European Environment Agency

European Environment Agency
European Topic Centre
Human health and the environment

Estimating the external costs of industrial air pollution: Trends 2012-2021

Technical note on the methodology and additional results from the EEA briefing 24/2023

TECHNICAL NOTE

European Environment Agency

Estimating the external costs of industrial air pollution: Trends 2012-2021

Technical note on the methodology and additional results

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Prepared by the EEA in collaboration with the European Topic Centre on Human Health and the Environment (ETC-HE)

Corrigendum:

An error in the data for external costs caused has been corrected in the briefing and the technical note that underpins it, as has the resulting ranking of facilities. Facility "DJP - De Hoop BV", located in the Netherlands with Inspire ID NL.RIVM/000064335.FACILITY, appeared wrongly as the facility with the highest external costs caused in 2021 in Map 1 of the briefing, as well as Map 4.1 and Table 4.4 of the technical note. The new maps and table now show the correct data and ranking.

The data on total external costs per pollutant group, externalities by country and externalities by sector which can be seen in the briefing did not contain this error and are unaffected.

The corrected versions of briefing and technical note were published on 29/04/2024.

Contents

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1 Introduction

1.1 Industrial pollution in the context of a Zero-Pollution Ambition

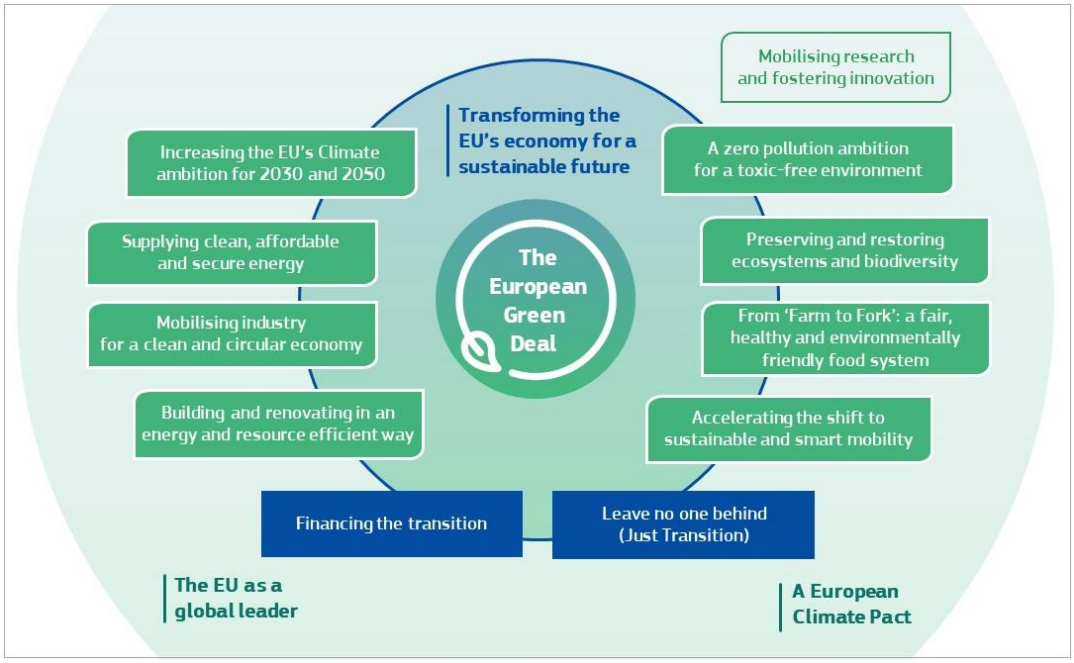
The European industry is crucial for our society's wellbeing. They provide many important economic and social benefits: they produce goods and products and generate employment and tax revenues.

However, Europe's largest industrial installations account for a significant share of total emissions of key air pollutants and greenhouse gases (GHG), as well as other important environmental impacts, including the release of pollutants to water and soil, generation of waste and the use of energy. Despite the general reduction of industrial emissions in Europe over the last decades, the impacts and costs of pollution from industry remain high.

Pollution is recognised as the largest environmental cause of multiple mental and physical diseases and of premature deaths. In addition, pollution is behind the loss of biodiversity, and reduces ecosystems' resilience and their capacity to act as a carbon sink. Our economy's productivity is also affected by pollution.

At the end of 2019, the European Commission launched the European Green Deal. This is an ambitious Action Plan with a series of key actions aimed at transforming the European economy and tackling the environmental and climate challenges of our era. The main aim of the plan is to transform the EU into a sustainable, healthy, thriving and modern society. The figure below is a good summary of all the actions envisaged for the plan. Important aspects are, of course, financing such transition and ensuring it is fair (the so-called 'leave no one behind' principle) (EC, 2019a).

Figure 1.1 – The European Green Deal



Source: (EC, 2019a)

One of the key actions in the EU Green Deal is 'A zero-pollution ambition.' In October 2020, the Commission published a roadmap on the initiative, with three pillars (EC, 2020):

- Prevention, remediation and monitoring.
- Incorporation of the zero-pollution ambition into all policies.
- Decoupling of economic growth from increased pollution.

As part of this, the Commission published an Action Plan and Monitoring framework, to establish a way to track progress on Zero-Pollution targets.

On the one hand, the EEA published its Zero-pollution monitoring assessment at the end of 2022 and the European Commission's Joint Research Centre (JRC) published the Zero-Pollution Outlook report.

The EEA's Zero-Pollution Monitoring Assessment report indicated that the EU was a large source of air, water and land pollution; considering intensive production within the 27 Member States but also consumption within the EU of products manufactured elsewhere (EEA, 2022c).

The assessment also shows that air emissions from production processes have fallen in the last decade, while economic growth has continued (EEA, 2022c). Despite this improvement, European industry continues to be one of the biggest sources of pollution.

One of the objectives of the Zero-Pollution Action Plan was to revise the Industrial Emissions Directive (Directive 2010/75/EU, IED) which covers large industrial operators across Europe. The Directive successfully implemented a regime by which environmental permit conditions have to be set based on best available techniques (BAT) established via a thorough process led by the Commission's JRC in Seville. Through this process, the Commission compiles and analyses industry data, discusses, negotiates and finally publishes sectoral BAT reference documents (BREFs) and their legally binding BAT conclusions. Member State competent authorities have to ensure that these sectoral BAT conclusions are the reference for establishing permit conditions in industrial installations covered by the IED. However, ten years after the adoption of the Directive it was clear that more had to be done if industry was to be part of the Zero-Pollution Ambition.

The Commission published a proposal for revising the IED in 2022 which focused, among other topics, on cleaner processes, fostering innovation, reducing the use of derogations and focusing on the most stringent BAT associated emission levels (BAT-AELs) in the many cases where BAT conclusions are expressed as a concentration range (EC, 2022). A final revised version of the IED was agreed at the end of 2023.

As can be seen in the briefing, the European Commission has also published an industrial strategy and a proposal for Regulation (Net zero industry act) which aim at enabling the digital and green transformation from industry and accelerate the implementation of the technologies that have the potential of support this transformation (EC, 2023, 2021).

As part of this move towards decoupling growth from pollution, it is important to analyse the impacts that this pollution has on health and environment, which translates in costs imposed upon stakeholders that are not participating in creating the pollution. Likewise, reducing pollution does not only have an adverse economic impact for the operator or the industrial sector in question when they implement abatement options for their activities. It has positive benefits in avoided health and environmental costs which usually outweigh these upfront costs.

The EEA has done exercises of this kind in the past. In 2011, it published a technical report on this topic assessing the damage costs to health and the environment in 2009, caused by pollutant emissions from industrial facilities officially reporting to the European Pollutant Release and Transfer Register (E-PRTR). Then, in 2014, The EEA updated this report with new scientific data and included new analysis, covering damage costs in the 2008-2012 period (EEA, 2011a, 2014). Following that work, the ETC-ATNI published an update building upon the significant scientific progress made in damage cost estimation methodologies to calculate these external costs since 2014 (Schucht et al., 2021). That report led to the publication of an earlier briefing based on 2017 data (EEA, 2021).

The latest briefing includes the results of the analysis covering 2012-2021. Damage costs for the whole time period have been recalculated based on the latest available scientific information and applied to emissions estimates for each year.

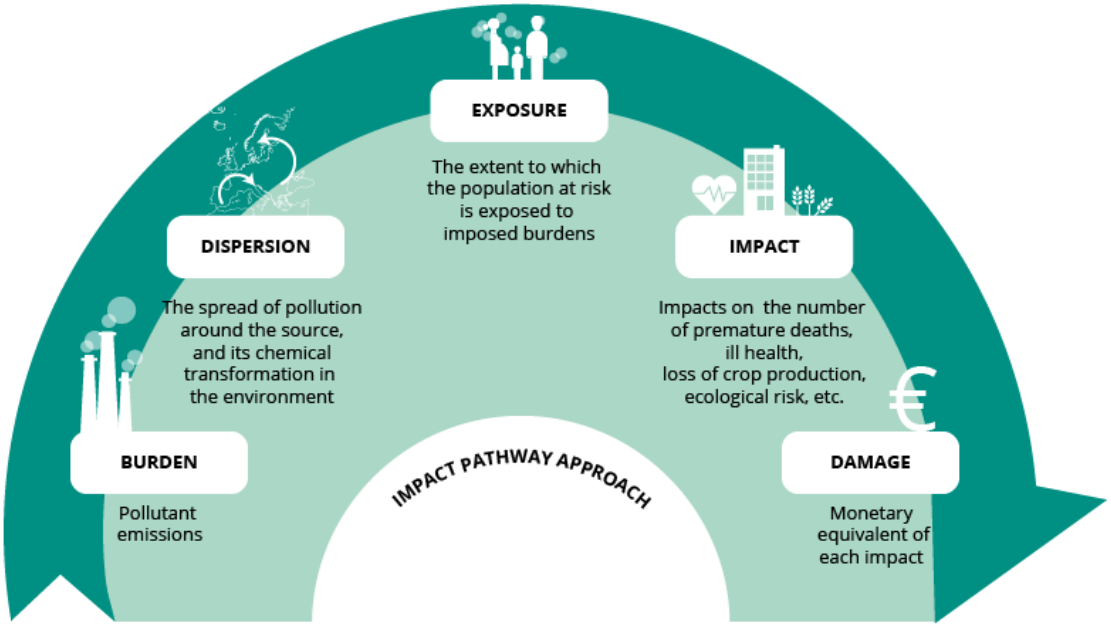
Calculating the impacts of pollutants on human health and the environment is based on a modelling framework that links knowledge of pollutant emissions with their impacts and consequent damage costs, using the *impact pathway approach* (IPA) (ExternE, 1995, 2005). Scientific modelling frameworks and economic methods applied for estimating the impacts and damage costs of the 'traditional' main air pollutants (nitrogen oxide (NO_X), sulphur dioxide (SO_2), particulate matter (PM), ammonia (NH_3) and non-methane volatile organic compounds (NMVOCs)) have been developed through research funded by the European Commission and Member States since the early 1990s (for instance Holland et al., (2005a, 2005b), Hurley et al.,(2005)). They have been subject to international peer review (Krupnick et al., 2005). Methods such as those developed under the European Commission's Clean Air for Europe programme (CAFE) and partly updated under the HRAPIE (Health risks of air pollution in Europe) project (WHO, 2013) are regularly applied in cost-benefit analyses to support national, EU and international policymaking in air pollution and climate mitigation (e.g. (Amann, 2017; Amann et al., 2020; Klimont et al., 2022)). Estimation of damage costs from emissions of heavy metals, organic pollutants and the greenhouse gas carbon dioxide (CO_2) has also been developed over the years and used to inform European and national policymakers.

