | 4.271E-02 | 6.208E-03 | 2.060E+00 | 4.888E-02 | 1.544E-02 | 2.272E+01 |
| 1996 | 1.453E-01 | 5.606E+00 | 4.461E-01 | 8.523E-03  | 1.539E-02  | 1.413E+01 | 4.592E-02 | 6.941E-03 | 2.192E+00 | 6.039E-02 | 1.685E-02 | 2.293E+01 |
| 1997 | 1.399E-01 | 5.918E+00 | 4.646E-01 | 7.969E-03  | 1.894E-02  | 1.463E+01 | 5.358E-02 | 7.268E-03 | 2.173E+00 | 5.952E-02 | 1.212E-02 | 2.378E+01 |
| 1998 | 1.488E-01 | 6.412E+00 | 4.301E-01 | 8.549E-03  | 2.534E-02  | 1.489E+01 | 4.931E-02 | 7.444E-03 | 2.234E+00 | 4.919E-02 | 1.273E-02 | 2.455E+01 |
| 1999 | 1.649E-01 | 6.344E+00 | 4.378E-01 | 1.199E-02  | 4.126E-02  | 1.520E+01 | 4.690E-02 | 8.500E-03 | 2.068E+00 | 3.067E-02 | 1.143E-02 | 2.463E+01 |
| 2000 | 2.024E-01 | 5.446E+00 | 4.517E-01 | 1.277E-02  | 3.613E-02  | 1.529E+01 | 3.705E-02 | 7.904E-03 | 1.970E+00 | 7.032E-02 | 1.218E-02 | 2.379E+01 |
| 2001 | 1.256E-01 | 5.452E+00 | 5.440E-01 | 1.018E-02  | 3.083E-02  | 1.578E+01 | 3.638E-02 | 7.409E-03 | 2.038E+00 | 5.427E-02 | 9.605E-03 | 2.434E+01 |
| 2002 | 1.212E-01 | 4.996E+00 | 6.667E-01 | 7.933E-03  | 3.737E-02  | 1.602E+01 | 3.540E-02 | 6.840E-03 | 2.015E+00 | 2.711E-02 | 7.198E-03 | 2.413E+01 |
| 2003 | 1.163E-01 | 4.941E+00 | 7.205E-01 | 7.811E-03  | 4.338E-02  | 1.624E+01 | 6.284E-02 | 6.857E-03 | 2.029E+00 | 4.248E-02 | 6.044E-03 | 2.442E+01 |
| 2004 | 9.855E-02 | 4.900E+00 | 6.492E-01 | 8.534E-03  | 4.058E-02  | 1.669E+01 | 6.326E-02 | 7.221E-03 | 2.051E+00 | 3.444E-02 | 6.780E-03 | 2.477E+01 |
| 2005 | 1.412E-01 | 4.951E+00 | 7.223E-01 | 8.081E-03  | 4.061E-02  | 1.750E+01 | 4.778E-02 | 6.940E-03 | 2.088E+00 | 4.011E-02 | 5.688E-03 | 2.579E+01 |
| 2006 | 1.235E-01 | 4.692E+00 | 8.290E-01 | 7.597E-03  | 3.366E-02  | 1.819E+01 | 7.207E-02 | 7.368E-03 | 2.154E+00 | 4.165E-02 | 4.754E-03 | 2.640E+01 |
| 2007 | 1.497E-01 | 4.358E+00 | 7.898E-01 | 1.765E-02  | 4.830E-02  | 1.937E+01 | 7.250E-02 | 7.439E-03 | 2.258E+00 | 1.631E-02 | 4.513E-03 | 2.733E+01 |
| 2008 | 1.463E-01 | 4.921E+00 | 8.216E-01 | 1.553E-02  | 4.212E-02  | 1.963E+01 | 7.489E-02 | 7.721E-03 | 2.213E+00 | 7.359E-02 | 4.767E-03 | 2.817E+01 |
| 2009 | 1.245E-01 | 3.174E+00 | 8.014E-01 | 8.774E-03  | 2.870E-02  | 1.946E+01 | 5.786E-02 | 7.448E-03 | 2.146E+00 | 1.760E-01 | 3.290E-03 | 2.619E+01 |
| 2010 | 2.122E-01 | 3.883E+00 | 6.139E-01 | 8.520E-03  | 4.799E-02  | 1.964E+01 | 4.819E-02 | 8.386E-03 | 2.299E+00 | 2.650E-01 | 3.396E-03 | 2.720E+01 |
| 2011 | 1.714E-01 | 5.712E+00 | 5.382E-01 | 8.138E-03  | 4.063E-02  | 1.972E+01 | 5.615E-02 | 8.817E-03 | 2.313E+00 | 3.113E-02 | 2.568E-03 | 2.878E+01 |
| 2012 | 1.929E-01 | 5.474E+00 | 6.106E-01 | 7.897E-03  | 3.993E-02  | 2.012E+01 | 5.252E-02 | 8.869E-03 | 2.358E+00 | 2.723E-02 | 2.720E-03 | 2.905E+01 |
| 2013 | 1.859E-01 | 5.028E+00 | 6.293E-01 | 8.553E-03  | 3.992E-02  | 2.013E+01 | 6.295E-02 | 8.360E-03 | 2.434E+00 | 2.987E-02 | 2.411E-03 | 2.871E+01 |
| 2014 | 1.476E-01 | 4.994E+00 | 7.107E-01 | 7.574E-03  | 4.437E-02  | 2.019E+01 | 5.765E-02 | 9.059E-03 | 2.347E+00 | 1.693E-02 | 3.088E-03 | 2.865E+01 |
| 2015 | 1.666E-01 | 4.562E+00 | 6.642E-01 | 1.017E-02  | 4.376E-02  | 2.042E+01 | 4.155E-02 | 9.803E-03 | 2.379E+00 | 6.242E-02 | 3.396E-03 | 2.844E+01 |
| 2016 | 1.849E-01 | 3.822E+00 | 7.491E-01 | 1.036E-02  | 3.526E-02  | 2.074E+01 | 3.944E-02 | 8.897E-03 | 2.450E+00 | 2.921E-02 | 3.317E-03 | 2.813E+01 |
| 2017 | 1.937E-01 | 3.603E+00 | 7.547E-01 | 1.037E-02  | 3.578E-02  | 2.085E+01 | 3.942E-02 | 9.493E-03 | 2.419E+00 | 1.545E-02 | 3.270E-03 | 2.800E+01 |
| 2018 | 2.161E-01 | 3.544E+00 | 8.195E-01 | 1.119E-02  | 3.569E-02  | 2.097E+01 | 3.879E-02 | 1.031E-02 | 2.530E+00 | 1.636E-02 | 1.862E-03 | 2.827E+01 |
| 2019 | 2.667E-01 | 3.117E+00 | 7.830E-01 | 6.670E-03  | 3.950E-02  | 2.067E+01 | 4.326E-02 | 9.309E-03 | 2.460E+00 | 1.755E-02 | 3.255E-03 | 2.749E+01 |
| 2020 | 2.069E-01 | 3.080E+00 | 8.348E-01 | 4.954E-03  | 2.250E-02  | 1.968E+01 | 4.048E-02 | 5.544E-03 | 2.462E+00 | 1.362E-02 | 3.292E-03 | 2.640E+01 |
| 2021 | 2.517E-01 | 3.100E+00 | 7.428E-01 | 1.033E-02  | 2.863E-02  | 2.035E+01 | 3.941E-02 | 5.516E-03 | 2.543E+00 | 1.301E-02 | 2.827E-03 | 2.713E+01 |
| 2022 | 2.656E-01 | 2.654E+00 | 6.319E-01 | 1.011E-02  | 4.645E-02  | 2.040E+01 | 4.120E-02 | 8.135E-03 | 2.454E+00 | 1.308E-02 | 3.326E-03 | 2.658E+01 |
| 2023 | 2.808E-01 | 1.484E+00 | 6.022E-01 | 3.898E-03  | 2.882E-02  | 2.017E+01 | 4.166E-02 | 8.632E-03 | 2.509E+00 | 1.277E-02 | 1.948E-03 | 2.520E+01 |



**Table B.25.** Annual anthropogenic Cu emissions in Portugal, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 1.067E+00 | 3.268E+00 | 3.299E+00 | 1.403E-02  | 5.262E+00  | 3.497E+01 | 9.691E-02 | 2.966E-04 | 2.084E-01 | 5.445E-02 | 1.139E-02 | 4.878E+01 |
| 1991 | 1.130E+00 | 3.428E+00 | 3.529E+00 | 1.477E-02  | 5.518E+00  | 3.682E+01 | 9.549E-02 | 3.050E-04 | 2.152E-01 | 5.450E-02 | 1.033E-02 | 5.134E+01 |
| 1992 | 1.339E+00 | 3.411E+00 | 3.904E+00 | 1.662E-02  | 5.888E+00  | 3.948E+01 | 9.382E-02 | 3.124E-04 | 2.021E-01 | 5.788E-02 | 8.419E-03 | 5.492E+01 |
| 1993 | 1.229E+00 | 3.387E+00 | 4.016E+00 | 1.755E-02  | 6.072E+00  | 4.133E+01 | 9.183E-02 | 2.948E-04 | 1.838E-01 | 6.227E-02 | 7.493E-03 | 5.684E+01 |
| 1994 | 1.144E+00 | 3.449E+00 | 4.573E+00 | 1.236E-01  | 6.331E+00  | 4.422E+01 | 9.021E-02 | 3.035E-04 | 1.993E-01 | 4.918E-02 | 7.700E-03 | 6.059E+01 |
| 1995 | 1.340E+00 | 3.628E+00 | 4.476E+00 | 2.209E-01  | 6.537E+00  | 4.611E+01 | 8.390E-02 | 3.194E-04 | 1.780E-01 | 4.840E-02 | 9.641E-03 | 6.303E+01 |
| 1996 | 1.067E+00 | 3.596E+00 | 4.484E+00 | 1.941E-01  | 6.936E+00  | 4.932E+01 | 8.768E-02 | 3.177E-04 | 1.625E-01 | 5.039E-02 | 1.021E-02 | 6.634E+01 |
| 1997 | 1.106E+00 | 3.920E+00 | 5.146E+00 | 2.465E-01  | 7.200E+00  | 5.176E+01 | 9.086E-02 | 3.252E-04 | 1.528E-01 | 5.103E-02 | 1.086E-02 | 7.010E+01 |
| 1998 | 1.216E+00 | 3.963E+00 | 6.556E+00 | 2.289E-01  | 7.728E+00  | 5.468E+01 | 9.285E-02 | 3.618E-04 | 1.474E-01 | 5.033E-02 | 1.048E-02 | 7.510E+01 |
| 1999 | 1.466E+00 | 4.333E+00 | 7.258E+00 | 2.205E-01  | 7.997E+00  | 5.708E+01 | 8.354E-02 | 3.868E-04 | 1.437E-01 | 5.091E-02 | 1.003E-02 | 7.921E+01 |
| 2000 | 1.360E+00 | 4.354E+00 | 7.248E+00 | 1.971E-01  | 8.701E+00  | 6.338E+01 | 7.435E-02 | 5.179E-04 | 1.735E-01 | 4.794E-02 | 8.430E-03 | 8.617E+01 |
| 2001 | 1.354E+00 | 4.225E+00 | 8.367E+00 | 2.268E-01  | 8.763E+00  | 6.379E+01 | 7.183E-02 | 5.093E-04 | 1.677E-01 | 4.326E-02 | 8.271E-03 | 8.745E+01 |
| 2002 | 1.570E+00 | 4.271E+00 | 9.189E+00 | 2.192E-01  | 8.974E+00  | 6.507E+01 | 7.532E-02 | 5.084E-04 | 1.365E-01 | 4.272E-02 | 8.289E-03 | 9.002E+01 |
| 2003 | 1.330E+00 | 3.825E+00 | 9.618E+00 | 2.556E-01  | 9.036E+00  | 6.414E+01 | 7.586E-02 | 5.111E-04 | 1.114E-01 | 4.188E-02 | 8.480E-03 | 8.902E+01 |
| 2004 | 1.337E+00 | 4.540E+00 | 1.053E+01 | 2.594E-01  | 9.100E+00  | 6.398E+01 | 7.743E-02 | 5.521E-04 | 1.176E-01 | 4.262E-02 | 7.905E-03 | 9.067E+01 |
| 2005 | 1.512E+00 | 4.521E+00 | 1.030E+01 | 2.415E-01  | 9.065E+00  | 6.208E+01 | 7.723E-02 | 5.704E-04 | 1.025E-01 | 4.233E-02 | 8.090E-03 | 8.854E+01 |
| 2006 | 1.340E+00 | 4.461E+00 | 6.423E+00 | 2.404E-01  | 9.299E+00  | 6.246E+01 | 7.726E-02 | 5.955E-04 | 1.023E-01 | 3.618E-02 | 7.864E-03 | 8.511E+01 |
| 2007 | 1.132E+00 | 4.670E+00 | 6.026E+00 | 2.415E-01  | 9.163E+00  | 6.202E+01 | 7.730E-02 | 6.334E-04 | 9.373E-02 | 4.213E-02 | 8.318E-03 | 8.417E+01 |
| 2008 | 1.042E+00 | 4.521E+00 | 4.569E+00 | 1.968E-01  | 9.161E+00  | 6.134E+01 | 7.886E-02 | 6.049E-04 | 9.503E-02 | 3.566E-02 | 8.623E-03 | 8.182E+01 |
| 2009 | 1.166E+00 | 3.853E+00 | 3.855E+00 | 1.821E-01  | 9.046E+00  | 6.278E+01 | 8.358E-02 | 6.065E-04 | 9.247E-02 | 3.504E-02 | 8.853E-03 | 8.180E+01 |
| 2010 | 8.191E-01 | 4.016E+00 | 2.998E+00 | 2.024E-01  | 9.395E+00  | 6.350E+01 | 8.459E-02 | 6.139E-04 | 8.991E-02 | 3.546E-02 | 9.143E-03 | 8.179E+01 |
| 2011 | 9.606E-01 | 3.253E+00 | 2.249E+00 | 1.919E-01  | 8.811E+00  | 5.820E+01 | 7.514E-02 | 6.103E-04 | 7.871E-02 | 3.309E-02 | 9.917E-03 | 7.462E+01 |
| 2012 | 1.176E+00 | 2.966E+00 | 1.806E+00 | 2.043E-01  | 8.154E+00  | 5.383E+01 | 8.395E-02 | 6.420E-04 | 7.393E-02 | 3.323E-02 | 9.970E-03 | 6.916E+01 |
| 2013 | 1.084E+00 | 3.284E+00 | 1.722E+00 | 1.618E-01  | 7.933E+00  | 5.247E+01 | 9.210E-02 | 5.945E-04 | 7.335E-02 | 3.213E-02 | 9.754E-03 | 6.769E+01 |
| 2014 | 1.104E+00 | 3.426E+00 | 1.624E+00 | 1.208E-01  | 8.168E+00  | 5.376E+01 | 9.723E-02 | 6.287E-04 | 6.449E-02 | 3.048E-02 | 9.185E-03 | 6.917E+01 |
| 2015 | 1.292E+00 | 3.142E+00 | 1.667E+00 | 1.557E-01  | 8.268E+00  | 5.274E+01 | 1.044E-01 | 6.745E-04 | 5.915E-02 | 3.049E-02 | 8.761E-03 | 6.825E+01 |
| 2016 | 1.147E+00 | 2.857E+00 | 1.485E+00 | 1.409E-01  | 8.449E+00  | 5.368E+01 | 9.671E-02 | 7.607E-04 | 5.761E-02 | 3.102E-02 | 8.244E-03 | 6.887E+01 |
| 2017 | 1.265E+00 | 3.128E+00 | 1.409E+00 | 1.533E-01  | 8.581E+00  | 5.334E+01 | 9.901E-02 | 8.478E-04 | 5.602E-02 | 3.181E-02 | 8.502E-03 | 6.904E+01 |
| 2018 | 1.142E+00 | 2.836E+00 | 1.478E+00 | 1.169E-01  | 8.646E+00  | 5.401E+01 | 9.701E-02 | 8.869E-04 | 5.637E-02 | 3.324E-02 | 7.965E-03 | 7.144E+01 |
| 2019 | 6.802E-01 | 2.770E+00 | 1.574E+00 | 1.633E-01  | 8.905E+00  | 5.566E+01 | 9.957E-02 | 8.936E-04 | 6.038E-02 | 3.334E-02 | 7.961E-03 | 7.514E+01 |
| 2020 | 4.483E-01 | 2.881E+00 | 1.520E+00 | 1.169E-01  | 7.322E+00  | 4.733E+01 | 7.452E-02 | 3.806E-04 | 6.243E-02 | 3.394E-02 | 6.925E-03 | 6.663E+01 |
| 2021 | 3.213E-01 | 2.359E+00 | 1.355E+00 | 2.144E-01  | 7.895E+00  | 5.134E+01 | 7.639E-02 | 4.134E-04 | 7.080E-02 | 3.396E-02 | 8.557E-03 | 7.248E+01 |
| 2022 | 2.625E-01 | 2.506E+00 | 1.352E+00 | 8.621E-02  | 8.576E+00  | 5.452E+01 | 1.025E-01 | 7.812E-04 | 5.581E-02 | 3.291E-02 | 7.709E-03 | 7.834E+01 |
| 2023 | 2.705E-01 | 2.328E+00 | 1.580E+00 | 8.231E-02  | 9.104E+00  | 5.778E+01 | 1.080E-01 | 8.805E-04 | 6.383E-02 | 3.295E-02 | 8.467E-03 | 8.402E+01 |

**Table B.26.** Annual anthropogenic Cu emissions in Spain, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 5.635E+00 | 1.320E+01 | 1.110E+00 | 5.374E-04  | 1.041E-01  | 5.093E+01 | 1.247E+00 | 1.631E-03 | 5.360E+00 | 1.838E+00 | 6.650E-01 | 8.329E+01 |
| 1991 | 5.957E+00 | 1.378E+01 | 1.267E+00 | 5.576E-04  | 1.041E-01  | 5.411E+01 | 1.356E+00 | 1.801E-03 | 5.480E+00 | 1.859E+00 | 6.733E-01 | 8.805E+01 |
| 1992 | 7.089E+00 | 1.271E+01 | 1.360E+00 | 6.083E-04  | 1.041E-01  | 5.819E+01 | 1.335E+00 | 1.987E-03 | 5.404E+00 | 2.020E+00 | 5.943E-01 | 9.249E+01 |
| 1993 | 5.600E+00 | 1.237E+01 | 1.223E+00 | 6.298E-04  | 1.040E-01  | 5.769E+01 | 1.350E+00 | 1.954E-03 | 5.258E+00 | 1.961E+00 | 5.204E-01 | 8.956E+01 |
| 1994 | 5.759E+00 | 1.305E+01 | 1.200E+00 | 6.850E-04  | 1.040E-01  | 6.128E+01 | 1.319E+00 | 2.082E-03 | 4.897E+00 | 2.391E+00 | 4.935E-01 | 9.365E+01 |
| 1995 | 6.577E+00 | 1.374E+01 | 1.046E+00 | 6.577E-04  | 1.040E-01  | 6.175E+01 | 1.205E+00 | 2.280E-03 | 5.032E+00 | 2.267E+00 | 4.376E-01 | 9.547E+01 |
| 1996 | 5.233E+00 | 1.715E+01 | 1.031E+00 | 6.627E-04  | 1.114E-01  | 6.450E+01 | 1.214E+00 | 2.472E-03 | 4.980E+00 | 2.912E+00 | 5.803E-01 | 1.025E+02 |
| 1997 | 8.428E+00 | 1.864E+01 | 1.031E+00 | 6.656E-04  | 4.507E-02  | 6.618E+01 | 9.226E-01 | 2.637E-03 | 5.043E+00 | 3.101E+00 | 5.377E-01 | 1.099E+02 |
| 1998 | 7.151E+00 | 1.837E+01 | 9.910E-01 | 7.107E-04  | 7.431E-02  | 7.308E+01 | 9.702E-01 | 2.805E-03 | 5.219E+00 | 2.958E+00 | 5.520E-01 | 1.157E+02 |
| 1999 | 8.438E+00 | 1.840E+01 | 9.339E-01 | 7.164E-04  | 2.345E-01  | 7.652E+01 | 9.200E-01 | 3.065E-03 | 5.455E+00 | 3.015E+00 | 5.141E-01 | 1.206E+02 |
| 2000 | 8.670E+00 | 1.720E+01 | 9.675E-01 | 7.126E-04  | 1.151E-01  | 8.025E+01 | 7.658E-01 | 3.288E-03 | 5.708E+00 | 4.157E+00 | 2.083E-01 | 1.244E+02 |
| 2001 | 8.139E+00 | 1.553E+01 | 1.024E+00 | 7.036E-04  | 2.175E-01  | 8.384E+01 | 8.077E-01 | 3.350E-03 | 5.943E+00 | 3.760E+00 | 4.603E-02 | 1.264E+02 |
| 2002 | 9.607E+00 | 1.607E+01 | 1.028E+00 | 6.845E-04  | 2.228E-01  | 8.690E+01 | 8.333E-01 | 3.223E-03 | 6.126E+00 | 4.049E+00 | 5.287E-02 | 1.322E+02 |
| 2003 | 7.707E+00 | 1.577E+01 | 1.030E+00 | 6.356E-04  | 3.004E-01  | 9.316E+01 | 9.648E-01 | 3.382E-03 | 6.237E+00 | 4.780E+00 | 4.876E-02 | 1.374E+02 |
| 2004 | 8.041E+00 | 1.348E+01 | 1.078E+00 | 7.093E-04  | 5.447E-01  | 9.470E+01 | 9.414E-01 | 3.749E-03 | 6.436E+00 | 2.997E+00 | 0.000E+00 | 1.359E+02 |
| 2005 | 8.283E+00 | 1.512E+01 | 1.090E+00 | 6.841E-04  | 5.526E-01  | 9.833E+01 | 9.036E-01 | 3.976E-03 | 6.637E+00 | 2.847E+00 | 0.000E+00 | 1.422E+02 |
| 2006 | 6.822E+00 | 1.443E+01 | 1.030E+00 | 7.210E-04  | 5.034E-01  | 1.048E+02 | 9.958E-01 | 4.131E-03 | 6.843E+00 | 3.020E+00 | 0.000E+00 | 1.475E+02 |
| 2007 | 6.813E+00 | 1.431E+01 | 9.830E-01 | 7.029E-04  | 6.129E-01  | 1.093E+02 | 8.914E-01 | 4.452E-03 | 6.954E+00 | 5.020E+00 | 0.000E+00 | 1.539E+02 |
| 2008 | 4.839E+00 | 1.449E+01 | 9.908E-01 | 6.871E-04  | 5.665E-01  | 1.039E+02 | 7.622E-01 | 4.209E-03 | 6.679E+00 | 4.854E+00 | 0.000E+00 | 1.463E+02 |
| 2009 | 3.640E+00 | 1.505E+01 | 1.110E+00 | 6.920E-04  | 6.696E-01  | 1.024E+02 | 6.307E-01 | 3.805E-03 | 6.411E+00 | 3.851E+00 | 0.000E+00 | 1.429E+02 |
| 2010 | 2.661E+00 | 1.582E+01 | 1.067E+00 | 6.631E-04  | 4.135E-01  | 1.002E+02 | 5.548E-01 | 3.883E-03 | 6.265E+00 | 3.973E+00 | 0.000E+00 | 1.395E+02 |
| 2011 | 4.626E+00 | 9.159E+00 | 1.012E+00 | 6.354E-04  | 6.990E-01  | 9.763E+01 | 4.467E-01 | 4.019E-03 | 6.109E+00 | 4.064E+00 | 0.000E+00 | 1.325E+02 |
| 2012 | 5.423E+00 | 9.239E+00 | 9.871E-01 | 5.720E-04  | 2.618E-01  | 9.152E+01 | 4.713E-01 | 3.648E-03 | 5.997E+00 | 4.066E+00 | 0.000E+00 | 1.265E+02 |
| 2013 | 4.097E+00 | 6.517E+00 | 9.803E-01 | 6.064E-04  | 4.330E-01  | 9.042E+01 | 2.635E-01 | 3.401E-03 | 5.403E+00 | 3.732E+00 | 0.000E+00 | 1.194E+02 |
| 2014 | 4.385E+00 | 7.926E+00 | 9.453E-01 | 6.506E-04  | 4.327E-01  | 9.239E+01 | 1.832E-01 | 3.481E-03 | 5.714E+00 | 3.403E+00 | 0.000E+00 | 1.236E+02 |
| 2015 | 4.922E+00 | 8.704E+00 | 9.065E-01 | 6.670E-04  | 3.836E-01  | 9.565E+01 | 2.541E-01 | 3.653E-03 | 5.762E+00 | 3.728E+00 | 0.000E+00 | 1.279E+02 |
| 2016 | 3.739E+00 | 8.786E+00 | 7.409E-01 | 7.058E-04  | 3.330E-01  | 9.859E+01 | 3.936E-01 | 4.026E-03 | 5.992E+00 | 3.538E+00 | 0.000E+00 | 1.299E+02 |
| 2017 | 4.435E+00 | 8.849E+00 | 7.819E-01 | 6.605E-04  | 3.482E-01  | 1.007E+02 | 6.558E-01 | 4.260E-03 | 6.101E+00 | 3.454E+00 | 0.000E+00 | 1.322E+02 |
| 2018 | 3.868E+00 | 7.796E+00 | 7.840E-01 | 6.633E-04  | 3.984E-01  | 1.024E+02 | 6.633E-01 | 4.634E-03 | 6.279E+00 | 3.903E+00 | 0.000E+00 | 1.334E+02 |
| 2019 | 1.549E+00 | 7.323E+00 | 7.470E-01 | 6.113E-04  | 3.714E-01  | 1.027E+02 | 6.857E-01 | 4.849E-03 | 6.305E+00 | 3.205E+00 | 0.000E+00 | 1.302E+02 |
| 2020 | 7.883E-01 | 6.421E+00 | 7.196E-01 | 4.994E-04  | 3.174E-01  | 8.444E+01 | 4.366E-01 | 1.719E-03 | 6.103E+00 | 3.529E+00 | 0.000E+00 | 1.088E+02 |
| 2021 | 9.595E-01 | 7.214E+00 | 6.668E-01 | 5.520E-04  | 3.015E-01  | 9.444E+01 | 5.301E-01 | 2.417E-03 | 6.253E+00 | 3.617E+00 | 1.258E-03 | 1.209E+02 |
| 2022 | 7.889E-01 | 6.235E+00 | 6.640E-01 | 6.276E-04  | 3.259E-01  | 9.712E+01 | 6.873E-01 | 4.020E-03 | 6.130E+00 | 2.956E+00 | 0.000E+00 | 1.233E+02 |
| 2023 | 4.424E-01 | 6.135E+00 | 6.486E-01 | 5.367E-04  | 3.253E-01  | 9.702E+01 | 5.821E-01 | 4.564E-03 | 6.009E+00 | 2.961E+00 | 1.344E-03 | 1.227E+02 |