2 Methodology

2.1 Approach in a nutshell

The exact modelling and approach are slightly different depending on the pollutant, but the main concept is that of the 'impact-pathway' approach (IPA), which is used to estimate the damage costs of all pollutants with the exception of GHG. The IPA framework was developed during the 1990s and aims to address consistently through a logical step-by-step progression from the emission of the pollutant to quantifying its impact and monetising damage costs. An overview of the IPA is shown in Figure 2.1.

Figure 2.1 – The impact pathway approach



Source(s): EEA (2021) based on EEA (2011b)

The concept has remained stable over the years, but the inputs and complexity of the modelling have changed significantly as new data has become available.

For the main air pollutants (NO_X, PM, NH_3, NMVOC, SO_2), the exposure route is simpler (inhalation mainly), but their atmospheric chemistry and dispersion are generally more complex, than for example for heavy metals (see below). To model this, dispersion and exposure modelling is used to estimate the spread of emissions and their transformation in the environment, as well as where impacts may occur. Various simulations are used to estimate how emissions emitted in a given country result in them being transformed (or not) and 'inhaled' or deposited in the same country or somewhere else. These models divide the European continent in grids of a given size (this is called resolution). In these simulations, the changes in pollutant concentrations in each grid that result from a change in emissions at the level of an emitter country are estimated. This relationship between changes in emissions and resulting changes in concentrations is not calculated specifically for each emitting facility

because this would be extremely complex and resource-intensive for a pan-European study. Therefore, the changes in the source emissions are simulated as percentage changes (15 % in the modelling used for this assessment) in the emissions of the emitter country as a whole (all sectors). Once this is done, the information on emission concentration changes of the main air pollutants is combined with data on the value at risk (population, crops, buildings) exposed to a given pollutant to estimate the exposure to which they are subject.

The concept is similar for heavy metals and organic pollutants. However, their atmospheric chemistry is simpler, but their exposure routes may be more complex (often involving not only inhalation but also ingestion). Because of this, a different model is used with a series of equations that indicate how pollutants pass through different environmental compartments (air, land, freshwater, seawater and then transfer to drinking water and agricultural products) leading to human exposure.

In the next step, the impact of a change of exposure on health, crop yield, forest biomass production and exceedance in critical loads for ecosystems is calculated for several relevant health and non-health impacts. This relies on exposure-response and dose-response functions linking a change in exposure to an increase in impact. Combined with impact incidence data (this refers to the typical baseline cases of these impact), it allows to attribute a fraction of these impacts to a higher exposure.

Finally, these impacts are monetised using estimations of public "willingness to pay" for better health and environmental protection. Knowing the amount of emissions that correspond to a 15 % change in emissions of a given pollutant, the damage costs can be calculated for 1 unit of emission (one tonne or one kilogram). This is called a "marginal damage cost" (MDC).

For monetising premature mortality, this work has used two distinct methodologies, the value of a statistical life (VSL) and value of a life year (VOLY).

- Value of statistical life (VSL): an estimate of damage costs based on the value a given population places *ex ante* on avoiding the death of an individual. VSL is based on the sum of money each individual is prepared to pay for a given reduction in the risk of premature death, for example from diseases linked to air pollution (OECD, 2012); and
- Value of a life year (VOLY): an estimate of damage costs based on the potential years of life lost (YOLL) from a specific risk, based on an estimated life expectancy, and then evaluates them by multiplying them by the VOLY. Therefore, the result is affected by the age at which deaths occur (OECD, 2012).
- The ranges of external costs (low – high) included in the results correspond to the values estimated using these two methods, rather than a minimum – maximum level of health impacts.

A detailed description of the methodology can be found in Schucht et al. (2021).

MDC are calculated for the pollutants in the scope of the study for each country. They are then multiplied by the emissions from industrial facilities reported under E-PRTR to calculate their externalities. The marginal damage costs calculated per pollutant per country are not sector specific. Therefore, before each multiplication, sectoral adjustments are applied which consider the stack height and distance to population of each industrial sector.

As noted above, this is done for all pollutants except GHG. For GHG, the marginal cost per tonne of CO_2 abated is combined with the different global temperature change potential (GTP) of CH_4 and N_2O relative to CO_2 to develop marginal cost per tonne which is multiplied by the emissions of these three pollutants reported to E-PRTR. Given policies that are in place to eliminate GHG emissions, additional emissions will be countered elsewhere, meaning that no increase in health or other damage will occur, but there will be additional abatement costs.

2.2 Scope of the study

The study focuses on the largest industrial facilities in Europe, a set of key pollutants, and selected impact categories with a focus on health. The geographical scope for the calculation of damage costs per tonne is the EEA38 and the UK. The calculation of externalities is performed for the EU27 (see section 2.3 below).

Large industry sectors include facilities such as most refineries, large thermal power stations, extensive chemical industrial complexes, large waste incinerators and others. These must report their emission releases and transfers and their waste transfers to their national competent authorities to comply with the requirements of Regulation 166/2006 (EU, 2006), which establishes an European Pollutant Releases and Transfers Register (E-PRTR). Annex I of the Regulation indicates within the activities in the scope of E-PRTR, what the capacity thresholds are. These capacity thresholds are generally consistent with those in annex I of the Industrial Emissions Directive (IED, 2010/75/EU) (EU, 2010). The IED is the main Directive covering industrial emissions from the largest operators in Europe.

Industrial emissions include a wide array of substances and, therefore, a broad range of associated effects on our societies. This work aims at capturing the most significant impacts of substances that can be quantified with sufficient certainty according to current knowledge. Data availability limits the number of substances considered, as this study builds on data officially reported to E-PRTR.

Specifically, marginal damage costs per tonne (main air pollutants and GHG) or per kilogramme (heavy metals and organics) have been developed for the following pollutant groups:

- 'main' air pollutants: particulate matter ($PM_{2.5}$, PM_{10}), sulphur dioxide (SO_2), ammonia (NH_3), nitrogen oxides (NO_x) and non-methane volatile organic compounds (NMVOCs),
- Heavy metals: arsenic, cadmium, chromium VI, lead, mercury, nickel.
- Organic pollutants: 1,3 Butadiene, benzene, formaldehyde, Polycyclic Aromatic Hydrocarbons, dioxins and furans.
- Greenhouse gases (GHG): carbon dioxide, methane and nitrous oxide.

The current assessment considers only ambient air pollution. Indoor air pollution (i.e. the impact of emissions on workers within the facilities) is therefore not part of it. Also, the briefing does not assess whether emissions of a given facility are consistent with its legal permitted conditions. Furthermore, the damage costs have not been compared against the

benefits of the facilities (i.e. production of good and products, generated employment and tax revenue).

In a nutshell, the impact categories considered for the calculation of externalities include health and non-health impacts.

Health impacts include mortality caused by the main air pollutants, heavy metals and organic pollutants as well as several morbidity impacts (including chronic effects such as bronchitis, IQ loss or cancer; or acute effects such as cardiac and respiratory hospital admissions). Health impacts from the main air pollutants are based on the analysis of direct releases of these substances or their precursors and of their formation in the atmosphere following chemical reactions.

Non-health impacts include ozone[1] damage to crops and forests and damage to buildings caused by NO_X and SO_2 (degradation of stone and metalwork).

For GHG, the impact considered is not a direct assessment of damage but a proxy to climate change impacts based on the cost of abatement of carbon emissions to meet the main target of the Paris agreement (limit global warming to 1.5-2 degrees Celsius above pre-industrial levels, (UNFCCC, 2015)). The rationale behind this proxy is that for each tonne of CO_2eq emitted, a tonne will have to be reduced elsewhere if the target of the Paris Agreement is to be achieved.

Finally, it is also relevant to present the main impacts of each pollutant on health and the environment. Each pollutant group is distinct in how they affect our bodies and our everyday lives. The text below includes for each pollutant group, their main effects on health and the environment. The main air pollutants have been described individually due to their more distinct characteristics compared to the other pollutant groups. As noted above, not every effect is quantified here but this assessment gives an idea of the main impacts from being exposed to these pollutants.

Particulate matter (PM)

PM is the most important pollutant in terms of potential damage to human health. Fine particles penetrate into our respiratory and/or cardiovascular system and can cause or aggravate diseases and cause cancers. PM is emitted from many sources including the industry, transport, and domestic combustion sectors. Primary PM is emitted directly to the atmosphere, whereas secondary PM is created from precursor pollutants (mainly the other main air pollutants mentioned below) (EEA, 2014).

Nitrogen oxides (NO_X)

Nitrogen oxides are emitted from fuel combustion, such as from power plants and other industrial facilities. NO_X contributes to acidification and eutrophication of waters and soils and can lead to the formation of particulate matter and ground-level ozone. High concentrations of NO_2 can cause airway inflammation and reduced lung function (EEA, 2014).

[1] As can be seen in this section, ozone is not included as a pollutant for the marginal damage costs as it is not emitted per se, it is a result of the transformation in the atmosphere of other precursor pollutants.

Sulphur oxides/sulphur dioxide (SO_X/SO_2)

Sulphur dioxide is emitted when fuels containing sulphur are burned. SO_2 contributes to acidification, with potentially significant impacts including adverse effects on aquatic ecosystems in rivers and lakes, and damage to forests. High concentrations of SO_2 can affect airway function and inflame the respiratory tract. SO_2 also contributes to the formation of particulate matter in the atmosphere (EEA, 2014).

Ammonia (NH_3)

NH_3 contributes to eutrophication, acidification and the formation of secondary particles. The vast majority of NH_3 emissions come from the agricultural sector (94 % in 2020, according to EEA (2022b)). Industry including waste management is responsible for a relatively smaller amount (around 2 %, EEA (2022b)) (EEA, 2014).

Non-methane volatile organic compounds (NMVOCs)

This group of pollutants are emitted by many sources including industry. The speciation changes depending on the activity. Generally, NMVOCs are ground-level ozone precursors but some species such as benzene and 1,3-butadiene can have direct effects on health(EEA, 2014).

Heavy metals

Heavy metals are emitted in combustion processes and other industrial processes. Heavy metals are toxic and deposit in water and soil, where they bioaccumulate, thus contributing to human exposure via ingestion (EEA, 2014).

Organic pollutants

Benzene, polycyclic aromatic hydrocarbons (PAHs), and dioxins and furans are categorised as organic pollutants. Benzene is also a NMVOC as noted above. They are known or suspected carcinogens and some such as dioxins and furans also bioaccumulate. Emissions from organic pollutants occur during combustion and other processes (EEA, 2014)

Greenhouse gases (GHG)

Carbon dioxide is emitted from combustion of fuels such as coal, oil, natural gas and biomass for industrial, domestic and transport purposes. CO_2 is the most significant GHG influencing climate change in terms of emissions (EEA, 2014). Methane is released in agriculture (manure management and livestock digestive processes), landfills, oil and gas exploration, extraction and distribution, coal mining, wastewater processes and combustion processes. Finally, a vast majority of N_2O is released from agricultural activities (soil management, manure management). Other anthropogenic sources are indirect emissions (deposition of air emissions of NO_X and NH_3), fuel combustion and other industrial processes. Although methane and nitrous oxide are emitted at much lower quantities than CO_2, they have a much larger global warming potential (GWP) and Global Temperature Change Potential (GTP) (IPCC, 2014).

2.3 New developments compared to the previous study

As noted in the briefing, there are four main developments of the methodology. This section provides an overview of the changes.

2.3.1 Development of new year-on-year marginal damage cost per tonne (MDCs)

In earlier work on externalities from the ETC-HE (Schucht et al., 2021) and EEA (2021, 2014, 2011a) a single set of marginal damage cost per tonne per country was used to calculate the externalities. This was based on a single set of source-receptor matrices (SRMs) based on a reference year and the rest of the data required for the calculation was made consistent as much as possible with that reference year. Then, this single set was multiplied by the tonnes reported by large industrial operators in E-PRTR (with some adjustments to account for the emitting sector, see sections 2.3.2 and 2.3.3 below).

The novelty for this assessment resides in the fact that the health component of the MDCs has been made year-dependent. This means in practice that there is a set of MDCs per year per pollutant per country. This was done to account for the effect of demographic changes on the calculation of health impacts.

2.3.2 New sectoral exposure adjustment factors

As noted in Schucht et al. (2021), the general set of MDCs calculated for this assessment (see annex 1) is calculated using EMEP SRMs assessing the impact of a reduction of pollutant emissions in a given country on air concentrations and depositions in the EEA38+UK area, including the emitting country. The modelled change in emissions is not sector specific but is distributed over all the emission sources in proportion to their contribution to the total.

Since EEA (2014), the calculation of externalities has used adjustment factors (that have been updated in subsequent assessments) to account for the distance of the sources of such sector to the population potentially affected. The factors are calculated using a model that is able to compare emission reductions of a pollutant in a given sector and country with emission reductions of that pollutant over all sources. When these factors are higher than 1, it means that reducing e.g. 1 tonne of a given pollutant in that sector has a relatively higher exposure reduction compared to a reduction of 1 tonne of the pollutant in all sectors (sources).

New modelling has been used to update these factors (see section 2.3.5 and annex 6). As opposed to previous versions of that modelling used in Schucht et al. (2021), the sector nomenclature used is GNFR, which is more disaggregated and can be mapped more easily to the sectors present in Annex I of the E-PRTR Regulation.

2.3.3 New sectoral PM_{10}:$PM_{2.5}$ ratio adjustment factors

In addition to the sectoral exposure adjustment factors mentioned above, the ETC-HE has now developed new adjustment factors to account for the mass fraction of $PM_{2.5}$ in the PM_{10} emitted. This is because health impacts are calculated for $PM_{2.5}$, whereas the PM fraction present in Annex II of the E-PRTR Regulation is PM_{10}. Earlier versions of the externalities assessment used a single conversion factor of 1.54 which was not country or sector specific. These sectors are available in annex 6.

2.3.4 Geographical scope

As in previous work by the ETC-HE on the topic, the impact of air pollution has been calculated for the EEA38+UK[2]. This means that the MDCs consider the valuation of the impact of pollution on all these countries.

The externalities assessment in Schucht et al. (2021) and EEA (2021) calculated the externalities from all emitting facilities in the E-PRTR, which includes the EU27, Iceland, Norway, Serbia, Liechtenstein, and Switzerland. Therefore, it was damage from all E-PRTR countries on the EEA38+UK countries. The current analysis calculated the externalities from the EU27[3] on the EEA38+UK countries. This is because all non-EU E-PRTR countries except Switzerland had reporting gaps and therefore insufficient data. It also reinforces the intention of assessing the impact of the EU on itself and its neighbouring countries.

2.3.5 New scientific information and modelling

As part of the updated assessment of externalities, updated modelling and scientific information has been used for the various steps of the methodology. Rather than a change in the underlying method (Impact Pathway Approach), these are updates to the source/input data used in the method. This includes, among others:

- Use of the latest SRMs at the time of the calculations, with 2019 representing the reference year.
- Use of the updated SHERPA model for assessing the direct impacts of NO_X as well as the sectoral exposure adjustment factors (see below). This version of the SHERPA model uses GNFR rather than SNAP sector codes which makes the assessment more accurate.
- Use of EMEP model[16] to develop PM_{10}:$PM_{2.5}$ adjustment factors.
- Use of updated population, mortality, baseline incidence of health impacts and GDP data.
- Use of updated crop and forest yield data.
- Updated Euro prices.
- Updated exposure-response functions in certain cases (see section 2.3.5 for additional details).

2.4 Data sources

2.4.1 E-PRTR

E-PRTR was established by Regulation 166/2006 and Commission Implementing Decision 2019/1741 (EU, 2006, 2019). It is a European-level register with key environmental data from industrial facilities in the EU, Iceland, Liechtenstein, Norway, Serbia, Switzerland and, until 2020, the UK.

[2] EU27, Albania, Bosnia and Herzegovina, Iceland, Kosovo, Liechtenstein, Montenegro, North Macedonia, Norway, Serbia, Switzerland and Turkey.

[3] The EU27 scope refers to continental EU and islands that are within the European geographical area, thus excluding facilities located in its Outermost Regions, that is, the nine regions that are part of the EU but are geographically very distant from the European continent (French Guiana, Guadeloupe, Martinique, Mayotte, Reunion Island and Saint-Martin (France),Azores, Madeira (Portugal), The Canary Islands (Spain).

E-PRTR contains data reported annually by over 30 000 industrial facilities from 65 economic activities and covers 91 pollutants either released to air, water and land or transferred off-site as waste. Facilities which are active in one of the 65 activities above the capacity thresholds set out in Annex I of Regulation 166/2006 and release or transfer these pollutants above the thresholds in Annex II are required to report data to the Register. National Competent Authorities are in charge of ensuring compliance with mandatory data reporting.

Data is available from 2007 and contributes to transparency and public participation in decision-making. The register therefore implements in the EU the UNECE (United Nations Economic Commission for Europe) PRTR Protocol to the Arhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters.

E-PRTR is now embedded in the so-called EU Registry on industrial sites. This represents an annual reporting stream that facilitates the annual reporting to the EEA of administrative and identification data pertaining to sites and facilities defined under the E-PRTR and installations, large combustion plants (LCPs) or waste incinerators covered under the IED. The data is collected as per the Commission's Implementing Decision 2018/1135 (EU, 2018).

The activity and pollutant thresholds in Annex I and II of the Regulation mean in practice that not all industrial emissions are captured in E-PRTR. Table 2.1 shows a comparison between the emissions reported to E-PRTR for 2019 (the reference year for the main modelling undertaken by the ETC) and the national totals reported to the UNECE Convention on Long-range Transboundary Air Pollution (CLRTAP). As can be seen in the table, E-PRTR only covers part of the emission totals. Notably, national air pollution inventories include smaller industrial sources outside the scope of E-PRTR as well as emissions from other sectors such as transport or residential. Some of these are diffuse sources and can make a substantial contribution to the overall population exposure to air pollution. With the exception of mercury and SO_2, other sources not in E-PRTR produce the majority of the emissions. Therefore, the damage costs estimated in this assessment do not represent the total damage cost caused by air pollution in Europe.

Table 2.1 - Comparison of the E-PRTR air emissions data for 2019 (tonnes) with the corresponding national emission inventory total air emissions – EU27

	Emissions reported to E-PRTR (tonnes)	Aggregated national total emissions (tonnes)	% E-PRTR emissions of national totals
NO_X	1 095 290	6 027 631	18%
SOx	797 438	1 622 096	49%
PM_{10}	46 515	1 725 164	3%
NMVOC	253 771	6 257 282	4%
NH_3	205 684	3 466 224	6%
As	14	69	21%
Cd	8	54	15%
Cr	43	290	15%
Hg	19	41	48%
Ni	83	426	19%
Pb	105	1 034	10%
Dioxins + furans	0.00037	0.0016	23%
PAH	28	703	4%

Notes: The following countries have not submitted data to E-PRTR for year 2019: Lithuania and Slovakia. They have been excluded from the EMEP totals of this table for a consistent comparison

The externalities determined in this assessment are based on emissions to air of selected pollutants reported by Member States[4] over the period 2012-2021 by EU Member States (between 9 000 and 10 500 individual facilities, depending on the reporting year). The version of the database used was Industrial reporting database version 8 (March 2023).