**Table B.27.** Annual anthropogenic Cu emissions in Sweden, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 5.413E-01 | 2.353E+01 | 5.048E-01 | 6.346E-03  | 4.396E-01  | 1.801E+01 | 2.665E-01 | 0.000E+00 | 1.505E+00 | 1.962E-02 | 0.000E+00 | 4.673E+01 |
| 1991 | 6.094E-01 | 2.037E+01 | 4.984E-01 | 4.896E-03  | 4.724E-01  | 1.833E+01 | 2.733E-01 | 0.000E+00 | 1.438E+00 | 2.008E-02 | 0.000E+00 | 4.420E+01 |
| 1992 | 6.197E-01 | 2.852E+01 | 4.589E-01 | 5.425E-03  | 6.066E-01  | 1.906E+01 | 2.800E-01 | 0.000E+00 | 1.632E+00 | 1.981E-02 | 0.000E+00 | 5.365E+01 |
| 1993 | 6.818E-01 | 1.810E+01 | 4.645E-01 | 6.260E-03  | 5.859E-01  | 1.995E+01 | 2.868E-01 | 0.000E+00 | 1.646E+00 | 1.969E-02 | 0.000E+00 | 4.412E+01 |
| 1994 | 7.751E-01 | 8.862E+00 | 4.506E-01 | 5.188E-03  | 5.442E-01  | 2.051E+01 | 2.938E-01 | 0.000E+00 | 1.724E+00 | 1.911E-02 | 0.000E+00 | 3.601E+01 |
| 1995 | 7.536E-01 | 8.079E+00 | 4.422E-01 | 6.120E-03  | 7.541E-01  | 2.116E+01 | 3.007E-01 | 0.000E+00 | 1.650E+00 | 1.912E-02 | 0.000E+00 | 3.597E+01 |
| 1996 | 1.055E+00 | 8.413E+00 | 4.436E-01 | 5.133E-03  | 8.154E-01  | 2.124E+01 | 2.855E-01 | 0.000E+00 | 1.613E+00 | 1.488E-01 | 0.000E+00 | 3.670E+01 |
| 1997 | 7.564E-01 | 9.313E+00 | 4.094E-01 | 5.216E-03  | 8.424E-01  | 2.132E+01 | 2.920E-01 | 0.000E+00 | 1.663E+00 | 1.692E-01 | 0.000E+00 | 3.800E+01 |
| 1998 | 8.022E-01 | 7.323E+00 | 3.770E-01 | 5.499E-03  | 9.036E-01  | 2.083E+01 | 2.867E-01 | 0.000E+00 | 1.722E+00 | 1.540E-01 | 0.000E+00 | 3.602E+01 |
| 1999 | 7.680E-01 | 4.763E+00 | 3.655E-01 | 5.684E-03  | 9.648E-01  | 2.151E+01 | 2.925E-01 | 0.000E+00 | 1.659E+00 | 1.222E-01 | 0.000E+00 | 3.404E+01 |
| 2000 | 7.492E-01 | 4.210E+00 | 3.659E-01 | 3.329E-03  | 1.147E+00  | 1.990E+01 | 2.869E-01 | 0.000E+00 | 1.568E+00 | 8.834E-02 | 0.000E+00 | 3.164E+01 |
| 2001 | 8.897E-01 | 3.776E+00 | 3.349E-01 | 2.862E-03  | 5.585E-01  | 2.021E+01 | 2.788E-01 | 0.000E+00 | 1.566E+00 | 9.171E-02 | 0.000E+00 | 3.096E+01 |
| 2002 | 9.381E-01 | 3.552E+00 | 3.334E-01 | 3.493E-03  | 8.933E-01  | 1.984E+01 | 2.835E-01 | 0.000E+00 | 1.632E+00 | 1.203E-01 | 0.000E+00 | 3.045E+01 |
| 2003 | 9.515E-01 | 3.346E+00 | 3.489E-01 | 3.544E-03  | 1.185E+00  | 1.901E+01 | 2.913E-01 | 0.000E+00 | 1.656E+00 | 1.030E-01 | 0.000E+00 | 3.050E+01 |
| 2004 | 8.498E-01 | 3.333E+00 | 3.357E-01 | 3.620E-03  | 1.251E+00  | 1.768E+01 | 2.775E-01 | 0.000E+00 | 1.683E+00 | 8.314E-02 | 0.000E+00 | 2.936E+01 |
| 2005 | 8.901E-01 | 3.984E+00 | 3.145E-01 | 3.716E-03  | 1.043E+00  | 1.732E+01 | 2.582E-01 | 0.000E+00 | 1.712E+00 | 2.134E-01 | 0.000E+00 | 2.935E+01 |
| 2006 | 9.021E-01 | 3.807E+00 | 2.808E-01 | 8.366E-03  | 1.081E+00  | 1.642E+01 | 2.522E-01 | 0.000E+00 | 1.713E+00 | 2.496E-01 | 0.000E+00 | 2.822E+01 |
| 2007 | 1.401E+00 | 5.565E+00 | 2.932E-01 | 3.117E-03  | 1.388E+00  | 1.743E+01 | 2.425E-01 | 0.000E+00 | 1.691E+00 | 2.164E-01 | 0.000E+00 | 3.165E+01 |
| 2008 | 1.378E+00 | 3.453E+00 | 2.859E-01 | 1.683E-03  | 8.580E-01  | 1.711E+01 | 2.330E-01 | 0.000E+00 | 1.715E+00 | 2.206E-01 | 0.000E+00 | 2.851E+01 |
| 2009 | 1.368E+00 | 2.557E+00 | 2.950E-01 | 2.197E-03  | 7.235E-01  | 1.732E+01 | 2.303E-01 | 0.000E+00 | 1.713E+00 | 1.819E-01 | 0.000E+00 | 2.780E+01 |
| 2010 | 1.741E+00 | 2.524E+00 | 2.917E-01 | 3.270E-03  | 7.901E-01  | 1.791E+01 | 2.430E-01 | 0.000E+00 | 1.772E+00 | 1.388E-01 | 0.000E+00 | 2.864E+01 |
| 2011 | 1.467E+00 | 2.793E+00 | 2.916E-01 | 2.642E-03  | 7.346E-01  | 1.812E+01 | 2.428E-01 | 0.000E+00 | 1.767E+00 | 1.963E-01 | 0.000E+00 | 2.832E+01 |
| 2012 | 1.694E+00 | 2.248E+00 | 2.860E-01 | 3.103E-03  | 6.245E-01  | 1.737E+01 | 2.178E-01 | 0.000E+00 | 1.762E+00 | 1.333E-01 | 0.000E+00 | 2.691E+01 |
| 2013 | 1.528E+00 | 1.966E+00 | 2.749E-01 | 7.012E-03  | 6.950E-01  | 1.801E+01 | 2.208E-01 | 0.000E+00 | 1.754E+00 | 2.094E-01 | 0.000E+00 | 2.706E+01 |
| 2014 | 1.332E+00 | 2.288E+00 | 2.537E-01 | 5.070E-03  | 7.004E-01  | 1.785E+01 | 2.069E-01 | 0.000E+00 | 1.752E+00 | 5.030E-02 | 0.000E+00 | 2.704E+01 |
| 2015 | 1.341E+00 | 2.120E+00 | 2.525E-01 | 2.811E-03  | 5.960E-01  | 1.993E+01 | 1.996E-01 | 0.000E+00 | 1.802E+00 | 7.625E-02 | 0.000E+00 | 2.927E+01 |
| 2016 | 1.430E+00 | 2.072E+00 | 2.579E-01 | 6.952E-03  | 5.893E-01  | 2.041E+01 | 2.101E-01 | 0.000E+00 | 1.784E+00 | 8.689E-02 | 0.000E+00 | 2.995E+01 |
| 2017 | 1.448E+00 | 2.552E+00 | 2.615E-01 | 1.028E-02  | 5.533E-01  | 2.030E+01 | 2.073E-01 | 0.000E+00 | 1.804E+00 | 8.697E-02 | 0.000E+00 | 3.076E+01 |
| 2018 | 1.443E+00 | 2.620E+00 | 2.288E-01 | 1.122E-02  | 4.925E-01  | 2.115E+01 | 2.328E-01 | 0.000E+00 | 1.791E+00 | 1.165E-01 | 0.000E+00 | 3.074E+01 |
| 2019 | 1.402E+00 | 2.439E+00 | 2.244E-01 | 9.415E-03  | 4.765E-01  | 2.057E+01 | 2.122E-01 | 0.000E+00 | 1.878E+00 | 9.934E-02 | 0.000E+00 | 3.052E+01 |
| 2020 | 1.186E+00 | 1.811E+00 | 2.221E-01 | 4.064E-03  | 3.202E-01  | 1.934E+01 | 1.853E-01 | 0.000E+00 | 1.904E+00 | 4.362E-01 | 0.000E+00 | 2.929E+01 |
| 2021 | 1.484E+00 | 1.783E+00 | 2.234E-01 | 0.000E+00  | 2.065E-01  | 2.110E+01 | 1.892E-01 | 0.000E+00 | 1.976E+00 | 1.423E-01 | 0.000E+00 | 3.093E+01 |
| 2022 | 1.425E+00 | 1.490E+00 | 2.128E-01 | 0.000E+00  | 5.635E-01  | 2.120E+01 | 2.391E-01 | 0.000E+00 | 1.899E+00 | 6.155E-02 | 0.000E+00 | 3.055E+01 |
| 2023 | 1.405E+00 | 1.868E+00 | 2.128E-01 | 0.000E+00  | 4.480E-01  | 2.093E+01 | 2.634E-01 | 0.000E+00 | 1.930E+00 | 1.098E-01 | 0.000E+00 | 2.987E+01 |

**Table B.28.** Annual anthropogenic Cu emissions in the United Kingdom, tonnes/year

| Year | A_PubPow  | B_Ind     | C_OthCom  | D_Fugitive | E_Solvents | F_RoadTr  | G_Ship    | H_Avia    | I_Offroad | J_Waste   | L_AgriOth | Total     |
|------|-----------|-----------|-----------|------------|------------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 1990 | 4.115E+01 | 5.459E+01 | 1.250E+01 | 4.426E-01  | 2.161E+02  | 3.409E+02 | 2.330E+00 | 2.327E+00 | 1.314E+00 | 6.470E+00 | 0.000E+00 | 6.813E+02 |
| 1991 | 4.071E+01 | 4.637E+01 | 1.233E+01 | 4.180E-01  | 2.166E+02  | 3.432E+02 | 2.302E+00 | 2.269E+00 | 1.309E+00 | 6.440E+00 | 0.000E+00 | 6.751E+02 |
| 1992 | 3.814E+01 | 4.356E+01 | 1.066E+01 | 3.793E-01  | 2.173E+02  | 3.424E+02 | 2.272E+00 | 2.484E+00 | 1.301E+00 | 6.409E+00 | 0.000E+00 | 6.681E+02 |
| 1993 | 3.189E+01 | 4.411E+01 | 1.020E+01 | 3.600E-01  | 2.180E+02  | 3.438E+02 | 2.291E+00 | 2.583E+00 | 1.258E+00 | 6.389E+00 | 0.000E+00 | 6.640E+02 |
| 1994 | 2.849E+01 | 4.441E+01 | 8.423E+00 | 3.618E-01  | 2.228E+02  | 3.508E+02 | 2.589E+00 | 2.713E+00 | 1.239E+00 | 6.458E+00 | 0.000E+00 | 6.712E+02 |
| 1995 | 2.177E+01 | 4.483E+01 | 6.393E+00 | 3.538E-01  | 2.271E+02  | 3.575E+02 | 2.702E+00 | 2.818E+00 | 1.270E+00 | 6.055E+00 | 0.000E+00 | 6.740E+02 |
| 1996 | 2.018E+01 | 4.518E+01 | 6.441E+00 | 3.545E-01  | 2.330E+02  | 3.658E+02 | 2.727E+00 | 2.987E+00 | 1.269E+00 | 6.264E+00 | 0.000E+00 | 6.877E+02 |
| 1997 | 1.511E+01 | 4.503E+01 | 6.177E+00 | 3.493E-01  | 2.374E+02  | 3.725E+02 | 2.643E+00 | 3.222E+00 | 1.288E+00 | 5.559E+00 | 0.000E+00 | 6.932E+02 |
| 1998 | 1.757E+01 | 4.052E+01 | 5.236E+00 | 3.424E-01  | 2.419E+02  | 3.800E+02 | 2.712E+00 | 3.539E+00 | 1.181E+00 | 5.951E+00 | 0.000E+00 | 7.030E+02 |
| 1999 | 1.299E+01 | 3.645E+01 | 5.229E+00 | 3.301E-01  | 2.486E+02  | 3.876E+02 | 2.752E+00 | 3.807E+00 | 1.181E+00 | 5.934E+00 | 0.000E+00 | 7.082E+02 |
| 2000 | 1.339E+01 | 3.093E+01 | 3.974E+00 | 3.336E-01  | 2.489E+02  | 3.876E+02 | 2.506E+00 | 3.964E+00 | 1.176E+00 | 5.902E+00 | 0.000E+00 | 7.017E+02 |
| 2001 | 9.351E+00 | 2.466E+01 | 3.847E+00 | 2.899E-01  | 2.520E+02  | 3.915E+02 | 2.362E+00 | 3.997E+00 | 1.159E+00 | 5.909E+00 | 0.000E+00 | 6.982E+02 |
| 2002 | 3.264E+00 | 2.452E+01 | 2.789E+00 | 2.325E-01  | 2.587E+02  | 4.013E+02 | 2.410E+00 | 3.940E+00 | 1.177E+00 | 5.874E+00 | 0.000E+00 | 7.072E+02 |
| 2003 | 2.952E+00 | 2.445E+01 | 2.408E+00 | 2.306E-01  | 2.643E+02  | 4.069E+02 | 2.279E+00 | 4.126E+00 | 1.218E+00 | 5.889E+00 | 0.000E+00 | 7.176E+02 |
| 2004 | 3.621E+00 | 2.338E+01 | 2.194E+00 | 2.149E-01  | 2.648E+02  | 4.120E+02 | 2.234E+00 | 4.500E+00 | 1.311E+00 | 5.912E+00 | 0.000E+00 | 7.234E+02 |
| 2005 | 3.203E+00 | 1.896E+01 | 2.132E+00 | 2.161E-01  | 2.655E+02  | 4.127E+02 | 2.207E+00 | 4.761E+00 | 1.314E+00 | 5.933E+00 | 0.000E+00 | 7.203E+02 |
| 2006 | 3.311E+00 | 1.809E+01 | 1.949E+00 | 2.297E-01  | 2.690E+02  | 4.181E+02 | 2.058E+00 | 4.883E+00 | 1.389E+00 | 5.916E+00 | 0.000E+00 | 7.287E+02 |
| 2007 | 2.100E+00 | 1.774E+01 | 1.909E+00 | 2.388E-01  | 2.704E+02  | 4.232E+02 | 2.088E+00 | 5.009E+00 | 1.430E+00 | 5.891E+00 | 0.000E+00 | 7.339E+02 |
| 2008 | 2.028E+00 | 1.983E+01 | 1.986E+00 | 2.337E-01  | 2.659E+02  | 4.178E+02 | 1.968E+00 | 4.927E+00 | 1.405E+00 | 5.802E+00 | 0.000E+00 | 7.270E+02 |
| 2009 | 1.923E+00 | 1.221E+01 | 2.112E+00 | 1.945E-01  | 2.624E+02  | 4.104E+02 | 1.882E+00 | 4.517E+00 | 1.349E+00 | 5.850E+00 | 0.000E+00 | 7.080E+02 |
| 2010 | 1.893E+00 | 1.312E+01 | 1.982E+00 | 2.099E-01  | 2.604E+02  | 4.056E+02 | 1.757E+00 | 4.297E+00 | 1.392E+00 | 5.963E+00 | 0.000E+00 | 7.011E+02 |
| 2011 | 1.803E+00 | 1.726E+01 | 1.977E+00 | 2.118E-01  | 2.609E+02  | 4.044E+02 | 1.658E+00 | 4.448E+00 | 1.264E+00 | 6.012E+00 | 0.000E+00 | 7.046E+02 |
| 2012 | 2.951E+00 | 1.139E+01 | 1.913E+00 | 2.014E-01  | 2.617E+02  | 4.039E+02 | 1.497E+00 | 4.437E+00 | 1.319E+00 | 5.991E+00 | 0.000E+00 | 6.995E+02 |
| 2013 | 2.331E+00 | 1.328E+01 | 1.923E+00 | 2.150E-01  | 2.612E+02  | 4.045E+02 | 1.368E+00 | 4.515E+00 | 1.255E+00 | 5.835E+00 | 0.000E+00 | 7.005E+02 |
| 2014 | 2.131E+00 | 1.290E+01 | 1.857E+00 | 1.965E-01  | 2.690E+02  | 4.156E+02 | 1.418E+00 | 4.625E+00 | 1.130E+00 | 5.818E+00 | 0.000E+00 | 7.187E+02 |
| 2015 | 2.042E+00 | 1.137E+01 | 1.162E+00 | 1.655E-01  | 2.745E+02  | 4.221E+02 | 1.382E+00 | 4.769E+00 | 1.211E+00 | 5.675E+00 | 0.000E+00 | 7.281E+02 |
| 2016 | 1.675E+00 | 9.129E+00 | 1.192E+00 | 1.106E-01  | 2.806E+02  | 4.299E+02 | 1.351E+00 | 5.062E+00 | 1.217E+00 | 5.820E+00 | 0.000E+00 | 7.401E+02 |
| 2017 | 1.272E+00 | 1.018E+01 | 1.220E+00 | 1.059E-01  | 2.845E+02  | 4.339E+02 | 1.312E+00 | 5.244E+00 | 1.184E+00 | 5.574E+00 | 0.000E+00 | 7.483E+02 |
| 2018 | 1.564E+00 | 9.453E+00 | 1.292E+00 | 7.169E-02  | 2.859E+02  | 4.337E+02 | 1.305E+00 | 5.322E+00 | 1.079E+00 | 5.430E+00 | 0.000E+00 | 7.489E+02 |
| 2019 | 1.082E+00 | 9.356E+00 | 1.195E+00 | 6.804E-02  | 2.882E+02  | 4.358E+02 | 1.320E+00 | 5.340E+00 | 1.089E+00 | 5.431E+00 | 0.000E+00 | 7.524E+02 |
| 2020 | 1.253E+00 | 7.724E+00 | 1.169E+00 | 7.047E-02  | 2.253E+02  | 3.531E+02 | 1.147E+00 | 2.132E+00 | 9.688E-01 | 5.182E+00 | 0.000E+00 | 6.011E+02 |
| 2021 | 2.038E+00 | 8.471E+00 | 1.226E+00 | 6.700E-02  | 2.505E+02  | 3.892E+02 | 1.152E+00 | 2.018E+00 | 1.063E+00 | 5.220E+00 | 0.000E+00 | 6.640E+02 |
| 2022 | 1.843E+00 | 8.282E+00 | 1.234E+00 | 5.636E-02  | 2.716E+02  | 4.093E+02 | 1.159E+00 | 4.164E+00 | 9.845E-01 | 5.233E+00 | 0.000E+00 | 7.071E+02 |
| 2023 | 1.423E+00 | 8.623E+00 | 9.548E-01 | 3.908E-02  | 2.681E+02  | 4.073E+02 | 1.100E+00 | 4.930E+00 | 1.053E+00 | 5.268E+00 | 0.000E+00 | 7.020E+02 |