The pollutants selected for calculating the damage cost per tonne are included in section 2.2. In certain cases, the pollutant is not reported exactly as such in the E-PRTR, but in aggregated form or with other valence states:

- Chromium rather than chromium (VI): Marginal damage costs were assessed for hexavalent chromium (CrVI), whereas Annex II of the E-PRTR Regulation (EU, 2006) refers to 'chromium and its compounds'. The ETC-HE assumes the fraction of Cr emitted as CrVI to be 20 % (ExternE, 1995, 1998, 2005; Schucht et al., 2021). Therefore, the costs for CrVI are scaled by 20 % before multiplying them with the Cr emissions reported in E-PRTR.
- Polycyclic aromatic hydrocarbons (PAHs): Marginal damage costs were assessed for benzo-a-pyrene (BaP)-equivalents, whereas the E-PRTR Regulation (EU, 2006) requires emissions to be estimated for four PAH species, including BaP. Schucht et al. (2021) reviewed several sources on ambient air emissions and concentrations for the four pollutants (WHO, 2000; IARC, 2012b; Samburova et al., 2017; Ramirez et al., 2011; Ziola and Słaby, 2020; OSPAR Commission, 2002; Shen et al., 2013) and considered that the toxicity of BaP is 10x higher than any of the other three components in the list, and that BaP constitutes around 20% of air releases. This implies that the PAH

[4] Data was reported to the EU Registry only from 2017. Data previously reported via the former E-PRTR dataflow was added to the database via a complex mapping process that merged the former and 'new' databases

mixture has a mass equivalent toxicity of 30 % BaP emissions. The damage costs for BaP are therefore scaled by 30 % when calculating the externalities of PAH emissions reported in E-PRTR.

- $PM_{2.5}$: This pollutant is not reported in E-PRTR (only PM_{10}).

The dataset used in this assessment was not complete for all countries:

- Due to some reporting gaps from non-EU countries, the externalities assessment has focused on the EU27.
- Whereas the study period for this assessment is 2012-2021, there are some EU Member States that had not submitted a full timeline of emissions data at the time of the calculation of externalities. The data gaps are the Czech Republic (2021), Malta (2020, 2021), Lithuania (2020, 2021), and Slovakia (2018-2021).

For presenting the results, E-PRTR activities have been grouped into the following EEA categories[5]:

- Fuel production and processing
- Energy production
- Heavy industry
- Light industry
- Waste management
- Wastewater treatment
- Livestock

Data gap filling

A gap filling exercise was performed only for the calculation of EU summaries (total damage, pollutant level and sector level) for the four EU Member States that had not submitted data up to the latest available year -2021 (Czech Republic, Lithuania, Malta, Slovakia). In these cases, the data from the latest available year was projected to the missing years. This was done by using the same amounts of emissions in the missing year as in the last year reported.

In cases where individual facility or Member State data is presented, the data from the missing countries has not been projected to avoid giving the wrong impression that certain countries and facilities could lead the rankings presented in this technical note with projected data.

2.4.2 Data sources for the health impacts - Main air pollutants

Dispersion and exposure modelling is used to estimate how the main air pollutants may travel and transform in the atmosphere and what the exposure routes are for human health and the environment. For the main air pollutants, the sources used were:

[5] The EEA has a sectoral/activity classification system was on the following source https://cdr.eionet.europa.eu/help/nomenclature_emission/

- $PM_{2.5}$: EMEP Source-Receptor Matrices (SRMs) at 0.2x0.3degree resolution, refined with EMEP/SHERPA correction factors calculated at 10km resolution;
- Ozone, nitrogen deposition: EMEP SRMs at to 0.2x0.3degree resolution;
- NO_2: SHERPA Source-Receptor Relationships (SRRs) at 0.1x0.1 resolution.

EMEP Source-Receptor Matrices (SRMs)

These matrices are published each year by EMEP/MSC-W under the UNECE LRTAP convention. For this report, the most recent 2019 EMEP SRMs (EMEP, 2021) at the time of writing of the work underpinning this note were used. A general overview of how these matrices are developed and used can be found in Schucht et al. (2021).

SHERPA source-receptor relationships (SRRs)

For modelling the direct impact of NO_x, the SHERPA model developed by the JRC has been used.

The version of the SHERPA model used for this work is based on the EMEPV4.3 model version at a spatial resolution of 0.1x0.1. Such model is based on 2015 emissions data from CAMS v4.2 without condensables (Pisoni et al., 2019).

Population density data

The data used for the dispersion modelling is the most recent GHS population data developed by the JRC[6]. The reference year is 2015, with a resolution of $1km^2$.

Exposure-response functions

The health effects from the main air pollutants included in this work use what are called 'exposure-response' functions.

As noted above, the HRAPIE (Health Risks of Air Pollution In Europe) study, led by the WHO in 2013 (WHO, 2013) remains the most recent comprehensive review of air pollution epidemiology in Europe, covering exposure-response functions for mortality and morbidity for $PM_{2.5}$, PM_{10}, NO_2 and ozone (Schucht et al., 2021). Therefore, it remains the main source of these functions for many of the studies of this type carried out in Europe. Reviews of the exposure-response functions by the WHO are currently under way. In the meantime, additional functions were identified in studies for the EEA and European Commission (e.g. Klimont et al. (2022)) and these have been integrated with the present analysis where there was reasonable consensus across the groups involved in the work.

The tables below prepared by the ETC-HE contain the response functions, types of exposure assessed and sources upon which the response functions are based.

[6] https://ghsl.jrc.ec.europa.eu/ghs_pop.php

Table 2.2 - Response functions for all-cause mortality recommended adopted by Klimont et al. (2022) for the EU's 3rd Clean Air Outlook

Pollutant	Relative Risk with 95% uncertainty per 10 µg/m³	Population (age in years)	Exposure	Source
$PM_{2.5}$	1.08 (1.06 1.09)	>30	Long-term	(Chen and Hoek, 2020)
NO_2	1.02 (1.01; 1.04)	>30	Long-term	(Huangfu and Atkinson, 2020)
Peak O_3	1.01 (1.00; 1.02)	>30	Short-term	(Huangfu and Atkinson, 2020)
PM_{10}	1.04 (1.02; 1.07)	1 month – 1 year	Long-term	(Woodruff et al., 1997)

Table 2.3 - Morbidity response functions for PM

Health outcome (ICD code where given)	Pollutant	Relative Risk per 10 µg/m³	Population age (years)	Type of exposure	Source
Chronic bronchitis in adults	PM_{10} (*)	1.117 (*)	27+	Long-term	(Abbey et al., 1995; Schindler et al., 2009)
Bronchitis symptoms in children	PM_{10} (*)	1.08 (*)	6-12	Long-term	(Hoek et al., 2012)
Cardiovascular hospital admissions	$PM_{2.5}$	1.0091	All ages	Short-term	APED studies, 2000-2009
Respiratory hospital admissions	$PM_{2.5}$	1.019	All ages	Short-term	APED studies, 2000-2009
Restricted activity days	$PM_{2.5}$	1.047	All ages	Short-term	(Ostro, 1987)
Workdays lost	$PM_{2.5}$	1.046	15 - 65	Short-term	(Ostro, 1987)
Stroke (I60-69)	$PM_{2.5}$	1.13	All ages	Long-term	(Alexeeff et al., 2021)
Myocardial infraction (I21)	$PM_{2.5}$	1.08	All ages	Long-term	(Alexeeff et al., 2021)
Diabetes Type 2 (E11)	$PM_{2.5}$	1.10	All ages	Long-term	(Yang et al., 2020)
Lung cancer (C33-34)	$PM_{2.5}$	1.09	>20	Long-term	(Hamra et al., 2014)
Asthma (J45)	$PM_{2.5}$	1.03	0-15	Long-term	(Khreis et al., 2017)

(*) For the quantification of health impacts in the present study this function is converted to the reference of $PM_{2.5}$ concentrations using a factor of 1.54 based on observations indicating that $PM_{2.5}$ typically accounts for around 65% of PM_{10}

Table 2.4 - Morbidity response functions for NO_2

Health outcome	Relative Risk per 10 µg/m³	Population (age)	Reference
Bronchitis	1.021	5-14	(McConnell et al., 2003)
Respiratory hospital admissions	1.018	All ages	APED meta-analysis referred to by WHO (2013)
Asthma	1.17	30-75	(Brunekreef et al., 2021)
Diabetes Type 2	1.05	>30	(Ricardo, 2023)
Stroke	1.08	40-89	(Brunekreef et al., 2021)

Table 2.5 - Morbidity response functions for O_3

Health outcome	Change per 10 µg/m³	Population (age)	Reference
Cardiovascular hospital admissions	1.0089	>65 years	APHENA study referred to by WHO (2013)
Respiratory hospital admissions	1.0044	>65 years	APHENA study referred to by WHO (2013)
Minor restricted activity days	1.0154	All ages	(Ostro and Rothschild, 1989)

There is potential for double counting when combining estimates for different pollutants, specifically effects quantified against exposure to $PM_{2.5}$ and against NO_2. This arises because response functions are derived from epidemiological studies that unavoidably consider simultaneous exposure to a number of pollutants, some of which, like $PM_{2.5}$ and NO_2, share common sources such as traffic and industry to a significant extent. Research on the extent of double counting using 2-pollutant models in the epidemiological research has revealed inconsistent results. The approach taken here reflects the discussion on double counting in COMEAP (2018) and Ricardo (2020) where it was concluded that a reduction of NO_2 functions to 40% of their original value (as indicated in the tables above) was appropriate. This has been applied in the modelling for all NO_2 effects that are also quantified for $PM_{2.5}$. The only exception from the list of NO_2 impacts concerns new incidence of asthma in the age group 30-75 years: for $PM_{2.5}$ new incidence of asthma is also covered, but for a different age group, those aged 0-15 years. Therefore, this is the only function for which the value was not reduced to 40% compared to the response functions stated in Table 2.2 and Table 2.4 for NO_2. The relative risks for NO_2 in Table 2.2 and Table 2.4 have not been adjusted for the 60% reduction proposed in the text (see Table 9 in (Schucht et al., 2021) for a full list of response functions from the WHO (2013) HRAPIE study).

For the present edition of the marginal damage cost (MDC) calculation for health impacts from main air pollutants, heavy metals and organic pollutants, population and mortality data from Eurostat were used to the extent possible . For the countries not covered by Eurostat, population data from the United Nations World Population Prospects (UN/WPP) were used (UN, 2022). Where available, information on the incidence of disease, work days lost, etc. were extracted from the European Health Information Gateway and WHO's Global Health Observatory (WHO, 2022a, 2022b). Where data were missing for specific countries, rates were approximated using data from surrounding countries. For example baseline rates for work days lost for several Balkan countries were taken from data for Bulgaria and Romania.

In line with the assumptions made in the mortality assessment for the Air Quality Assessment by the EEA (2022a), no adaptations were applied to the mortality statistics to account for COVID-19. The reasoning behind this is that (i) covid deaths are considered "natural deaths", (ii) exposure to air pollution might have influenced the severity of the disease caused by the virus and (iii) there is no evidence on how to correctly adjust mortality data to exclude deaths caused by COVID-19. Any adjustment for the years of the pandemic would of course need to be carried through to surrounding years for an indefinable period, introducing longer-term uncertainty.

The calculations using exposure-response functions from the main air pollutants are undertaken using the Alpha-RiskPoll model.

Health impacts are monetised using peer-reviewed literature values which aim at estimating the societal costs of these impacts. This study uses the latest update to these damage costs from Klimont et al. (2022), which can be found in Table 2.6.

Table 2.6 - Unit costs (costs per life year, death, new incidence of illness, etc.) in 2019 (expressed in €$_{2021}$)

Mortality	Value (€2021)
Value of a life year (VOLY[1])	111 470
Value of a statistical life (VSL[1])	4.2 million
Infant Mortality	6.5 million
Morbidity	**Value (€2021)**
Bronchitis in Children (age 6 -12)	420
Chronic Bronchitis in adults	75 100
Cardiovascular hospital admissions	6 950
Respiratory hospital admissions	5 650
Restricted activity days	154
Minor restricted activity day	57
Asthma symptom days in children (age 5-19 years)	59
Lost working days	183
Stroke (CVA)	115 532
Lung cancer	35 130
New incidence of asthma in children (age < 16 years)	8 157
Diabetes Mellitus Type2	24 957
Non-fatal myocardial infarction	39 517

Notes:
1) Opinion amongst economists is divided as to whether mortality valuation is better represented by using the value of a life year (VOLY) or value of a statistical life (VSL). Both are used here, to demonstrate sensitivity to the parameter.

2.4.3 *Data sources for the health impacts - Heavy metals and organic pollutants*

Heavy metals and organic pollutant dispersion and exposure is modelled differently to the main air pollutants. The impact pathway methodology to calculate the marginal damage cost per tonne is described in detail in Schucht et al. (2021).

The model used in the present study is the uniform world model (Rabl et al., 2014; Spadaro and Rabl, 2004), which has been tailored to a particular pollutant and exposure route. Details are described in Schucht et al. (2021).

The key input data sources for the marginal damage cost per tonne calculations:

- Pollutants that affect human health via inhalation (1,3 butadiene, benzene, formaldehyde, Benzo(a)pyrene, dioxins and furans, chromium, nickel): Nedellec and Rabl (2016a, 2016b, 2016c); Nedellec et al. (2019); Rabl et al. (2014); Allemani et al.

(2018); Haney et al. (2013); IARC (2012a, 2012b); Nadler and Zurbenko (2014); Proctor et al. (2021); Searl (2005); US EPA (2003); WHO (2000); the European Cancer Information System (ECIS) database[7]; California Office of Environmental Health Hazard Assessment (OEHHA)[8]; the US EPA Integrated risk information system (IRIS) database[9] ; IHME Global Health Data Exchange database[10].

- Pollutants that affect human health via inhalation and dietary intake:
    - Arsenic: Shohel et al. (2009); Cubadda et al. (2017); Smith et al. (1998); Parvez et al. (2010); Wasserman et al. (2007); Kang et al. (2007); James et al. (2013).
    - Lead: Menke et al. (2006); US EPA (2005); Spadaro and Rabl (2004); Surkan et al. (2007).
    - Cadmium: Menke et al. (2009); Téllez-Plaza et al. (2012); Nawrot et al. (2006); Engström et al. (2011); Huette et al. (2020); Svedbom et al. (2013).
    - Mercury: Rice et al. (2010); Spadaro and Rabl (2008).

The quantification of impacts is undertaken using the RiskPoll model.

A major improvement compared to earlier EEA work on externalities is the application of a Monte Carlo statistical approach to characterise the mean and confidence intervals (68% and 95%) of the MDCs by considering the full range of literature values for the various inputs of the impact analysis.

An overview of exposure pathways and health outcomes considered in this work for heavy metals and organic compounds can be found in Table 2.7 below.

[7] https://ecis.jrc.ec.europa.eu

[8] https://oehha.ca.gov/chemicals

[9] https://www.epa.gov/iris

[10] https://vizhub.healthdata.org/gbd-results/

Table 2.7 - Exposure pathways and health outcomes considered in the calculation of the MDCs of toxic metals and organics

Pollutant	Exposure pathway	Health outcome
Arsenic (As, inorganic)	Inhalation and ingestion	Non-cancer and cancer mortality, chronic bronchitis, IQ loss and diabetes
Cadmium (Cd)	Inhalation and ingestion	All-cause mortality, non-fatal cancers and osteoporosis (hip fractures)
Chromium (hexavalent, CrVI)	Inhalation only	Fatal and non-fatal cancers
Lead (Pb)	Inhalation and ingestion	All-cause mortality, IQ loss and anaemia
Mercury (Hg)	Inhalation and ingestion	Cardiovascular mortality and IQ loss
Nickel (Ni)	Inhalation only	Fatal and non-fatal cancers
1,3 butadiene	Inhalation only	Fatal and non-fatal cancers
Benzene	Inhalation only	Fatal and non-fatal cancers
Dioxins and Furans (TCDD equiv.)	Inhalation and ingestion	Fatal and non-fatal cancers
Formaldehyde	Inhalation only	Fatal and non-fatal cancers
Benzo(a)pyrene (B(a)P)	Inhalation only	Fatal and non-fatal cancers

2.4.4 Data sources for other impacts

For other quantified impacts (all caused by the main air pollutants), other sources have been used.

Crops and forests

For damage from ozone on crops and forests, dose-response functions for four representative crop species have been obtained from Van Dingenen et al. (2009). Data on the relative sensitivities from the other crops from ICP Vegetation (2010) was used to estimate their dose-response functions. For forests, dose-response functions are from two representative coniferous and deciduous tree species and were obtained from ICP Vegetation (2018). Alongside this, national crop yield data for 120 crops and gross value added (GVA) of the forest industry were obtained from the FAO[11] and Eurostat[12], respectively. These values can be found in Schucht et al. (2021).

Buildings

For buildings, values for materials damage per tonne emission of NO_x and SO_2 are taken from the CASES phase of the ExternE study, using methods described in ExternE (2005) and NEEDS (2008), updated for inflation (correction factor 1.49 to convert price in €2000 to prices in €2021).

Ecosystems

The impact on ecosystems is based on the calculation of exceedances of critical loads for eutrophication in Natura 2000 areas, as developed under the UNECE LRTAP convention over

[11] http://www.fao.org/faostat/en/#data/QV

[12] https://ec.europa.eu/eurostat/databrowser/view/tag00058/default/table?lang=en

many years, and their subsequent monetisation as established by the ECLAIRE study (Holland et al., 2015a, 2015b). The assessment here is limited to eutrophication because exceedances of critical loads for acidification are currently much less important than for eutrophication. The rationale is that including impacts from acidification would not have an important impact on overall results. Even though the monetised impacts are low compared to health impacts, the political importance of biodiversity, and the extent of critical loads exceedances for nitrogen, are high.

Impacts accounted for are exceedances of critical loads for eutrophication from total deposition of nitrogen (dry and wet, oxidised and reduced nitrogen). The reference scenario and the EMEP SRMs representing changes in the deposition of oxidised, reduced and total nitrogen for the precursors NO_X and NH_3[13] were provided to the Coordination Centre for Effects (CCE) under the LRTAP Convention, hosted by the Umweltbundesamt (UBA) in Germany, who develops and maintains the critical loads data base. Critical loads represent an estimate of an exposure to one or more pollutants below which significant harmful effects on specified sensitive elements of the environment do not occur according to present knowledge. On behalf of the ETC-HE the CCE carried out the calculation of the changes in exceedances of critical loads for eutrophication due to changes in oxidised and reduced nitrogen represented by the EMEP SRMs.

The CCE based their calculations on the most recent European critical loads dataset (UBA 2022/110)[14] and the provided deposition data (including the reference and reduction scenarios). The exceedance was calculated for every available critical load value and later aggregated on the basis of the deposition grids. The delivered results contain information about the share of the receptor area with critical load exceedance within each analysis grid and the total receptor area.

With respect to the monetisation of damage to ecosystems, the current report follows also the approach developed in the ECLAIRE project, by basing the valuation on Christie and Rayment (2012). A single set of willingness to pay estimate is applied to all countries (given that studies similar to Christie and Rayment, based on England and Wales, have not been performed elsewhere).

2.4.5 Avoided carbon abatement costs data and global temperature change potentials (GTP)

The abatement avoidance costs used for the assessment of GHG have been taken from EC (2019b). The global temperature potentials (GTP) used to calculate the externalities caused by non-CO_2 GHG are from IPCC (2014).

[13] The ETC-HE also calculated the impact of emission reductions of the other precursors for eutrophication (PM_{10}, NMVOC and SO_2) on the N deposition but these turned out to be negligible and were excluded from the assessment.

[14] https://www.eea.europa.eu/data-and-maps/data/external/background-data-for-critical-loads

2.4.6 Sectoral adjustments factors

The last step of the externalities calculation is the multiplication of the MDCs by the industrial air emissions reported by EU Member States to E-PRTR. Because these MDCs are not sector-specific, the ETC-HE's methodology applied two sets of adjustment factors to take into account the exposure patterns and the PM fractions present in each industrial sector and country. See section 2.3 and annex 6.

For details on the general methodology, the most detailed description is available in Schucht et al. (2021).

3 Average European damage costs

Table 3.1 - Average European damage cost for 2019 (€2021 per tonne) - impacts on health ($PM_{2.5}$, O_3, NO_2), crops, forests, ecosystems & materials

Pollutant	Average European damage cost (€2021 per tonne) – EEA 38+UK	
	VOLY	VSL
NO_X	15 353	42 953
SO_2	16 212	38 345
PM_{10}	51 482	141 145
$PM_{2.5}$	86 490	237 123
NMVOC	1 844	4 480
NH_3	18 991	52 268

Missing emitter countries: Liechtenstein and Kosovo. Partial data for Iceland, Albania, Bosnia and Herzegovina, Montenegro, Norway, North Macedonia, Switzerland, Serbia, UK and Turkey.