## 5.1 Annex C. Deposition of Pb and Cu to the OSPAR regions

**Table C.1.** Annual deposition of Pb to five OSPAR regions, tonnes/year

| Region | I. Arctic Waters |            | II. Greater North Sea |            | III. Celtic Seas |            | IV. Bay of Biscay |            | V. Wider Atlantic |            |
|--------|------------------|------------|-----------------------|------------|------------------|------------|-------------------|------------|-------------------|------------|
|        | Simulated        | Normalised | Simulated             | Normalised | Simulated        | Normalised | Simulated         | Normalised | Simulated         | Normalised |
| 1990   | 2438.9           | 2388.5     | 1811.3                | 1832.9     | 487.9            | 579.1      | 659.2             | 659.5      | 4181.8            | 4092.3     |
| 1991   | 2175.5           | 2253.0     | 1614.8                | 1656.3     | 566.2            | 535.7      | 647.6             | 608.8      | 3664.4            | 3899.2     |
| 1992   | 2212.3           | 2125.3     | 1525.4                | 1493.0     | 423.6            | 494.5      | 520.0             | 561.2      | 4030.6            | 3712.5     |
| 1993   | 1981.3           | 2005.2     | 1259.7                | 1342.6     | 515.9            | 455.6      | 574.3             | 516.7      | 3447.5            | 3532.2     |
| 1994   | 1871.1           | 1892.5     | 1261.4                | 1204.6     | 472.7            | 418.8      | 358.4             | 475.1      | 3082.5            | 3358.4     |
| 1995   | 1842.2           | 1786.8     | 1130.8                | 1078.3     | 406.8            | 384.3      | 480.8             | 436.2      | 3309.6            | 3191.1     |
| 1996   | 1560.7           | 1688.0     | 909.9                 | 963.4      | 438.3            | 351.8      | 383.5             | 400.1      | 2498.3            | 3030.3     |
| 1997   | 1505.7           | 1595.8     | 952.8                 | 859.1      | 351.1            | 321.4      | 341.1             | 366.7      | 3136.8            | 2876.2     |
| 1998   | 1449.1           | 1509.9     | 880.5                 | 765.1      | 369.5            | 293.0      | 396.8             | 335.7      | 3124.9            | 2728.7     |
| 1999   | 1670.7           | 1430.1     | 782.4                 | 680.7      | 244.3            | 266.6      | 366.5             | 307.2      | 2802.3            | 2587.8     |
| 2000   | 1522.4           | 1356.1     | 679.8                 | 605.5      | 221.7            | 242.1      | 256.4             | 281.0      | 2764.2            | 2453.8     |
| 2001   | 1168.8           | 1287.7     | 364.1                 | 538.9      | 124.3            | 219.6      | 235.4             | 257.0      | 2056.1            | 2326.4     |
| 2002   | 1128.3           | 1224.7     | 378.7                 | 480.4      | 178.2            | 198.9      | 225.9             | 235.2      | 2425.6            | 2206.0     |
| 2003   | 1084.5           | 1166.8     | 331.6                 | 429.4      | 159.7            | 179.9      | 207.2             | 215.4      | 1850.7            | 2092.3     |
| 2004   | 1161.7           | 1113.7     | 326.8                 | 385.4      | 114.4            | 162.8      | 197.6             | 197.6      | 1727.7            | 1985.6     |
| 2005   | 992.6            | 1065.1     | 316.0                 | 348.0      | 116.3            | 147.3      | 124.9             | 181.5      | 1503.1            | 1885.8     |
| 2006   | 1089.2           | 1021.0     | 314.3                 | 316.4      | 120.0            | 133.6      | 185.7             | 167.2      | 1915.2            | 1793.0     |
| 2007   | 881.2            | 980.9      | 254.8                 | 290.3      | 101.5            | 121.4      | 191.6             | 154.6      | 1621.8            | 1707.3     |
| 2008   | 1186.0           | 944.6      | 373.5                 | 269.0      | 127.9            | 110.8      | 160.2             | 143.5      | 1902.2            | 1628.6     |
| 2009   | 975.5            | 911.9      | 284.5                 | 252.1      | 106.1            | 101.8      | 135.6             | 133.8      | 1668.1            | 1557.0     |
| 2010   | 765.4            | 882.6      | 210.4                 | 239.1      | 73.9             | 94.3       | 135.9             | 125.5      | 1313.8            | 1492.6     |
| 2011   | 971.1            | 856.3      | 258.8                 | 229.3      | 91.5             | 88.2       | 111.9             | 118.5      | 1421.8            | 1435.4     |
| 2012   | 726.4            | 832.9      | 232.0                 | 222.3      | 101.2            | 83.5       | 94.7              | 112.6      | 1209.9            | 1385.5     |
| 2013   | 780.9            | 812.1      | 218.2                 | 217.4      | 100.2            | 80.2       | 102.0             | 107.7      | 1500.9            | 1342.8     |
| 2014   | 770.4            | 793.6      | 291.1                 | 214.3      | 113.1            | 78.2       | 126.5             | 103.8      | 1439.7            | 1307.5     |
| 2015   | 882.5            | 777.1      | 234.5                 | 212.4      | 109.5            | 77.5       | 101.8             | 100.7      | 1403.0            | 1279.6     |
| 2016   | 692.4            | 762.6      | 190.2                 | 211.0      | 88.1             | 78.0       | 91.1              | 98.4       | 1310.8            | 1259.1     |
| 2017   | 714.5            | 749.6      | 203.0                 | 209.8      | 84.9             | 79.7       | 85.4              | 96.8       | 1125.8            | 1246.1     |
| 2018   | 725.2            | 737.9      | 193.1                 | 208.1      | 90.6             | 82.6       | 95.3              | 95.7       | 1305.0            | 1240.5     |
| 2019   | 671.2            | 727.3      | 193.7                 | 205.4      | 86.9             | 86.5       | 82.4              | 95.1       | 1203.8            | 1242.5     |
| 2020   | 772.8            | 717.5      | 194.8                 | 201.3      | 101.7            | 91.5       | 94.8              | 94.9       | 1219.7            | 1252.2     |
| 2021   | 692.9            | 708.4      | 167.2                 | 195.1      | 79.1             | 97.6       | 97.5              | 94.9       | 1163.0            | 1269.4     |
| 2022   | 754.8            | 699.5      | 201.4                 | 186.3      | 92.6             | 104.5      | 106.7             | 95.1       | 1353.7            | 1294.4     |
| 2023   | 677.3            | 690.7      | 176.3                 | 174.4      | 94.5             | 112.4      | 94.5              | 95.3       | 1334.6            | 1327.0     |

**Table C.2.** Trends in Pb deposition to the OSPAR regions for two sub-periods within 1990-2023, separated by breakpoints.

| Region                | Breakpoint | Deposition<br>in 1990,<br>t/y | Slope before<br>breakpoint,<br>%/y | p-value | Deposition at<br>breakpoint,<br>t/y | Slope after<br>breakpoint,<br>%/y | p-value |
|-----------------------|------------|-------------------------------|------------------------------------|---------|-------------------------------------|-----------------------------------|---------|
| I. Arctic Waters      | 2000       | 2439                          | -4.3                               | 1.1E-03 | 1522                                | -1.4                              | 9.1E-06 |
| II. Greater North Sea | 2000       | 1811                          | -5.8                               | 9.9E-05 | 680                                 | -1.3                              | 1.2E-06 |
| III. Celtic Seas      | 2003       | 488                           | -6.8                               | 8.1E-05 | 160                                 | -1.0                              | 1.5E-02 |
| IV. Bay of Biscay     | 2008       | 659                           | -4.2                               | 3.3E-07 | 160                                 | -1.2                              | 3.8E-02 |
| V. Wider Atlantic     | 2002       | 4182                          | -3.4                               | 3.2E-04 | 2426                                | -1.3                              | 2.0E-04 |