Table 3.2 - Climate change avoidance costs in €/tCO_2 equivalent (€2021)

	Low	Central	High
Short and medium term, to 2030	65	109	206
Longer term (2040 to 2060)	170	293	543

For the assessment, the central value, short and medium term has been used (€109, see the table above). As noted above, the relative Global Temperature change Potential (GTP) have been used to calculate the values for methane and nitrous oxide (Table 3.3).

Table 3.3 – Climate change avoidance costs for CO_2, CH_4 and N_2O as used in the current assessment (€2021/t)

Greenhouse gas	€
CO_2	109
CH_4	7 288
N_2O	30 132

Table 3.4 - Time trend of the mean marginal damage costs of heavy metals and organic compounds for European emissions, in €2021 per kg of pollutant emitted to air

Pollutant	2012	2013	2014	2015	2016	2017	2018	2019†	2020	2021
Arsenic	9 086	9 169	9 400	9 659	9 939	10 204	10 448	10 328	10 294	10 563
Cadmium	226 081	228 987	234 206	239 636	246 035	252 540	257 793	253 058	252 133	259 949
Chromium VI	635	620	580	708	645	696	748	687	684	742
Lead	40 941	41 282	42 254	43 161	44 340	45 402	46 191	45 201	45 013	46 231
Mercury	16 964	17 317	17 868	17 787	17 733	17 658	17 459	16 755	16 869	17 475
Nickel	21.1	20.6	19.3	23.5	21.4	23.2	24.9	22.9	22.8	24.7
1,3 Butadiene	3.83	3.74	3.50	4.27	3.89	4.20	4.51	4.15	4.13	4.47
Benzene	0.822	0.802	0.751	0.916	0.834	0.901	0.968	0.889	0.885	0.960
Benzo(a)pyrene	1 327	1 294	1 212	1 478	1 346	1 454	1 561	1 435	1 429	1 549
Dioxins/Furans (TCDD equiv.)	122.6M	119.6M	112.0M	136.6M	124.4M	134.4M	144.3M	132.6M	132.1M	143.2M
Formaldehyde	0.275	0.268	0.251	0.306	0.279	0.302	0.324	0.298	0.296	0.321

The impact domain covers all member states and cooperating countries of the EEA plus the UK (EEA38+UK).

† Reference year; M, million euros

Annex 1 contains a series of tables with the country-specific marginal damage costs per tonne of pollutant, for the main air pollutants for the reference year (2019). On the other hand, annex 3 includes the values used for all other years.

Annex 2 contains the country-specific and year-specific marginal damage costs per tonne of pollutant, for heavy metals and organic pollutants.

4 Additional results

The briefing includes a table with the total quantified external costs from industrial air pollution, a map that shows the 129 facilities accounting for 50 % of the aggregate damage costs from the main air pollutants (accounting for around 1 % of the facilities included in the assessment) and two graphs showing the trends by sector and by country. See below (Table 4.1, Map 4.1, Figure 4.1, Figure 4.2, a and b) for reference.

This section (subsections 4.2, 4.3, 4.4, 4.5, 4.6) contains additional maps and results obtained during the analysis.

It is worth noting that Figure 4.1 of this technical note contains the data of all sectors (as opposed to the briefing which focused on the top four). The fact that livestock, waste management and wastewater management appear at the bottom of the ranking of sectors with the most externalities should not be interpreted as not being relevant sectors. The reasons for this lower ranking are varied:

- This is a pan-European study. Therefore it focuses on external costs for the whole of the EU, but one should not ignore the local problems that emissions from these facilities may produce.
- The analysis focuses on air emissions. Therefore, naturally the wastewater will be at the bottom of the ranking since the majority of its emissions are to water.
- The sectoral scope is that of the E-PRTR Regulation from 2006. Therefore, the livestock sector only includes poultry farms with 40 000 places or more and pig farms with 2 000 places for production pigs (over 30 kg) and for 750 places for sows. Intensive cattle farms which are one of the biggest emitting sectors of ammonia and methane emissions are not in the scope. Likewise only certain types of very large and controlled waste management facilities are part of the scope.

4.1 Results published in the briefing

Table 4.1 - Total external costs from industrial air pollution by pollutant group (EU27)

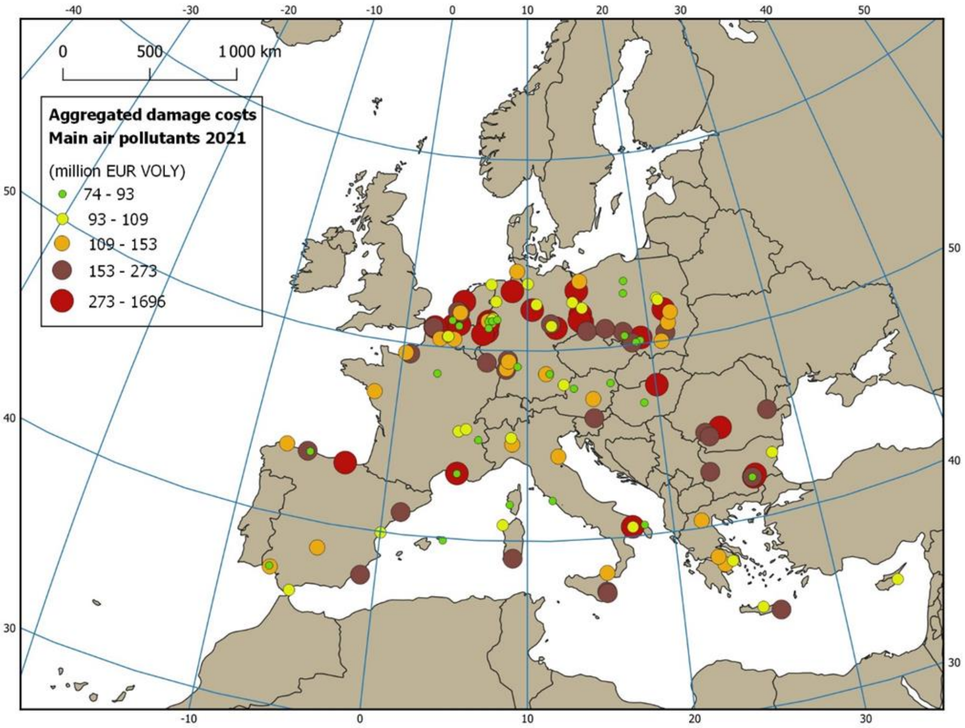
	Aggregated external costs (million €)										
	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**TOTAL**
Main air pollutants VOLY	119 042	104 531	98 362	95 345	82 197	80 721	76 608	63 255	54 277	59 728	834 066
Main air pollutants VSL	329 152	291 050	274 609	277 302	237 010	238 591	226 419	186 285	173 111	193 056	2 426 585
Greenhouse gases	193 641	187 188	183 596	181 747	180 129	180 852	174 949	157 898	137 567	150 657	1 728 224
Heavy metals	13 803	13 055	13 179	11 553	14 041	14 493	13 395	10 140	8 039	8 924	120 622
Organic pollutants	66	143	141	147	140	154	99	60	52	69	1 071
Sum VOLY	**326 553**	**304 919**	**295 277**	**288 791**	**276 507**	**276 219**	**265 051**	**231 354**	**199 935**	**219 378**	**2 683 984**
Sum VSL	**536 663**	**491 437**	**471 524**	**470 749**	**431 320**	**434 089**	**414 862**	**354 383**	**318 769**	**352 707**	**4 276 503**

Notes: For the main air pollutants, the lower value of the range is a calculation of mortality using VOLY, while the upper value uses VSL

Euro price base: 2021

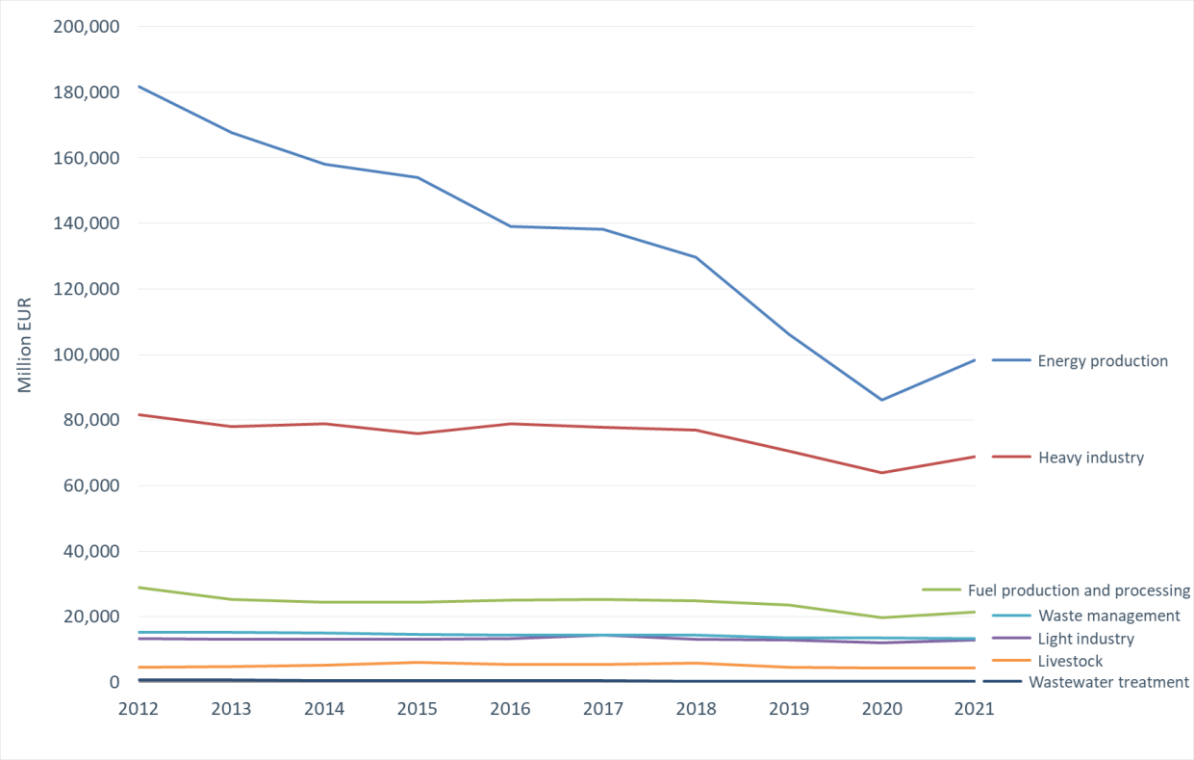
Data gaps: Czechia (2021), Malta (2020-2021), Lithuania (2020-2021) and Slovakia (2018-2021). This data has been projected using the latest reported year for the summaries at EU level (by pollutant group and by sector) but not when individual countries or facilities are presented.