**Table C.3.** Annual deposition of Pb to the Exclusive Economic Zones of the OSPAR Contracting Parties, tonnes/year

|      | EEZ 48   | EEZ 65   | EEZ 71   | EEZ 91   | EEZ 99   | EEZ 100  | EEZ 108  | EEZ 109  | EEZ 110  | EEZ 119  | EEZ 123  | EEZ 185  | EEZ 187  | EEZ 188  | EEZ 189  | EEZ 190  | EEZ 191  | EEZ 209  | EEZ 212  | EEZ 213  | EEZ 215  | EEZ 216  | EEZ 224  | EEZ 273  |
|------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1990 | 2.25E+02 | 1.99E+02 | 4.72E+02 | 2.74E+02 | 3.06E+00 | 7.48E+00 | 4.24E+02 | 9.22E+00 | 3.74E+00 | 9.20E-01 | 1.74E+01 | 3.82E+01 | 2.74E-01 | 1.47E+01 | 2.29E+02 | 1.43E+02 | 1.91E+02 | 3.51E+02 | 1.88E+02 | 1.13E+03 | 2.15E+02 | 9.06E+02 | 1.15E+02 | 3.08E+02 |
| 1991 | 1.78E+02 | 2.03E+02 | 4.38E+02 | 2.28E+02 | 3.56E+00 | 7.61E+00 | 4.30E+02 | 1.29E+01 | 4.67E+00 | 9.47E-01 | 2.22E+01 | 2.57E+01 | 1.67E-01 | 1.19E+01 | 1.93E+02 | 1.07E+02 | 1.50E+02 | 3.82E+02 | 1.40E+02 | 1.18E+03 | 1.62E+02 | 8.48E+02 | 1.24E+02 | 3.16E+02 |
| 1992 | 2.81E+02 | 1.91E+02 | 4.70E+02 | 3.03E+02 | 2.28E+00 | 6.57E+00 | 3.83E+02 | 9.29E+00 | 3.14E+00 | 8.31E-01 | 1.71E+01 | 3.00E+01 | 2.00E-01 | 1.32E+01 | 2.08E+02 | 1.19E+02 | 1.54E+02 | 2.65E+02 | 1.77E+02 | 9.89E+02 | 1.71E+02 | 7.47E+02 | 1.08E+02 | 2.21E+02 |
| 1993 | 2.33E+02 | 1.74E+02 | 3.94E+02 | 2.10E+02 | 3.16E+00 | 7.24E+00 | 3.74E+02 | 1.55E+01 | 5.33E+00 | 6.74E-01 | 1.65E+01 | 2.15E+01 | 1.75E-01 | 1.03E+01 | 1.62E+02 | 9.34E+01 | 1.14E+02 | 3.42E+02 | 1.64E+02 | 9.81E+02 | 1.82E+02 | 6.18E+02 | 1.11E+02 | 3.17E+02 |
| 1994 | 1.32E+02 | 1.89E+02 | 4.05E+02 | 1.22E+02 | 1.94E+00 | 6.46E+00 | 4.07E+02 | 7.89E+00 | 2.84E+00 | 8.79E-01 | 1.98E+01 | 1.95E+01 | 1.32E-01 | 9.79E+00 | 1.66E+02 | 1.05E+02 | 1.24E+02 | 2.27E+02 | 1.43E+02 | 9.72E+02 | 1.71E+02 | 5.49E+02 | 1.07E+02 | 1.69E+02 |
| 1995 | 2.16E+02 | 1.74E+02 | 3.19E+02 | 2.52E+02 | 2.06E+00 | 6.29E+00 | 3.48E+02 | 1.03E+01 | 3.42E+00 | 5.90E-01 | 1.43E+01 | 1.55E+01 | 1.17E-01 | 8.92E+00 | 1.39E+02 | 7.58E+01 | 9.85E+01 | 2.46E+02 | 1.28E+02 | 8.43E+02 | 1.70E+02 | 5.87E+02 | 8.74E+01 | 2.45E+02 |
| 1996 | 1.30E+02 | 1.64E+02 | 2.93E+02 | 1.03E+02 | 2.17E+00 | 5.84E+00 | 3.49E+02 | 9.95E+00 | 2.77E+00 | 6.17E-01 | 1.41E+01 | 1.20E+01 | 9.50E-02 | 7.22E+00 | 1.00E+02 | 5.65E+01 | 7.35E+01 | 2.54E+02 | 1.36E+02 | 8.01E+02 | 1.44E+02 | 4.33E+02 | 7.30E+01 | 1.86E+02 |
| 1997 | 2.25E+02 | 1.47E+02 | 3.04E+02 | 1.59E+02 | 1.39E+00 | 5.54E+00 | 2.95E+02 | 9.39E+00 | 3.00E+00 | 5.61E-01 | 1.12E+01 | 1.45E+01 | 9.80E-02 | 6.14E+00 | 1.03E+02 | 5.65E+01 | 8.69E+01 | 2.09E+02 | 9.75E+01 | 7.53E+02 | 1.49E+02 | 4.89E+02 | 6.94E+01 | 1.65E+02 |
| 1998 | 1.90E+02 | 1.23E+02 | 2.77E+02 | 1.68E+02 | 1.74E+00 | 5.07E+00 | 3.49E+02 | 5.30E+00 | 1.94E+00 | 4.55E-01 | 1.30E+01 | 1.64E+01 | 1.02E-01 | 7.08E+00 | 1.05E+02 | 6.01E+01 | 8.29E+01 | 2.05E+02 | 1.36E+02 | 6.89E+02 | 1.43E+02 | 4.88E+02 | 7.41E+01 | 1.85E+02 |
| 1999 | 1.48E+02 | 1.43E+02 | 3.13E+02 | 1.13E+02 | 2.46E+00 | 4.98E+00 | 2.35E+02 | 4.95E+00 | 1.70E+00 | 4.89E-01 | 1.14E+01 | 1.65E+01 | 1.27E-01 | 6.77E+00 | 1.02E+02 | 5.78E+01 | 8.46E+01 | 2.22E+02 | 1.56E+02 | 5.43E+02 | 1.64E+02 | 5.05E+02 | 7.80E+01 | 1.67E+02 |
| 2000 | 1.32E+02 | 1.15E+02 | 2.79E+02 | 8.03E+01 | 1.69E+00 | 4.36E+00 | 2.34E+02 | 3.19E+00 | 1.21E+00 | 4.52E-01 | 1.08E+01 | 1.46E+01 | 1.02E-01 | 4.74E+00 | 8.95E+01 | 5.93E+01 | 8.15E+01 | 1.47E+02 | 1.09E+02 | 4.63E+02 | 1.59E+02 | 4.23E+02 | 7.12E+01 | 1.31E+02 |
| 2001 | 1.16E+02 | 7.25E+01 | 2.08E+02 | 1.38E+02 | 7.99E-01 | 2.12E+00 | 1.24E+02 | 2.99E+00 | 1.15E+00 | 3.74E-01 | 8.84E+00 | 6.21E+00 | 5.26E-02 | 3.31E+00 | 5.06E+01 | 2.58E+01 | 3.61E+01 | 9.29E+01 | 8.27E+01 | 2.72E+02 | 1.19E+02 | 2.72E+02 | 5.32E+01 | 1.19E+02 |
| 2002 | 1.41E+02 | 8.23E+01 | 2.30E+02 | 8.00E+01 | 9.66E-01 | 3.21E+00 | 2.12E+02 | 3.60E+00 | 1.18E+00 | 4.14E-01 | 9.47E+00 | 7.63E+00 | 5.48E-02 | 3.20E+00 | 5.14E+01 | 3.15E+01 | 3.88E+01 | 1.31E+02 | 9.15E+01 | 3.33E+02 | 1.09E+02 | 2.48E+02 | 5.85E+01 | 1.21E+02 |
| 2003 | 9.78E+01 | 7.54E+01 | 2.48E+02 | 8.93E+01 | 6.82E-01 | 3.13E+00 | 1.67E+02 | 2.89E+00 | 1.24E+00 | 3.66E-01 | 9.29E+00 | 6.29E+00 | 4.81E-02 | 2.51E+00 | 3.41E+01 | 2.19E+01 | 3.47E+01 | 1.03E+02 | 7.27E+01 | 2.90E+02 | 9.08E+01 | 2.65E+02 | 5.58E+01 | 1.04E+02 |
| 2004 | 1.66E+02 | 6.88E+01 | 2.31E+02 | 9.40E+01 | 9.38E-01 | 2.26E+00 | 1.18E+02 | 2.06E+00 | 7.35E-01 | 3.58E-01 | 9.74E+00 | 7.63E+00 | 7.28E-02 | 2.29E+00 | 3.85E+01 | 2.28E+01 | 3.69E+01 | 9.62E+01 | 1.19E+02 | 2.49E+02 | 1.41E+02 | 2.37E+02 | 6.37E+01 | 1.01E+02 |
| 2005 | 1.04E+02 | 7.47E+01 | 1.94E+02 | 5.19E+01 | 5.20E-01 | 2.71E+00 | 1.11E+02 | 2.19E+00 | 7.67E-01 | 3.67E-01 | 9.27E+00 | 5.77E+00 | 4.17E-02 | 2.16E+00 | 3.47E+01 | 2.44E+01 | 3.22E+01 | 6.12E+01 | 9.04E+01 | 2.52E+02 | 1.06E+02 | 2.56E+02 | 5.44E+01 | 6.39E+01 |
| 2006 | 1.53E+02 | 8.14E+01 | 2.18E+02 | 1.02E+02 | 9.21E-01 | 2.58E+00 | 1.25E+02 | 2.12E+00 | 8.10E-01 | 4.26E-01 | 9.42E+00 | 6.74E+00 | 5.27E-02 | 1.95E+00 | 3.33E+01 | 2.16E+01 | 3.20E+01 | 8.38E+01 | 9.96E+01 | 2.54E+02 | 1.24E+02 | 2.50E+02 | 6.08E+01 | 8.78E+01 |
| 2007 | 9.23E+01 | 6.33E+01 | 1.96E+02 | 9.77E+01 | 6.35E-01 | 2.34E+00 | 1.12E+02 | 1.95E+00 | 6.79E-01 | 3.15E-01 | 8.64E+00 | 5.59E+00 | 3.50E-02 | 1.67E+00 | 2.86E+01 | 1.99E+01 | 2.89E+01 | 7.69E+01 | 5.95E+01 | 2.05E+02 | 8.84E+01 | 2.23E+02 | 5.22E+01 | 8.29E+01 |
| 2008 | 1.19E+02 | 8.82E+01 | 2.64E+02 | 6.65E+01 | 7.22E-01 | 3.24E+00 | 1.47E+02 | 2.58E+00 | 8.32E-01 | 4.90E-01 | 1.14E+01 | 8.49E+00 | 6.24E-02 | 2.62E+00 | 4.27E+01 | 2.85E+01 | 3.83E+01 | 7.72E+01 | 1.10E+02 | 2.96E+02 | 1.07E+02 | 2.51E+02 | 7.30E+01 | 7.61E+01 |
| 2009 | 7.12E+01 | 6.70E+01 | 2.02E+02 | 4.22E+01 | 7.39E-01 | 2.29E+00 | 1.27E+02 | 1.71E+00 | 5.92E-01 | 3.53E-01 | 8.93E+00 | 5.28E+00 | 4.19E-02 | 1.93E+00 | 3.17E+01 | 2.31E+01 | 3.29E+01 | 7.51E+01 | 7.18E+01 | 2.17E+02 | 1.02E+02 | 2.28E+02 | 5.64E+01 | 6.93E+01 |
| 2010 | 8.49E+01 | 5.20E+01 | 1.31E+02 | 6.29E+01 | 5.54E-01 | 1.61E+00 | 8.40E+01 | 1.84E+00 | 6.83E-01 | 2.74E-01 | 6.72E+00 | 3.59E+00 | 2.58E-02 | 1.63E+00 | 2.58E+01 | 1.44E+01 | 2.01E+01 | 6.18E+01 | 4.58E+01 | 1.70E+02 | 8.83E+01 | 1.85E+02 | 4.42E+01 | 7.19E+01 |
| 2011 | 5.22E+01 | 7.20E+01 | 2.27E+02 | 6.54E+01 | 3.73E-01 | 2.25E+00 | 1.08E+02 | 1.22E+00 | 4.41E-01 | 3.93E-01 | 9.70E+00 | 5.05E+00 | 3.79E-02 | 1.40E+00 | 2.78E+01 | 1.88E+01 | 2.65E+01 | 4.38E+01 | 8.50E+01 | 2.08E+02 | 8.22E+01 | 2.45E+02 | 6.51E+01 | 5.52E+01 |
| 2012 | 6.25E+01 | 5.57E+01 | 1.61E+02 | 3.09E+01 | 4.07E-01 | 2.17E+00 | 1.07E+02 | 1.44E+00 | 4.97E-01 | 2.87E-01 | 6.40E+00 | 4.18E+00 | 3.00E-02 | 1.96E+00 | 2.81E+01 | 1.72E+01 | 2.32E+01 | 5.51E+01 | 5.14E+01 | 1.93E+02 | 7.80E+01 | 1.82E+02 | 4.01E+01 | 4.70E+01 |
| 2013 | 7.86E+01 | 6.30E+01 | 1.88E+02 | 3.73E+01 | 5.85E-01 | 2.38E+00 | 1.19E+02 | 1.72E+00 | 5.67E-01 | 3.31E-01 | 7.18E+00 | 4.54E+00 | 3.50E-02 | 1.47E+00 | 2.26E+01 | 1.51E+01 | 2.38E+01 | 5.76E+01 | 5.66E+01 | 1.97E+02 | 7.04E+01 | 1.92E+02 | 4.29E+01 | 5.85E+01 |
| 2014 | 6.67E+01 | 7.35E+01 | 2.00E+02 | 4.25E+01 | 7.17E-01 | 2.47E+00 | 1.21E+02 | 2.16E+00 | 7.17E-01 | 3.78E-01 | 7.76E+00 | 5.11E+00 | 5.09E-02 | 1.28E+00 | 2.65E+01 | 2.22E+01 | 3.07E+01 | 6.79E+01 | 6.98E+01 | 2.38E+02 | 5.70E+01 | 1.93E+02 | 4.39E+01 | 6.37E+01 |
| 2015 | 5.01E+01 | 8.02E+01 | 2.11E+02 | 3.83E+01 | 4.66E-01 | 2.58E+00 | 1.25E+02 | 1.36E+00 | 4.77E-01 | 4.34E-01 | 9.28E+00 | 4.71E+00 | 3.41E-02 | 1.25E+00 | 2.24E+01 | 1.71E+01 | 2.55E+01 | 5.16E+01 | 7.71E+01 | 2.16E+02 | 8.19E+01 | 2.23E+02 | 5.54E+01 | 5.50E+01 |
| 2016 | 6.67E+01 | 5.56E+01 | 1.52E+02 | 3.78E+01 | 4.48E-01 | 2.19E+00 | 1.02E+02 | 1.47E+00 | 5.06E-01 | 2.56E-01 | 6.81E+00 | 3.25E+00 | 2.19E-02 | 1.01E+00 | 1.82E+01 | 1.34E+01 | 1.91E+01 | 4.50E+01 | 5.63E+01 | 1.78E+02 | 7.04E+01 | 1.62E+02 | 4.28E+01 | 4.80E+01 |
| 2017 | 5.34E+01 | 6.18E+01 | 1.58E+02 | 2.79E+01 | 3.62E-01 | 2.07E+00 | 9.14E+01 | 1.43E+00 | 4.81E-01 | 3.09E-01 | 7.51E+00 | 3.48E+00 | 2.71E-02 | 1.06E+00 | 1.76E+01 | 1.35E+01 | 1.99E+01 | 4.96E+01 | 5.33E+01 | 1.77E+02 | 6.73E+01 | 1.88E+02 | 4.39E+01 | 4.33E+01 |
| 2018 | 4.65E+01 | 5.44E+01 | 1.86E+02 | 3.85E+01 | 3.92E-01 | 1.83E+00 | 1.02E+02 | 1.72E+00 | 4.75E-01 | 3.03E-01 | 8.03E+00 | 3.35E+00 | 2.95E-02 | 1.04E+00 | 1.69E+01 | 1.33E+01 | 2.10E+01 | 4.84E+01 | 7.17E+01 | 1.73E+02 | 6.80E+01 | 1.60E+02 | 4.83E+01 | 5.27E+01 |
| 2019 | 4.59E+01 | 5.09E+01 | 1.69E+02 | 2.10E+01 | 4.77E-01 | 1.67E+00 | 1.10E+02 | 1.52E+00 | 5.79E-01 | 2.64E-01 | 6.47E+00 | 4.14E+00 | 3.46E-02 | 9.56E-01 | 1.83E+01 | 1.39E+01 | 2.34E+01 | 4.67E+01 | 4.22E+01 | 1.65E+02 | 5.65E+01 | 1.72E+02 | 3.64E+01 | 4.56E+01 |
| 2020 | 3.86E+01 | 6.18E+01 | 1.92E+02 | 2.46E+01 | 5.56E-01 | 2.19E+00 | 1.16E+02 | 1.48E+00 | 4.99E-01 | 3.40E-01 | 8.67E+00 | 4.21E+00 | 3.67E-02 | 9.27E-01 | 1.75E+01 | 1.36E+01 | 2.31E+01 | 5.54E+01 | 5.65E+01 | 1.77E+02 | 6.50E+01 | 2.07E+02 | 5.07E+01 | 5.22E+01 |
| 2021 | 6.88E+01 | 4.75E+01 | 1.48E+02 | 3.60E+01 | 4.93E-01 | 1.57E+00 | 8.69E+01 | 1.26E+00 | 4.78E-01 | 2.58E-01 | 6.98E+00 | 2.95E+00 | 2.17E-02 | 1.01E+00 | 1.66E+01 | 1.20E+01 | 1.70E+01 | 4.73E+01 | 5.47E+01 | 1.50E+02 | 6.47E+01 | 1.65E+02 | 4.47E+01 | 5.21E+01 |
| 2022 | 7.37E+01 | 6.92E+01 | 1.87E+02 | 3.83E+01 | 4.31E-01 | 2.24E+00 | 1.05E+02 | 1.72E+00 | 5.80E-01 | 3.62E-01 | 8.57E+00 | 3.34E+00 | 2.41E-02 | 1.03E+00 | 1.90E+01 | 1.29E+01 | 1.97E+01 | 5.04E+01 | 5.05E+01 | 1.88E+02 | 6.09E+01 | 1.98E+02 | 4.88E+01 | 6.07E+01 |
| 2023 | 6.36E+01 | 5.19E+01 | 1.58E+02 | 3.60E+01 | 4.37E-01 | 1.71E+00 | 1.09E+02 | 1.27E+00 | 4.10E-01 | 2.91E-01 | 6.18E+00 | 3.00E+00 | 2.30E-02 | 1.08E+00 | 1.92E+01 | 1.34E+01 | 1.93E+01 | 4.69E+01 | 4.01E+01 | 1.63E+02 | 7.10E+01 | 1.67E+02 | 3.86E+01 | 5.17E+01 |



**Table C.4.** Annual deposition of Cu to five OSPAR regions, tonnes/year

| Region | I. Arctic Waters |            | II. Greater North Sea |            | III. Celtic Seas |            | IV. Bay of Biscay |            | V. Wider Atlantic |            |
|--------|------------------|------------|-----------------------|------------|------------------|------------|-------------------|------------|-------------------|------------|
|        | Simulated        | Normalised | Simulated             | Normalised | Simulated        | Normalised | Simulated         | Normalised | Simulated         | Normalised |
| 1990   | 346.2            | 321.4      | 600.1                 | 573.2      | 90.5             | 112.1      | 68.6              | 75.6       | 367.4             | 368.2      |
| 1991   | 307.9            | 317.0      | 516.6                 | 557.0      | 125.2            | 114.6      | 81.4              | 75.9       | 372.6             | 374.0      |
| 1992   | 319.1            | 313.1      | 548.0                 | 543.2      | 96.4             | 116.7      | 85.5              | 76.1       | 404.7             | 378.6      |
| 1993   | 300.4            | 309.7      | 485.7                 | 531.6      | 121.7            | 118.3      | 92.3              | 76.1       | 377.4             | 382.2      |
| 1994   | 299.8            | 306.6      | 565.9                 | 522.0      | 134.3            | 119.6      | 50.5              | 76.1       | 354.2             | 384.7      |
| 1995   | 323.4            | 303.9      | 525.9                 | 514.2      | 121.2            | 120.4      | 71.2              | 75.9       | 397.9             | 386.3      |
| 1996   | 320.2            | 301.6      | 487.2                 | 508.2      | 182.2            | 120.9      | 90.2              | 75.7       | 373.5             | 387.0      |
| 1997   | 274.7            | 299.5      | 494.9                 | 503.7      | 134.7            | 121.1      | 62.8              | 75.4       | 448.1             | 387.0      |
| 1998   | 242.3            | 297.8      | 509.3                 | 500.5      | 106.6            | 121.0      | 74.4              | 75.0       | 379.9             | 386.3      |
| 1999   | 295.5            | 296.3      | 585.9                 | 498.5      | 100.8            | 120.6      | 77.6              | 74.5       | 357.2             | 385.1      |
| 2000   | 267.6            | 295.1      | 584.1                 | 497.5      | 102.9            | 120.0      | 62.5              | 74.0       | 367.6             | 383.3      |
| 2001   | 246.5            | 294.0      | 428.4                 | 497.3      | 102.7            | 119.2      | 73.2              | 73.4       | 324.9             | 381.1      |
| 2002   | 292.5            | 293.2      | 443.1                 | 497.8      | 126.2            | 118.2      | 83.3              | 72.8       | 408.0             | 378.5      |
| 2003   | 333.7            | 292.4      | 433.2                 | 498.8      | 135.6            | 117.0      | 73.7              | 72.2       | 398.0             | 375.7      |
| 2004   | 334.3            | 291.8      | 476.7                 | 500.1      | 100.4            | 115.7      | 69.6              | 71.5       | 336.5             | 372.7      |
| 2005   | 319.6            | 291.3      | 517.9                 | 501.5      | 102.0            | 114.3      | 60.5              | 70.8       | 303.1             | 369.6      |
| 2006   | 317.5            | 290.9      | 520.9                 | 502.9      | 109.7            | 112.9      | 82.3              | 70.1       | 409.2             | 366.6      |
| 2007   | 299.6            | 290.4      | 464.7                 | 504.1      | 90.7             | 111.4      | 80.8              | 69.3       | 372.9             | 363.6      |
| 2008   | 317.6            | 290.0      | 571.2                 | 505.0      | 121.4            | 109.8      | 61.3              | 68.6       | 443.0             | 360.7      |
| 2009   | 307.6            | 289.6      | 522.4                 | 505.3      | 111.2            | 108.3      | 61.7              | 67.8       | 396.1             | 358.1      |
| 2010   | 282.6            | 289.1      | 410.9                 | 504.8      | 100.7            | 106.9      | 84.7              | 67.1       | 340.7             | 355.8      |
| 2011   | 321.7            | 288.5      | 608.8                 | 503.5      | 111.1            | 105.5      | 69.8              | 66.4       | 366.8             | 353.9      |
| 2012   | 230.9            | 287.8      | 432.8                 | 501.1      | 94.1             | 104.1      | 51.1              | 65.7       | 290.3             | 352.6      |
| 2013   | 264.6            | 287.0      | 459.7                 | 497.5      | 113.5            | 103.0      | 66.1              | 65.1       | 393.1             | 351.8      |
| 2014   | 256.0            | 286.0      | 543.3                 | 492.5      | 109.8            | 101.9      | 57.9              | 64.5       | 345.4             | 351.6      |
| 2015   | 295.9            | 284.8      | 585.3                 | 485.9      | 105.7            | 101.1      | 71.9              | 63.9       | 365.4             | 352.2      |
| 2016   | 248.9            | 283.4      | 457.9                 | 477.5      | 110.1            | 100.4      | 65.2              | 63.4       | 361.2             | 353.6      |
| 2017   | 254.4            | 281.8      | 472.9                 | 467.3      | 93.9             | 100.0      | 56.5              | 63.0       | 307.7             | 356.0      |
| 2018   | 286.1            | 279.9      | 435.7                 | 454.9      | 111.2            | 99.9       | 65.3              | 62.6       | 361.1             | 359.3      |
| 2019   | 284.8            | 277.6      | 410.2                 | 440.3      | 109.5            | 100.1      | 45.8              | 62.3       | 338.8             | 363.7      |
| 2020   | 302.9            | 275.1      | 407.6                 | 423.2      | 94.0             | 100.5      | 63.2              | 62.1       | 352.1             | 369.3      |
| 2021   | 272.0            | 272.1      | 348.1                 | 403.5      | 91.2             | 101.3      | 67.8              | 62.0       | 364.1             | 376.1      |
| 2022   | 299.4            | 268.8      | 427.4                 | 381.1      | 101.3            | 102.5      | 76.5              | 62.0       | 404.2             | 384.3      |
| 2023   | 246.6            | 265.1      | 368.3                 | 355.7      | 100.9            | 104.1      | 54.0              | 62.1       | 420.4             | 393.8      |

**Table C.5.** Trends in Cu deposition to the OSPAR regions for two sub-periods within 1990–2023, separated by breakpoints. For regions without identified breakpoints, the slope and p-value are reported for the entire period.

| Region                | Breakpoint | Deposition<br>in 1990,<br>t/y | Slope before<br>breakpoint,<br>%/y | p-value | Deposition at<br>breakpoint,<br>t/y | Slope after<br>breakpoint,<br>%/y | p-value |
|-----------------------|------------|-------------------------------|------------------------------------|---------|-------------------------------------|-----------------------------------|---------|
| I. Arctic Waters      | -          | 346                           | -0.4                               | 1.3E-02 | -                                   | -                                 | -       |
| II. Greater North Sea | 2017       | 600                           | -0.3                               | 3.0E-01 | 473                                 | -2.8                              | 2.6E-01 |
| III. Celtic Seas      | 2003       | 90                            | 0.8                                | 4.4E-01 | 136                                 | -0.2                              | 4.6E-01 |
| IV. Bay of Biscay     | -          | 69                            | -0.8                               | 1.2E-02 | -                                   | -                                 | -       |
| V. Wider Atlantic     | -          | 367                           | -0.1                               | 2.6E-01 | -                                   | -                                 | -       |



**Table C.6.** Annual deposition of Cu to the Exclusive Economic Zones of the OSPAR Contracting Parties, tonnes/year

|      | EEZ 48   | EEZ 65   | EEZ 71   | EEZ 91   | EEZ 99   | EEZ 100  | EEZ 108  | EEZ 109  | EEZ 110  | EEZ 119  | EEZ 123  | EEZ 185  | EEZ 187  | EEZ 188  | EEZ 189  | EEZ 190  | EEZ 191  | EEZ 209  | EEZ 212  | EEZ 213  | EEZ 215  | EEZ 216  | EEZ 224  | EEZ 273  |
|------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| 1990 | 1.96E+01 | 2.67E+01 | 6.77E+01 | 2.86E+01 | 3.18E-01 | 9.45E-01 | 5.32E+01 | 2.50E+00 | 7.83E-01 | 1.23E-01 | 2.37E+00 | 1.25E+01 | 6.76E-02 | 6.62E+00 | 1.02E+02 | 5.57E+01 | 6.47E+01 | 5.35E+01 | 5.83E+01 | 3.04E+02 | 3.15E+01 | 1.66E+02 | 1.73E+01 | 2.92E+01 |
| 1991 | 1.77E+01 | 3.07E+01 | 5.58E+01 | 1.92E+01 | 4.66E-01 | 1.31E+00 | 6.86E+01 | 3.56E+00 | 1.06E+00 | 1.38E-01 | 3.06E+00 | 8.73E+00 | 4.53E-02 | 5.51E+00 | 7.91E+01 | 3.71E+01 | 4.51E+01 | 7.40E+01 | 4.15E+01 | 3.35E+02 | 2.40E+01 | 1.50E+02 | 2.08E+01 | 3.54E+01 |
| 1992 | 2.82E+01 | 2.79E+01 | 5.90E+01 | 3.89E+01 | 4.66E-01 | 1.03E+00 | 5.84E+01 | 2.83E+00 | 9.18E-01 | 1.12E-01 | 2.30E+00 | 1.05E+01 | 5.10E-02 | 7.18E+00 | 9.27E+01 | 4.66E+01 | 5.42E+01 | 6.49E+01 | 4.73E+01 | 3.06E+02 | 2.57E+01 | 1.43E+02 | 1.55E+01 | 3.63E+01 |
| 1993 | 2.62E+01 | 2.83E+01 | 6.01E+01 | 2.20E+01 | 6.46E-01 | 1.44E+00 | 6.03E+01 | 5.07E+00 | 1.59E+00 | 9.31E-02 | 2.87E+00 | 8.45E+00 | 4.54E-02 | 5.39E+00 | 7.82E+01 | 3.99E+01 | 4.40E+01 | 8.36E+01 | 5.15E+01 | 3.03E+02 | 2.31E+01 | 1.23E+02 | 1.71E+01 | 4.74E+01 |
| 1994 | 1.29E+01 | 3.52E+01 | 6.16E+01 | 1.52E+01 | 2.77E-01 | 1.25E+00 | 7.83E+01 | 2.49E+00 | 8.63E-01 | 1.58E-01 | 3.09E+00 | 7.98E+00 | 4.45E-02 | 7.00E+00 | 9.76E+01 | 5.41E+01 | 5.23E+01 | 4.97E+01 | 4.02E+01 | 3.56E+02 | 2.49E+01 | 1.33E+02 | 1.83E+01 | 2.18E+01 |
| 1995 | 2.10E+01 | 3.02E+01 | 6.89E+01 | 2.97E+01 | 3.78E-01 | 1.13E+00 | 7.04E+01 | 3.93E+00 | 1.29E+00 | 9.18E-02 | 2.80E+00 | 7.16E+00 | 4.54E-02 | 6.29E+00 | 7.49E+01 | 3.41E+01 | 4.18E+01 | 6.57E+01 | 4.34E+01 | 3.40E+02 | 2.17E+01 | 1.44E+02 | 1.68E+01 | 3.33E+01 |
| 1996 | 1.36E+01 | 3.78E+01 | 6.06E+01 | 1.60E+01 | 4.84E-01 | 1.48E+00 | 1.12E+02 | 5.57E+00 | 1.28E+00 | 1.34E-01 | 3.17E+00 | 5.91E+00 | 3.76E-02 | 5.12E+00 | 6.61E+01 | 3.32E+01 | 3.80E+01 | 9.23E+01 | 4.67E+01 | 3.73E+02 | 2.41E+01 | 1.28E+02 | 1.84E+01 | 3.88E+01 |
| 1997 | 2.37E+01 | 2.90E+01 | 5.42E+01 | 2.08E+01 | 3.22E-01 | 1.07E+00 | 8.21E+01 | 3.86E+00 | 1.12E+00 | 1.01E-01 | 2.34E+00 | 8.32E+00 | 4.27E-02 | 4.83E+00 | 6.77E+01 | 3.53E+01 | 4.71E+01 | 5.93E+01 | 2.82E+01 | 3.31E+02 | 2.59E+01 | 1.37E+02 | 1.35E+01 | 2.92E+01 |
| 1998 | 2.13E+01 | 2.17E+01 | 5.29E+01 | 2.48E+01 | 4.54E-01 | 8.53E-01 | 6.19E+01 | 2.82E+00 | 1.01E+00 | 7.83E-02 | 2.56E+00 | 8.66E+00 | 4.38E-02 | 6.20E+00 | 7.85E+01 | 3.82E+01 | 4.65E+01 | 6.25E+01 | 4.08E+01 | 3.06E+02 | 2.09E+01 | 1.27E+02 | 1.29E+01 | 3.34E+01 |
| 1999 | 1.43E+01 | 2.38E+01 | 6.54E+01 | 1.84E+01 | 4.83E-01 | 1.03E+00 | 5.82E+01 | 3.22E+00 | 1.10E+00 | 1.02E-01 | 2.54E+00 | 1.04E+01 | 6.12E-02 | 8.51E+00 | 9.85E+01 | 4.63E+01 | 5.62E+01 | 7.80E+01 | 4.48E+01 | 3.21E+02 | 2.83E+01 | 1.44E+02 | 1.48E+01 | 3.32E+01 |
| 2000 | 1.95E+01 | 2.34E+01 | 5.17E+01 | 1.72E+01 | 4.43E-01 | 9.31E-01 | 5.19E+01 | 2.02E+00 | 7.98E-01 | 9.46E-02 | 2.46E+00 | 1.16E+01 | 6.66E-02 | 6.14E+00 | 1.00E+02 | 5.71E+01 | 6.76E+01 | 5.61E+01 | 3.78E+01 | 3.12E+02 | 2.06E+01 | 1.39E+02 | 1.59E+01 | 2.77E+01 |
| 2001 | 1.24E+01 | 2.11E+01 | 5.07E+01 | 2.96E+01 | 3.51E-01 | 7.05E-01 | 5.44E+01 | 3.34E+00 | 1.07E+00 | 1.07E-01 | 2.71E+00 | 6.18E+00 | 3.56E-02 | 7.08E+00 | 7.47E+01 | 3.49E+01 | 3.95E+01 | 6.40E+01 | 3.52E+01 | 2.70E+02 | 2.21E+01 | 9.10E+01 | 1.58E+01 | 2.94E+01 |
| 2002 | 2.33E+01 | 2.71E+01 | 5.95E+01 | 2.04E+01 | 4.29E-01 | 1.13E+00 | 6.69E+01 | 3.69E+00 | 1.07E+00 | 1.25E-01 | 3.61E+00 | 7.27E+00 | 3.96E-02 | 5.30E+00 | 7.92E+01 | 3.55E+01 | 3.88E+01 | 7.02E+01 | 4.47E+01 | 3.04E+02 | 2.82E+01 | 1.03E+02 | 1.59E+01 | 3.56E+01 |
| 2003 | 1.45E+01 | 3.37E+01 | 8.69E+01 | 2.06E+01 | 2.88E-01 | 1.60E+00 | 8.48E+01 | 3.12E+00 | 1.03E+00 | 1.42E-01 | 4.23E+00 | 7.59E+00 | 4.06E-02 | 5.07E+00 | 6.15E+01 | 3.11E+01 | 4.25E+01 | 6.84E+01 | 4.04E+01 | 3.01E+02 | 2.17E+01 | 1.31E+02 | 2.25E+01 | 3.40E+01 |
| 2004 | 2.65E+01 | 2.23E+01 | 7.47E+01 | 2.36E+01 | 3.20E-01 | 7.91E-01 | 4.63E+01 | 3.66E+00 | 1.12E+00 | 1.19E-01 | 3.62E+00 | 9.35E+00 | 4.39E-02 | 6.97E+00 | 8.12E+01 | 3.57E+01 | 4.23E+01 | 6.85E+01 | 7.66E+01 | 2.95E+02 | 2.70E+01 | 1.04E+02 | 2.21E+01 | 2.93E+01 |
| 2005 | 1.61E+01 | 2.43E+01 | 5.73E+01 | 1.68E+01 | 3.40E-01 | 1.08E+00 | 4.52E+01 | 3.95E+00 | 1.38E+00 | 9.60E-02 | 3.28E+00 | 8.68E+00 | 4.66E-02 | 6.43E+00 | 7.76E+01 | 4.50E+01 | 5.29E+01 | 6.51E+01 | 6.03E+01 | 2.97E+02 | 2.54E+01 | 1.41E+02 | 2.12E+01 | 2.85E+01 |
| 2006 | 2.45E+01 | 2.75E+01 | 6.14E+01 | 2.46E+01 | 4.21E-01 | 1.15E+00 | 5.71E+01 | 3.24E+00 | 9.77E-01 | 1.03E-01 | 2.80E+00 | 9.51E+00 | 5.52E-02 | 5.51E+00 | 7.60E+01 | 3.81E+01 | 4.97E+01 | 7.01E+01 | 5.11E+01 | 3.29E+02 | 2.92E+01 | 1.33E+02 | 1.75E+01 | 3.32E+01 |
| 2007 | 1.82E+01 | 2.40E+01 | 5.50E+01 | 2.58E+01 | 4.35E-01 | 8.24E-01 | 4.38E+01 | 3.70E+00 | 1.20E+00 | 9.44E-02 | 3.42E+00 | 8.42E+00 | 3.73E-02 | 6.27E+00 | 7.83E+01 | 3.96E+01 | 4.75E+01 | 7.05E+01 | 5.41E+01 | 2.62E+02 | 2.11E+01 | 1.21E+02 | 2.28E+01 | 3.46E+01 |
| 2008 | 2.36E+01 | 2.90E+01 | 7.27E+01 | 1.58E+01 | 2.75E-01 | 1.11E+00 | 7.19E+01 | 4.07E+00 | 1.07E+00 | 1.15E-01 | 3.78E+00 | 1.18E+01 | 6.59E-02 | 7.07E+00 | 9.38E+01 | 5.11E+01 | 6.01E+01 | 5.97E+01 | 5.09E+01 | 3.41E+02 | 2.06E+01 | 1.22E+02 | 2.20E+01 | 2.80E+01 |
| 2009 | 1.53E+01 | 2.49E+01 | 6.29E+01 | 1.71E+01 | 3.56E-01 | 1.06E+00 | 6.33E+01 | 2.90E+00 | 8.86E-01 | 9.61E-02 | 2.24E+00 | 8.32E+00 | 4.76E-02 | 5.64E+00 | 8.02E+01 | 4.39E+01 | 5.52E+01 | 5.60E+01 | 4.04E+01 | 3.07E+02 | 2.36E+01 | 1.41E+02 | 1.63E+01 | 2.82E+01 |
| 2010 | 2.18E+01 | 2.42E+01 | 6.32E+01 | 2.51E+01 | 3.69E-01 | 7.60E-01 | 5.08E+01 | 4.16E+00 | 1.34E+00 | 1.45E-01 | 5.22E+00 | 5.33E+00 | 3.02E-02 | 5.34E+00 | 7.10E+01 | 2.88E+01 | 3.41E+01 | 7.00E+01 | 3.61E+01 | 2.60E+02 | 2.13E+01 | 1.05E+02 | 2.49E+01 | 4.15E+01 |
| 2011 | 1.20E+01 | 2.96E+01 | 6.85E+01 | 2.70E+01 | 3.50E-01 | 1.24E+00 | 5.54E+01 | 2.11E+00 | 6.84E-01 | 1.27E-01 | 2.83E+00 | 1.11E+01 | 6.51E-02 | 6.00E+00 | 1.02E+02 | 5.50E+01 | 6.61E+01 | 4.78E+01 | 3.53E+01 | 3.44E+02 | 2.24E+01 | 1.73E+02 | 2.18E+01 | 3.56E+01 |
| 2012 | 1.60E+01 | 1.95E+01 | 5.05E+01 | 1.37E+01 | 2.11E-01 | 1.06E+00 | 5.07E+01 | 2.34E+00 | 8.43E-01 | 9.02E-02 | 2.07E+00 | 8.56E+00 | 5.20E-02 | 5.23E+00 | 6.91E+01 | 3.99E+01 | 4.78E+01 | 4.91E+01 | 3.40E+01 | 2.52E+02 | 1.89E+01 | 1.04E+02 | 1.49E+01 | 2.19E+01 |
| 2013 | 1.93E+01 | 2.28E+01 | 6.05E+01 | 1.56E+01 | 4.17E-01 | 1.07E+00 | 7.55E+01 | 4.03E+00 | 1.27E+00 | 1.04E-01 | 2.58E+00 | 9.01E+00 | 5.08E-02 | 5.30E+00 | 6.73E+01 | 3.74E+01 | 4.85E+01 | 6.81E+01 | 3.16E+01 | 2.86E+02 | 2.22E+01 | 1.18E+02 | 1.92E+01 | 3.31E+01 |
| 2014 | 1.85E+01 | 2.79E+01 | 5.31E+01 | 1.52E+01 | 2.83E-01 | 1.36E+00 | 5.35E+01 | 2.36E+00 | 8.68E-01 | 9.68E-02 | 2.04E+00 | 9.77E+00 | 7.25E-02 | 4.30E+00 | 7.92E+01 | 5.15E+01 | 5.91E+01 | 4.88E+01 | 3.36E+01 | 3.20E+02 | 1.94E+01 | 1.45E+02 | 1.18E+01 | 2.42E+01 |
| 2015 | 1.45E+01 | 3.28E+01 | 5.53E+01 | 2.27E+01 | 3.34E-01 | 1.39E+00 | 5.27E+01 | 2.64E+00 | 9.90E-01 | 1.42E-01 | 2.99E+00 | 1.09E+01 | 6.12E-02 | 6.34E+00 | 8.89E+01 | 5.35E+01 | 6.43E+01 | 5.83E+01 | 4.19E+01 | 3.39E+02 | 2.38E+01 | 1.54E+02 | 1.90E+01 | 3.51E+01 |
| 2016 | 1.72E+01 | 2.36E+01 | 4.58E+01 | 1.99E+01 | 2.36E-01 | 1.08E+00 | 6.69E+01 | 2.74E+00 | 8.12E-01 | 7.71E-02 | 2.29E+00 | 7.39E+00 | 4.31E-02 | 4.50E+00 | 6.59E+01 | 4.34E+01 | 4.58E+01 | 5.19E+01 | 2.81E+01 | 2.89E+02 | 2.22E+01 | 1.19E+02 | 1.48E+01 | 3.17E+01 |
| 2017 | 1.51E+01 | 2.70E+01 | 4.74E+01 | 1.97E+01 | 2.32E-01 | 1.21E+00 | 4.81E+01 | 2.22E+00 | 8.55E-01 | 1.25E-01 | 2.35E+00 | 8.74E+00 | 5.34E-02 | 5.89E+00 | 7.02E+01 | 4.10E+01 | 4.97E+01 | 5.07E+01 | 3.01E+01 | 2.80E+02 | 2.20E+01 | 1.24E+02 | 1.49E+01 | 2.45E+01 |
| 2018 | 1.34E+01 | 3.18E+01 | 6.35E+01 | 2.37E+01 | 2.46E-01 | 1.49E+00 | 5.49E+01 | 3.22E+00 | 8.46E-01 | 1.31E-01 | 3.01E+00 | 7.62E+00 | 5.21E-02 | 3.89E+00 | 5.47E+01 | 3.32E+01 | 4.66E+01 | 5.41E+01 | 3.14E+01 | 2.89E+02 | 2.27E+01 | 1.27E+02 | 1.89E+01 | 3.35E+01 |
| 2019 | 1.41E+01 | 2.21E+01 | 7.55E+01 | 9.60E+00 | 3.58E-01 | 8.84E-01 | 7.09E+01 | 2.42E+00 | 8.85E-01 | 9.86E-02 | 1.89E+00 | 7.93E+00 | 4.57E-02 | 4.06E+00 | 5.99E+01 | 3.58E+01 | 4.69E+01 | 4.23E+01 | 2.92E+01 | 2.62E+02 | 2.43E+01 | 1.27E+02 | 1.28E+01 | 2.17E+01 |
| 2020 | 1.40E+01 | 2.30E+01 | 5.61E+01 | 1.47E+01 | 3.36E-01 | 9.57E-01 | 5.11E+01 | 2.04E+00 | 7.14E-01 | 9.08E-02 | 3.97E+00 | 1.01E+01 | 6.65E-02 | 3.26E+00 | 5.79E+01 | 3.99E+01 | 5.12E+01 | 4.85E+01 | 3.87E+01 | 2.29E+02 | 2.55E+01 | 1.28E+02 | 2.12E+01 | 3.59E+01 |
| 2021 | 2.30E+01 | 1.92E+01 | 5.39E+01 | 2.33E+01 | 2.86E-01 | 6.93E-01 | 5.19E+01 | 2.77E+00 | 8.74E-01 | 1.19E-01 | 2.53E+00 | 6.16E+00 | 3.81E-02 | 4.11E+00 | 4.97E+01 | 3.01E+01 | 3.66E+01 | 5.11E+01 | 3.18E+01 | 2.19E+02 | 2.22E+01 | 9.93E+01 | 1.55E+01 | 3.00E+01 |
| 2022 | 2.30E+01 | 3.58E+01 | 6.17E+01 | 2.20E+01 | 3.36E-01 | 1.36E+00 | 5.33E+01 | 2.92E+00 | 9.68E-01 | 1.60E-01 | 3.58E+00 | 8.88E+00 | 5.05E-02 | 4.08E+00 | 5.61E+01 | 3.41E+01 | 4.71E+01 | 5.31E+01 | 2.75E+01 | 2.75E+02 | 2.11E+01 | 1.38E+02 | 2.01E+01 | 3.74E+01 |
| 2023 | 2.62E+01 | 2.13E+01 | 5.16E+01 | 2.28E+01 | 1.75E-01 | 8.69E-01 | 5.74E+01 | 1.91E+00 | 6.69E-01 | 1.11E-01 | 2.30E+00 | 6.55E+00 | 3.95E-02 | 4.05E+00 | 6.18E+01 | 3.51E+01 | 4.07E+01 | 3.82E+01 | 1.96E+01 | 2.37E+02 | 2.44E+01 | 9.58E+01 | 1.38E+01 | 2.57E+01 |