Map 4.1 Localisation of the 129 facilities accounting for 50 % of the aggregate damage costs from main air pollutants (2021)



Notes: Mortality valued using the value of a life year (VOLY)
Euro price base: 2021
Data gaps: Czechia, Malta, Lithuania, and Slovakia (No data reported for 2021)

Figure 4.1 – External costs by sector aggregated over all pollutants (2012-2021) (VOLY)

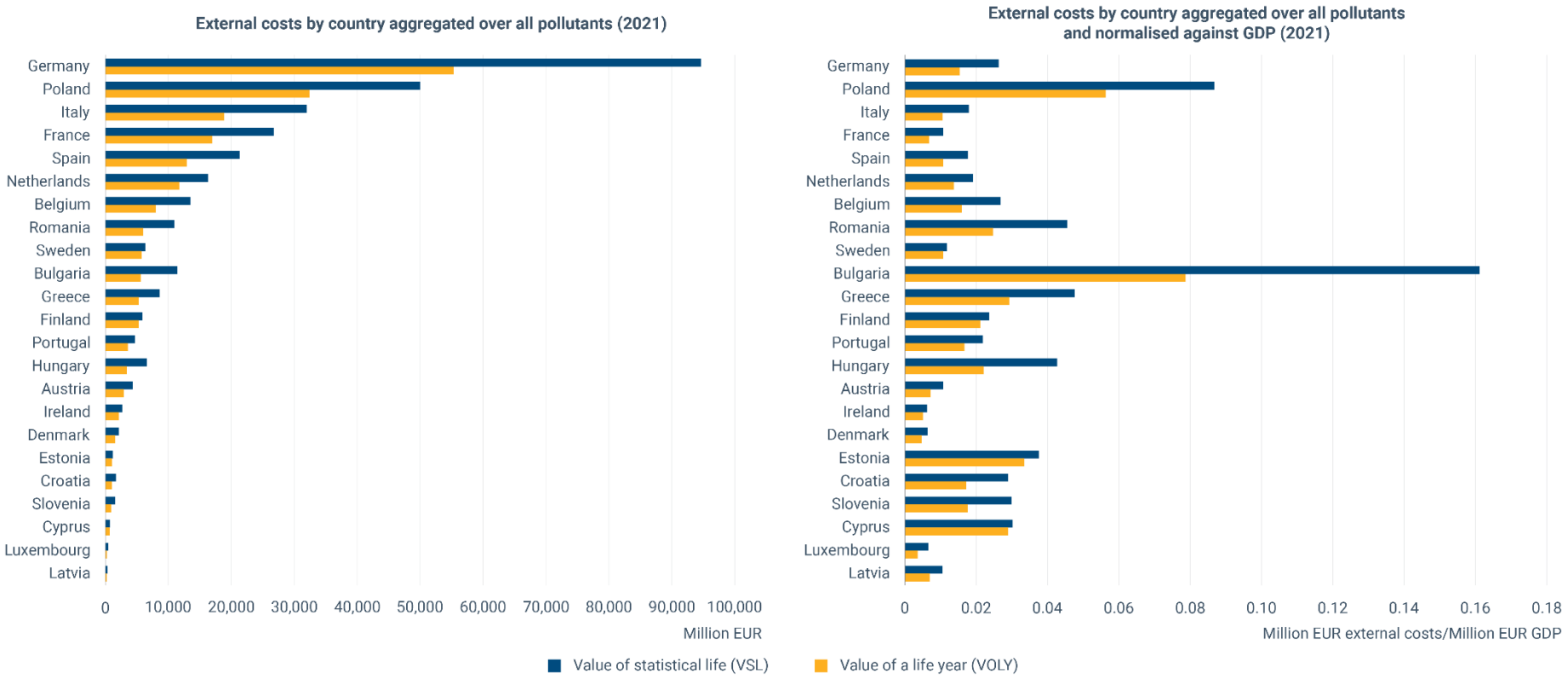


Mortality valued using the value of a life year (VOLY)

Euro price base: 2021

Data gaps: Czechia (2021), Malta (2020-2021), Lithuania (2020-2021) and Slovakia (2018-2021) - (Lack of data submission in these years. This data has been projected using the latest reported year for the summaries at EU level (by pollutant group and by sector) but not when individual countries or facilities are presented

Figure 4.2 – External costs by country aggregated over all pollutants – Absolute costs (left) and normalised by GDP (right) (2021)



Mortality valued using the value of a life year (VOLY) and the Value of Statistical Life (VSL)

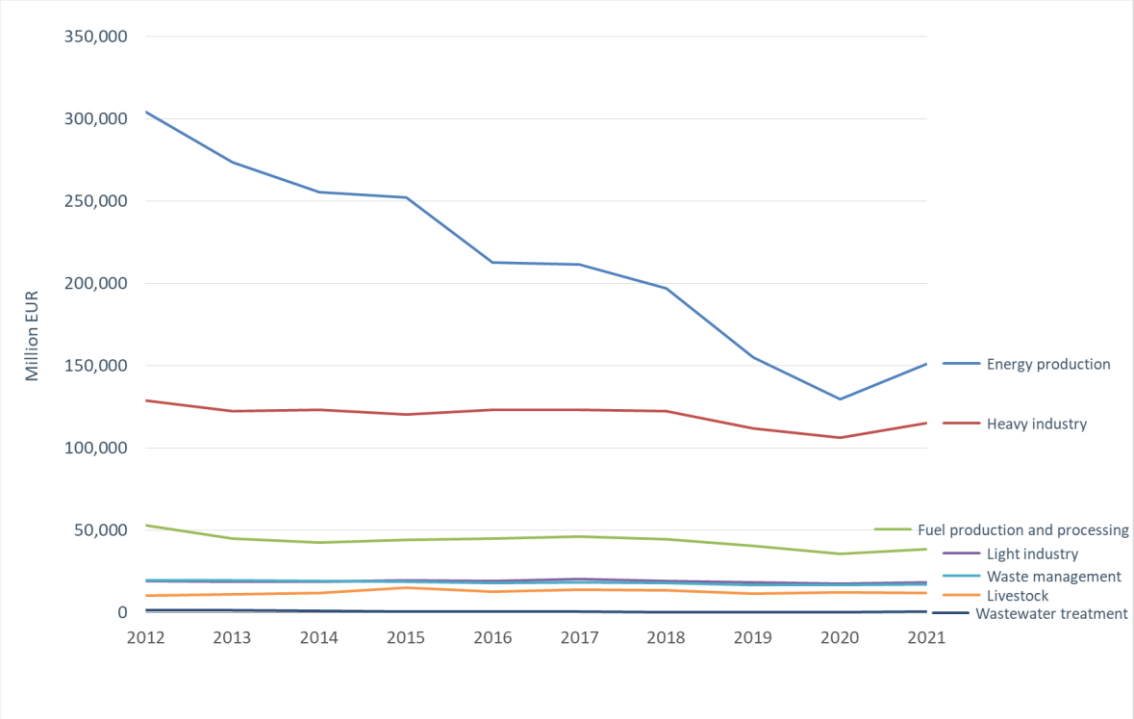
Euro price base: 2021

Data gaps: Czechia, Malta, Lithuania, and Slovakia (No data reported for 2021)

4.2 Externalities at sector level

In addition to the figure of the briefing (Figure 4.1 of this technical note), which quantifies the mortality from the main air pollutants using the VOLY, the following figure shows the same assessment but using the VSL instead. As can be seen in the figure below, the trends are practically identical. Note that the caveats on the relative importance of the sectors also applies to this figure (see the beginning of section 4).

Figure 4.3 – External costs by sector aggregated over all pollutants (2012-2021) (VSL)



Mortality valued using the value of a statistical life (VSL)

Euro price base: 2021

Data gaps: Czechia (2021), Malta (2020-2021), Lithuania (2020-2021) and Slovakia (2018-2021) - (Lack of data submission in these years. This data has been projected using the latest reported year for the summaries at EU level (by pollutant group and by sector) but not when individual countries or facilities are presented.

4.3 Externalities at country level

In addition to the figures in the briefing (Figure 4.2, a and b in this technical note), the ETC-HE undertook an analysis of the relative contribution of each pollutant group to the total external costs in a given country. This gives additional insights to the analysis of the biggest contributing pollutants to the external costs (Table 4.2 and Table 4.3).