**Table C.7.** Country contributions to annual Pb deposition to the OSPAR Regions in 2023, tonnes/year

| Country    | OSPAR I  | OSPAR II | OSPAR III | OSPAR IV | OSPAR V  |
|------------|----------|----------|-----------|----------|----------|
| BE         | 4.15E-01 | 2.42E+00 | 2.12E-01  | 9.62E-02 | 6.60E-01 |
| DK         | 5.57E-01 | 2.42E+00 | 5.03E-02  | 2.49E-02 | 2.99E-01 |
| FI         | 6.55E-01 | 1.03E-01 | 6.57E-03  | 1.94E-03 | 5.73E-02 |
| FR         | 1.47E+00 | 6.51E+00 | 1.24E+00  | 1.37E+00 | 3.23E+00 |
| DE         | 3.15E+00 | 9.53E+00 | 7.39E-01  | 3.52E-01 | 3.11E+00 |
| IS         | 4.15E-01 | 9.02E-03 | 6.89E-03  | 1.52E-03 | 1.65E-01 |
| IE         | 4.29E-01 | 5.53E-01 | 1.22E+00  | 7.94E-02 | 1.13E+00 |
| LU         | 3.36E-02 | 1.12E-01 | 1.50E-02  | 6.27E-03 | 4.96E-02 |
| NL         | 1.31E-01 | 7.98E-01 | 4.70E-02  | 1.95E-02 | 1.67E-01 |
| NO         | 1.04E+00 | 5.39E-01 | 1.69E-02  | 4.22E-03 | 1.57E-01 |
| PT         | 2.68E-01 | 3.60E-01 | 3.42E-01  | 3.00E+00 | 2.92E+00 |
| ES         | 1.25E+00 | 1.82E+00 | 9.59E-01  | 6.83E+00 | 4.18E+00 |
| SE         | 4.79E-01 | 2.80E-01 | 9.56E-03  | 3.52E-03 | 7.84E-02 |
| CH         | 7.73E-02 | 1.46E-01 | 2.82E-02  | 1.11E-02 | 9.63E-02 |
| GB         | 7.36E+00 | 2.64E+01 | 9.26E+00  | 1.16E+00 | 1.12E+01 |
| AL         | 1.82E-03 | 3.96E-04 | 2.58E-04  | 3.34E-04 | 2.66E-03 |
| AM         | 6.66E-03 | 3.50E-04 | 1.65E-04  | 1.93E-04 | 2.56E-03 |
| AT         | 8.85E-02 | 1.24E-01 | 1.12E-02  | 9.48E-03 | 7.67E-02 |
| AZ         | 3.43E-03 | 1.93E-04 | 8.72E-05  | 9.24E-05 | 1.41E-03 |
| BA         | 1.07E-01 | 4.01E-02 | 9.88E-03  | 1.27E-02 | 1.03E-01 |
| BG         | 4.10E-02 | 4.55E-03 | 1.78E-03  | 2.54E-03 | 2.24E-02 |
| BY         | 1.13E-01 | 3.57E-02 | 3.13E-03  | 1.63E-03 | 2.35E-02 |
| CY         | 1.49E-03 | 1.91E-04 | 1.27E-04  | 1.39E-04 | 1.72E-03 |
| CZ         | 2.22E-01 | 2.93E-01 | 1.64E-02  | 1.63E-02 | 1.49E-01 |
| EE         | 1.00E-01 | 3.25E-02 | 1.74E-03  | 7.25E-04 | 1.62E-02 |
| GE         | 1.66E-02 | 9.32E-04 | 4.21E-04  | 4.89E-04 | 6.39E-03 |
| GR         | 2.13E-02 | 3.36E-03 | 2.23E-03  | 2.70E-03 | 2.43E-02 |
| HR         | 3.35E-02 | 2.01E-02 | 2.94E-03  | 4.71E-03 | 3.01E-02 |
| HU         | 6.79E-02 | 5.95E-02 | 3.13E-03  | 4.10E-03 | 3.41E-02 |
| IT         | 6.46E-01 | 3.15E-01 | 1.43E-01  | 2.25E-01 | 1.12E+00 |
| KY         | 3.08E-02 | 1.52E-03 | 6.94E-04  | 8.47E-04 | 1.39E-02 |
| KZ         | 5.57E-01 | 2.46E-02 | 9.66E-03  | 1.05E-02 | 1.86E-01 |
| LI         | 3.38E-04 | 7.06E-04 | 1.02E-04  | 5.04E-05 | 3.91E-04 |
| LT         | 7.90E-02 | 3.75E-02 | 2.74E-03  | 1.44E-03 | 1.97E-02 |
| LV         | 1.02E-01 | 4.51E-02 | 2.92E-03  | 1.51E-03 | 2.21E-02 |
| MC         | 3.47E-05 | 2.39E-05 | 1.27E-05  | 1.07E-05 | 5.38E-05 |
| MD         | 7.03E-03 | 1.46E-03 | 1.64E-04  | 2.18E-04 | 2.31E-03 |
| ME         | 1.15E-03 | 3.23E-04 | 9.96E-05  | 1.39E-04 | 1.08E-03 |
| MK         | 1.54E-02 | 2.46E-03 | 1.20E-03  | 1.62E-03 | 1.32E-02 |
| MT         | 1.22E-03 | 3.57E-04 | 3.43E-04  | 3.70E-04 | 3.40E-03 |
| PL         | 2.71E+00 | 2.48E+00 | 1.22E-01  | 1.13E-01 | 1.10E+00 |
| RO         | 1.07E-01 | 2.46E-02 | 3.84E-03  | 5.30E-03 | 4.55E-02 |
| RS         | 9.98E-02 | 4.01E-02 | 6.57E-03  | 7.82E-03 | 6.22E-02 |
| RU         | 8.02E+00 | 2.10E-01 | 4.13E-02  | 2.19E-02 | 3.83E-01 |
| SI         | 2.34E-02 | 1.90E-02 | 2.21E-03  | 3.76E-03 | 2.03E-02 |
| SK         | 6.84E-02 | 5.89E-02 | 2.97E-03  | 3.35E-03 | 3.15E-02 |
| TJ         | 2.88E-01 | 1.51E-02 | 7.11E-03  | 7.83E-03 | 1.37E-01 |
| TM         | 2.23E-01 | 1.11E-02 | 5.55E-03  | 5.67E-03 | 9.11E-02 |
| TR         | 2.69E-01 | 1.71E-02 | 8.59E-03  | 1.03E-02 | 1.06E-01 |
| UA         | 3.29E-01 | 4.48E-02 | 7.28E-03  | 9.09E-03 | 9.48E-02 |
| UZ         | 9.54E-01 | 5.05E-02 | 2.35E-02  | 2.67E-02 | 4.46E-01 |
| OSPAR      | 1.77E+01 | 5.20E+01 | 1.41E+01  | 1.30E+01 | 2.74E+01 |
| Other EMEP | 1.53E+01 | 4.02E+00 | 4.46E-01  | 5.12E-01 | 4.39E+00 |
| Non-EMEP   | 4.58E+01 | 6.27E+00 | 4.68E+00  | 6.61E+00 | 1.07E+02 |
| Land       | 8.48E+01 | 2.97E+01 | 1.50E+01  | 2.19E+01 | 1.94E+02 |
| Sea        | 5.11E+02 | 8.49E+01 | 6.02E+01  | 5.19E+01 | 9.96E+02 |
| Total      | 6.75E+02 | 1.77E+02 | 9.45E+01  | 9.38E+01 | 1.33E+03 |

**Table C.8.** Sector contributions to annual Pb deposition to the OSPAR Regions in 2023, tonnes/year

| Sector        | OSPAR I  | OSPAR II | OSPAR III | OSPAR IV | OSPAR V  |
|---------------|----------|----------|-----------|----------|----------|
| A_PPr         | 1.30E+01 | 2.65E+00 | 7.46E-01  | 7.92E-01 | 1.15E+01 |
| B_Ind         | 3.43E+01 | 2.56E+01 | 8.48E+00  | 9.70E+00 | 5.68E+01 |
| C_OSC         | 3.51E+00 | 4.52E+00 | 9.53E-01  | 1.36E+00 | 5.58E+00 |
| D_Fug         | 3.03E+00 | 5.13E-01 | 2.98E-01  | 3.12E-01 | 5.71E+00 |
| E_Slv         | 2.47E+00 | 1.79E+00 | 5.64E-01  | 4.36E-01 | 6.68E+00 |
| F_RTr         | 1.27E+01 | 2.18E+01 | 5.96E+00  | 5.76E+00 | 2.42E+01 |
| G_Shp         | 5.22E-02 | 7.56E-02 | 2.04E-02  | 6.70E-03 | 3.63E-02 |
| H_Avi         | 8.69E+00 | 4.07E+00 | 1.94E+00  | 1.28E+00 | 2.69E+01 |
| I_OfR         | 4.38E-01 | 5.41E-01 | 1.59E-01  | 5.58E-02 | 7.41E-01 |
| J_Wst         | 6.96E-01 | 7.72E-01 | 1.59E-01  | 3.53E-01 | 1.08E+00 |
| L_AOt         | 1.89E-02 | 6.67E-03 | 2.78E-03  | 5.24E-03 | 3.82E-02 |
| M_Oth         | 3.04E-02 | 3.51E-02 | 7.17E-03  | 9.23E-03 | 4.54E-02 |
| Anthropogenic | 7.90E+01 | 6.23E+01 | 1.93E+01  | 2.01E+01 | 1.39E+02 |
| Land          | 8.49E+01 | 2.97E+01 | 1.50E+01  | 2.19E+01 | 1.94E+02 |
| Sea           | 5.11E+02 | 8.49E+01 | 6.02E+01  | 5.19E+01 | 9.96E+02 |
| Total         | 6.75E+02 | 1.77E+02 | 9.46E+01  | 9.39E+01 | 1.33E+03 |



**Table C.9.** Country contributions to annual Cu deposition to the OSPAR Regions in 2023, tonnes/year

| Country    | OSPAR I  | OSPAR II | OSPAR III | OSPAR IV | OSPAR V  |
|------------|----------|----------|-----------|----------|----------|
| BE         | 9.76E-01 | 1.21E+01 | 9.30E-01  | 5.61E-01 | 2.70E+00 |
| DK         | 1.52E+00 | 1.49E+01 | 1.61E-01  | 1.24E-01 | 9.49E-01 |
| FI         | 1.09E+00 | 9.00E-02 | 6.71E-03  | 3.09E-03 | 5.03E-02 |
| FR         | 2.52E+00 | 2.06E+01 | 5.44E+00  | 7.30E+00 | 1.00E+01 |
| DE         | 6.30E+00 | 3.35E+01 | 2.46E+00  | 1.43E+00 | 9.80E+00 |
| IS         | 2.05E+00 | 1.83E-02 | 1.29E-02  | 1.57E-03 | 4.82E-01 |
| IE         | 1.52E+00 | 2.71E+00 | 1.08E+01  | 3.41E-01 | 6.06E+00 |
| LU         | 9.03E-02 | 5.26E-01 | 7.72E-02  | 4.15E-02 | 2.27E-01 |
| NL         | 1.62E+00 | 2.13E+01 | 1.02E+00  | 5.95E-01 | 3.54E+00 |
| NO         | 5.93E+00 | 4.01E+00 | 5.44E-02  | 1.44E-02 | 4.67E-01 |
| PT         | 9.97E-02 | 2.43E-01 | 3.18E-01  | 3.75E+00 | 2.73E+00 |
| ES         | 5.57E-01 | 1.11E+00 | 8.63E-01  | 6.64E+00 | 3.84E+00 |
| SE         | 1.12E+00 | 1.36E+00 | 2.10E-02  | 9.50E-03 | 1.49E-01 |
| CH         | 2.27E-01 | 6.96E-01 | 1.70E-01  | 5.23E-02 | 3.92E-01 |
| GB         | 2.80E+01 | 1.83E+02 | 5.15E+01  | 4.61E+00 | 5.05E+01 |
| AL         | 4.75E-05 | 3.62E-05 | 2.53E-05  | 3.66E-05 | 1.82E-04 |
| AM         | 1.05E-04 | 1.40E-06 | 4.41E-07  | 5.43E-07 | 5.72E-06 |
| AT         | 2.21E-01 | 7.08E-01 | 6.68E-02  | 4.78E-02 | 3.06E-01 |
| AZ         | 1.76E-03 | 5.56E-05 | 2.38E-05  | 1.85E-05 | 2.28E-04 |
| BA         | 4.69E-02 | 5.00E-02 | 1.37E-02  | 1.87E-02 | 8.12E-02 |
| BG         | 2.09E-02 | 3.88E-03 | 2.19E-03  | 3.12E-03 | 1.61E-02 |
| BY         | 1.71E-02 | 5.77E-03 | 6.11E-04  | 1.66E-04 | 2.93E-03 |
| CY         | 2.20E-03 | 4.55E-04 | 3.44E-04  | 3.40E-04 | 3.13E-03 |
| CZ         | 2.98E-01 | 7.99E-01 | 3.36E-02  | 3.94E-02 | 3.23E-01 |
| EE         | 1.30E-01 | 4.44E-02 | 2.88E-03  | 1.50E-03 | 2.39E-02 |
| GE         | 5.00E-04 | 1.14E-05 | 4.60E-06  | 4.76E-06 | 4.31E-05 |
| GR         | 2.39E-02 | 1.06E-02 | 8.16E-03  | 1.09E-02 | 6.01E-02 |
| HR         | 2.36E-02 | 4.79E-02 | 5.91E-03  | 1.08E-02 | 3.72E-02 |
| HU         | 8.52E-02 | 1.88E-01 | 6.00E-03  | 9.60E-03 | 4.09E-02 |
| IT         | 4.57E-01 | 4.73E-01 | 2.53E-01  | 3.38E-01 | 1.12E+00 |
| KY         | 2.87E-03 | 3.91E-05 | 1.20E-05  | 1.79E-05 | 3.01E-04 |
| KZ         | 8.79E-02 | 1.65E-03 | 3.47E-04  | 3.89E-04 | 7.06E-03 |
| LI         | 4.47E-04 | 1.72E-03 | 3.34E-04  | 1.21E-04 | 7.11E-04 |
| LT         | 1.30E-01 | 7.92E-02 | 6.84E-03  | 3.09E-03 | 3.51E-02 |
| LV         | 9.89E-02 | 5.06E-02 | 3.89E-03  | 2.25E-03 | 2.60E-02 |
| MC         | 8.07E-05 | 1.41E-04 | 8.59E-05  | 6.37E-05 | 2.11E-04 |
| MD         | 4.93E-04 | 1.11E-04 | 1.41E-05  | 1.67E-05 | 9.24E-05 |
| ME         | 1.67E-05 | 1.17E-05 | 6.91E-06  | 1.09E-05 | 4.45E-05 |
| MK         | 2.19E-03 | 4.05E-04 | 2.49E-04  | 4.07E-04 | 1.83E-03 |
| MT         | 2.83E-03 | 1.79E-03 | 2.23E-03  | 2.19E-03 | 1.52E-02 |
| PL         | 1.50E+00 | 2.45E+00 | 7.81E-02  | 9.02E-02 | 7.75E-01 |
| RO         | 6.51E-02 | 2.33E-02 | 3.04E-03  | 5.06E-03 | 1.93E-02 |
| RS         | 1.47E-02 | 9.06E-03 | 1.83E-03  | 2.67E-03 | 1.12E-02 |
| RU         | 1.14E+01 | 3.69E-01 | 9.77E-02  | 2.92E-02 | 3.65E-01 |
| SI         | 2.15E-02 | 4.22E-02 | 5.37E-03  | 1.03E-02 | 3.26E-02 |
| SK         | 2.06E-02 | 3.21E-02 | 8.06E-04  | 1.52E-03 | 1.00E-02 |
| TJ         | 1.03E-01 | 1.32E-03 | 3.54E-04  | 4.75E-04 | 8.28E-03 |
| TM         | 1.10E-01 | 2.12E-03 | 1.03E-03  | 8.52E-04 | 1.18E-02 |
| TR         | 1.81E-01 | 1.74E-02 | 1.19E-02  | 1.14E-02 | 7.85E-02 |
| UA         | 4.33E-02 | 7.52E-03 | 7.08E-04  | 9.28E-04 | 5.63E-03 |
| UZ         | 2.95E-01 | 5.30E-03 | 1.56E-03  | 1.86E-03 | 3.02E-02 |
| OSPAR      | 5.36E+01 | 2.97E+02 | 7.39E+01  | 2.55E+01 | 9.19E+01 |
| Other EMEP | 1.54E+01 | 5.43E+00 | 6.10E-01  | 6.44E-01 | 3.45E+00 |
| Non-EMEP   | 1.77E+01 | 2.33E+00 | 2.16E+00  | 4.19E+00 | 6.25E+01 |
| Land       | 7.62E+01 | 5.34E+01 | 1.61E+01  | 1.60E+01 | 1.09E+02 |
| Sea        | 8.41E+01 | 1.17E+01 | 8.33E+00  | 7.60E+00 | 1.56E+02 |
| Total      | 2.47E+02 | 3.69E+02 | 1.01E+02  | 5.39E+01 | 4.23E+02 |

**Table C.10.** Sector contributions to annual Cu deposition to the OSPAR Regions in 2023, tonnes/year

| Sector        | OSPAR I  | OSPAR II | OSPAR III | OSPAR IV | OSPAR V  |
|---------------|----------|----------|-----------|----------|----------|
| A_PPr         | 1.30E+01 | 2.65E+00 | 7.46E-01  | 7.92E-01 | 1.15E+01 |
| B_Ind         | 3.43E+01 | 2.56E+01 | 8.48E+00  | 9.70E+00 | 5.68E+01 |
| C_OSC         | 3.51E+00 | 4.52E+00 | 9.53E-01  | 1.36E+00 | 5.58E+00 |
| D_Fug         | 3.03E+00 | 5.13E-01 | 2.98E-01  | 3.12E-01 | 5.71E+00 |
| E_Slv         | 2.47E+00 | 1.79E+00 | 5.64E-01  | 4.36E-01 | 6.68E+00 |
| F_RTr         | 1.27E+01 | 2.18E+01 | 5.96E+00  | 5.76E+00 | 2.42E+01 |
| G_Shp         | 5.22E-02 | 7.56E-02 | 2.04E-02  | 6.70E-03 | 3.63E-02 |
| H_Avi         | 8.69E+00 | 4.07E+00 | 1.94E+00  | 1.28E+00 | 2.69E+01 |
| I_OfR         | 4.38E-01 | 5.41E-01 | 1.59E-01  | 5.58E-02 | 7.41E-01 |
| J_Wst         | 6.96E-01 | 7.72E-01 | 1.59E-01  | 3.53E-01 | 1.08E+00 |
| L_AOt         | 1.89E-02 | 6.67E-03 | 2.78E-03  | 5.24E-03 | 3.82E-02 |
| M_Oth         | 3.04E-02 | 3.51E-02 | 7.17E-03  | 9.23E-03 | 4.54E-02 |
| Anthropogenic | 7.90E+01 | 6.23E+01 | 1.93E+01  | 2.01E+01 | 1.39E+02 |
| Land          | 8.49E+01 | 2.97E+01 | 1.50E+01  | 2.19E+01 | 1.94E+02 |
| Sea           | 5.11E+02 | 8.49E+01 | 6.02E+01  | 5.19E+01 | 9.96E+02 |
| Total         | 6.75E+02 | 1.77E+02 | 9.46E+01  | 9.39E+01 | 1.33E+03 |

## Annex D. Statistics for uncertainty analysis

**Table D.1.** Summary of statistical parameters used to evaluate Pb modelling results against observations. Notation: 'N sites' denotes the number of measurement sites; 'Obs SD' and 'Mod SD' represent the standard deviations of observed and modelled values across measurement sites; Bias is the mean relative bias of annual values.

| Country                                             | N sites | Observed | Obs SD | Model | Mod SD | Bias, % |
|-----------------------------------------------------|---------|----------|--------|-------|--------|---------|
| Air concentration, ng m <sup>-3</sup>               |         |          |        |       |        |         |
| BE                                                  | 1       | 3.56     | –      | 3.89  | –      | 9       |
| DE                                                  | 8       | 6.90     | 3.51   | 8.27  | 4.86   | 25      |
| DK                                                  | 6       | 4.22     | 4.20   | 4.07  | 3.69   | 3       |
| ES                                                  | 12      | 1.94     | 0.95   | 2.99  | 1.64   | 60      |
| FI                                                  | 5       | 1.35     | 0.83   | 0.50  | 0.25   | -60     |
| FR                                                  | 7       | 1.83     | 1.04   | 1.92  | 0.57   | 22      |
| GB                                                  | 9       | 8.01     | 6.31   | 15.63 | 18.11  | 61      |
| IE                                                  | 1       | 0.97     | –      | 1.00  | –      | 3       |
| IS                                                  | 1       | 0.52     | –      | 0.84  | –      | 61      |
| NL                                                  | 3       | 9.15     | 3.74   | 12.05 | 5.82   | 30      |
| NO                                                  | 5       | 0.87     | 0.61   | 1.18  | 1.30   | 38      |
| SE                                                  | 6       | 1.01     | 0.51   | 1.13  | 0.76   | 13      |
| Wet deposition, kg km <sup>-2</sup> y <sup>-1</sup> |         |          |        |       |        |         |
| BE                                                  | 1       | 0.40     | –      | 0.28  | –      | -29     |
| DE                                                  | 6       | 0.59     | 0.20   | 0.48  | 0.12   | -13     |
| DK                                                  | 5       | 0.70     | 0.20   | 0.38  | 0.23   | -46     |
| ES                                                  | 6       | 0.62     | 0.67   | 0.59  | 0.31   | 118     |
| FI                                                  | 7       | 0.40     | 0.24   | 0.18  | 0.09   | -53     |
| FR                                                  | 8       | 0.47     | 0.19   | 0.26  | 0.08   | -38     |
| GB                                                  | 5       | 0.55     | 0.50   | 0.42  | 0.31   | 4       |
| IS                                                  | 2       | 0.43     | 0.16   | 0.36  | 0.03   | -9      |
| NL                                                  | 3       | 1.36     | 0.09   | 1.24  | 0.36   | -9      |
| NO                                                  | 4       | 0.82     | 0.71   | 0.29  | 0.28   | -65     |
| SE                                                  | 6       | 0.38     | 0.29   | 0.27  | 0.12   | -19     |

**Table D.2.** Summary of statistical parameters used to evaluate Cu modelling results against observations. Notation: 'N sites' denotes the number of measurement sites; 'Obs SD' and 'Mod SD' represent the standard deviations of observed and modelled values across measurement sites; Bias is the mean relative bias of annual values.

| Country                                             | N sites | Observed | Obs SD | Model | Mod SD | Bias, % |
|-----------------------------------------------------|---------|----------|--------|-------|--------|---------|
| Air concentration, ng m <sup>-3</sup>               |         |          |        |       |        |         |
| BE                                                  | 1       | 3.50     | –      | 10.90 | –      | 212     |
| DE                                                  | 8       | 1.96     | 0.51   | 6.39  | 1.85   | 241     |
| DK                                                  | 4       | 1.42     | 0.93   | 4.12  | 2.69   | 159     |
| ES                                                  | 10      | 4.92     | 2.34   | 1.35  | 1.03   | -62     |
| FI                                                  | 5       | 0.58     | 0.23   | 0.64  | 0.29   | 10      |
| FR                                                  | 5       | 1.61     | 0.64   | 3.51  | 1.35   | 123     |
| GB                                                  | 9       | 2.38     | 0.96   | 11.61 | 4.80   | 417     |
| IE                                                  | 1       | 0.85     | –      | 0.42  | –      | -51     |
| IS                                                  | 1       | 0.76     | –      | 0.16  | –      | -79     |
| NO                                                  | 5       | 0.63     | 0.30   | 0.68  | 0.52   | 2       |
| SE                                                  | 6       | 0.62     | 0.25   | 1.82  | 1.48   | 161     |
| Wet deposition, kg km <sup>-2</sup> y <sup>-1</sup> |         |          |        |       |        |         |
| BE                                                  | 1       | 2.43     | –      | 1.16  | –      | -52     |
| DE                                                  | 6       | 1.09     | 0.36   | 0.87  | 0.17   | -12     |
| DK                                                  | 5       | 0.76     | 0.10   | 0.71  | 0.19   | -7      |
| FI                                                  | 7       | 0.46     | 0.12   | 0.13  | 0.05   | -71     |
| FR                                                  | 1       | 1.18     | 0.60   | 0.47  | 0.30   | -55     |
| GB                                                  | 1       | 1.09     | 0.94   | 1.08  | 0.49   | 91      |
| IS                                                  | 1       | 2.38     | 0.43   | 0.11  | 0.03   | -95     |
| NL                                                  | 1       | 1.16     | 0.15   | 1.85  | 0.38   | 64      |
| NO                                                  | 1       | 2.27     | 0.69   | 0.34  | 0.23   | -83     |

**Table D.3** Uncertainty estimates for Pb and Cu emissions reported by OSPAR Contracting Parties and other EMEP countries.

| Country         | Pb   | Cu   |
|-----------------|------|------|
| <b>Belgium</b>  | 187% | 278% |
| <b>Denmark</b>  | 612% | 908% |
| <b>Finland</b>  | 38%  | 77%  |
| <b>France</b>   | 141% | 233% |
| <b>Sweden</b>   | 35%  | 63%  |
| <b>UK</b>       | 72%  | 50%  |
| <b>Austria</b>  | 34%  | n/a  |
| <b>Estonia</b>  | 46%  | n/a  |
| <b>Croatia</b>  | 165% | 156% |
| <b>Latvia</b>   | 11%  | n/a  |
| <b>Poland</b>   | 20%  | n/a  |
| <b>Slovakia</b> | 248% | 708% |

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