Table 4.2 – Relative proportion (%) of external cost by pollutant group in overall damage in 2021 (VOLY)

Country	Main air pollutants VOLY	Greenhouse gases	Heavy metals	Organic pollutants
Austria	22.6%	77.1%	0.3%	0.0%
Belgium	33.1%	64.3%	2.5%	0.1%
Bulgaria	40.0%	55.3%	4.6%	0.1%
Croatia	29.5%	69.8%	0.6%	0.1%
Cyprus	25.7%	72.8%	1.5%	0.0%
Denmark	18.1%	81.7%	0.1%	0.0%
Estonia	6.6%	88.6%	4.9%	0.0%
Finland	6.1%	92.8%	1.0%	0.1%
France	27.8%	66.3%	5.9%	0.0%
Germany	30.2%	68.6%	1.3%	0.0%
Greece	29.8%	66.3%	3.9%	0.0%
Hungary	40.3%	55.2%	4.5%	0.0%
Ireland	14.2%	85.5%	0.3%	0.0%
Italy	28.0%	69.8%	2.2%	0.0%
Latvia	21.3%	78.7%	0.0%	0.0%
Luxembourg	42.8%	56.9%	0.3%	0.0%
Netherlands	18.1%	80.3%	1.6%	0.0%
Poland	24.0%	71.9%	4.0%	0.1%
Portugal	13.6%	78.2%	8.2%	0.1%
Romania	35.5%	60.3%	4.1%	0.0%
Slovenia	32.7%	67.2%	0.1%	0.0%
Spain	33.4%	61.8%	4.8%	0.0%
Sweden	5.7%	92.9%	1.4%	0.0%

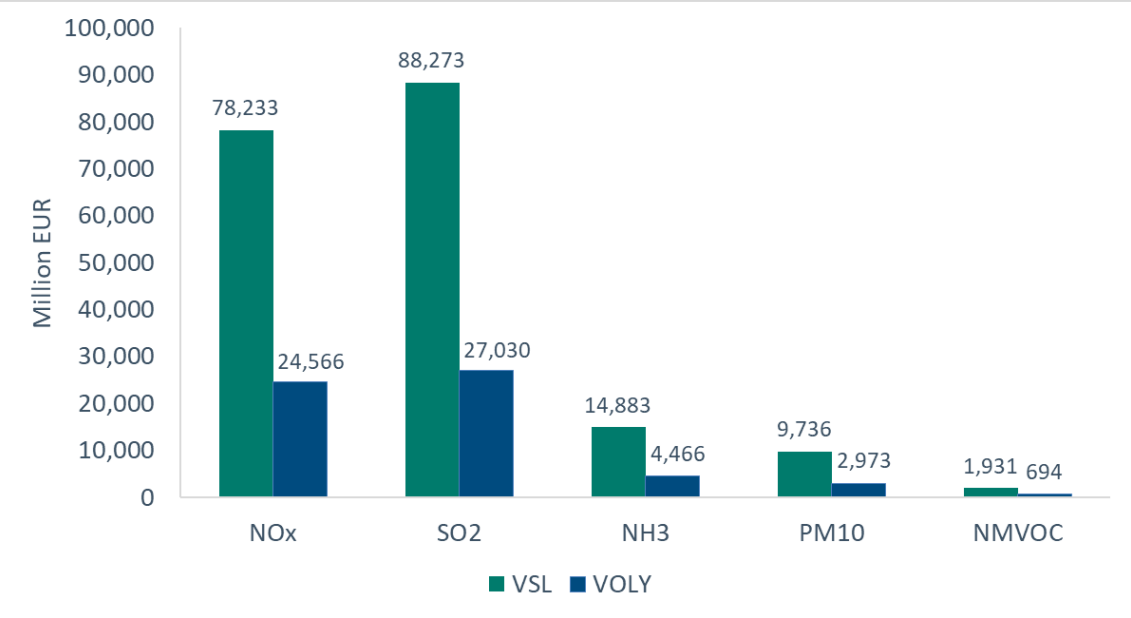
Table 4.3 – Relative proportion (%) of external cost by pollutant group in overall damage in 2021 (VSL)

Country	Main air pollutants VSL	Greenhouse gases	Heavy metals	Organic pollutants
Austria	48.3%	51.5%	0.2%	0.0%
Belgium	60.3%	38.1%	1.5%	0.1%
Bulgaria	70.7%	27.0%	2.2%	0.0%
Croatia	58.1%	41.5%	0.3%	0.0%
Cyprus	28.9%	69.7%	1.5%	0.0%
Denmark	40.2%	59.7%	0.1%	0.0%
Estonia	16.6%	79.0%	4.3%	0.0%
Finland	15.7%	83.3%	0.9%	0.1%
France	54.2%	42.0%	3.7%	0.0%
Germany	59.2%	40.1%	0.7%	0.0%
Greece	56.8%	40.8%	2.4%	0.0%
Hungary	69.1%	28.6%	2.3%	0.0%
Ireland	30.5%	69.2%	0.3%	0.0%
Italy	57.5%	41.2%	1.3%	0.0%
Latvia	48.2%	51.8%	0.0%	0.0%
Luxembourg	69.1%	30.7%	0.1%	0.0%
Netherlands	41.1%	57.8%	1.2%	0.0%
Poland	50.7%	46.6%	2.6%	0.1%
Portugal	34.1%	59.6%	6.2%	0.1%
Romania	64.9%	32.8%	2.2%	0.0%
Slovenia	60.3%	39.6%	0.1%	0.0%
Spain	59.6%	37.4%	2.9%	0.0%
Sweden	14.0%	84.7%	1.3%	0.0%

4.4 Externalities at pollutant level

The ETC-HE also analysed the relative weight of each pollutant on the total external costs of air pollution. This only provides an overview of the proportion of the externalities estimated that are caused by each pollutant, but it does not provide a ranking of the relevance of importance of each pollutant. Pollutants that are emitted in lower amounts can indeed be more hazardous or create severe issues at the local level.

Figure 4.4 – Damage costs caused by emissions of the main air pollutants (2021)

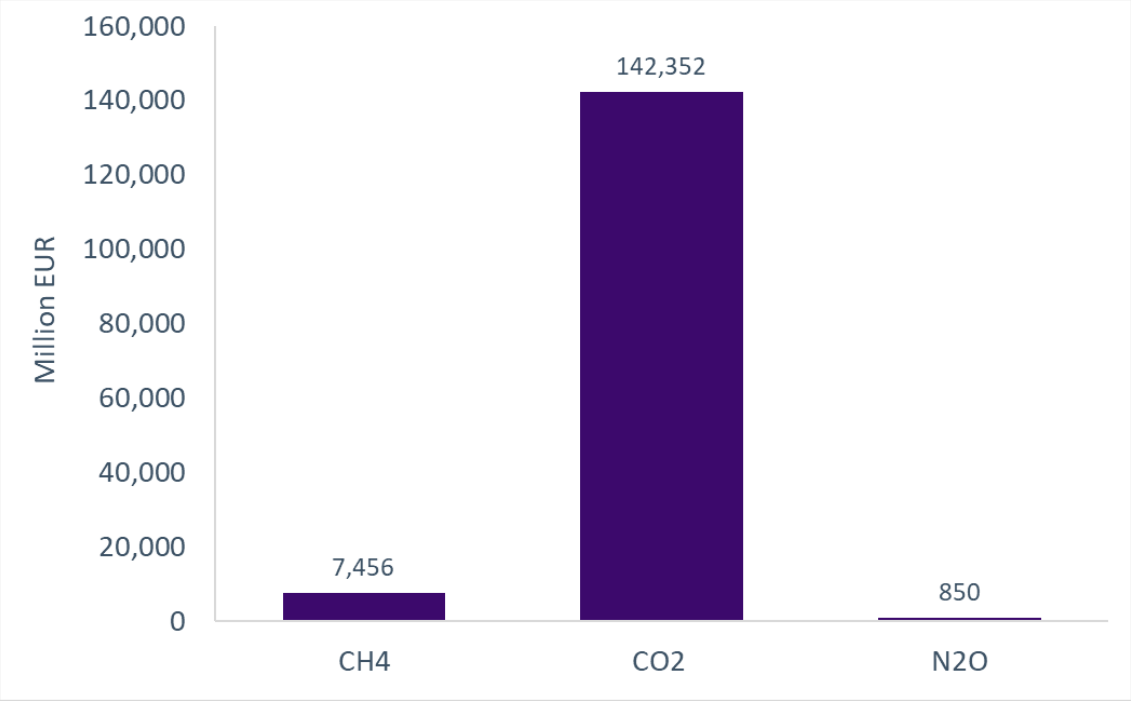


Mortality valued using the value of a life year (VOLY) and the Value of Statistical Life (VSL)

Euro price base: 2021

Data gaps: Czechia, Malta, Lithuania, and Slovakia (No data reported for 2021)

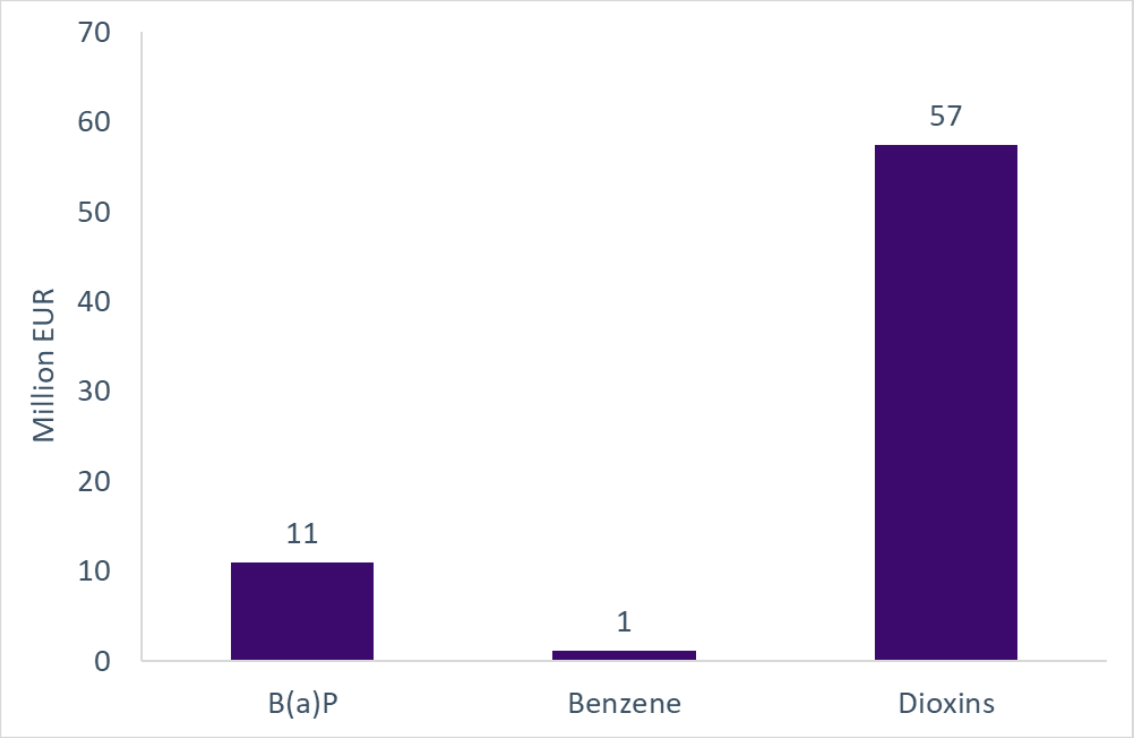
Figure 4.5 – Damage costs caused by emissions of greenhouse gases (2021)



Euro price base: 2021

Data gaps: Czechia, Malta, Lithuania, and Slovakia (No data reported for 2021)

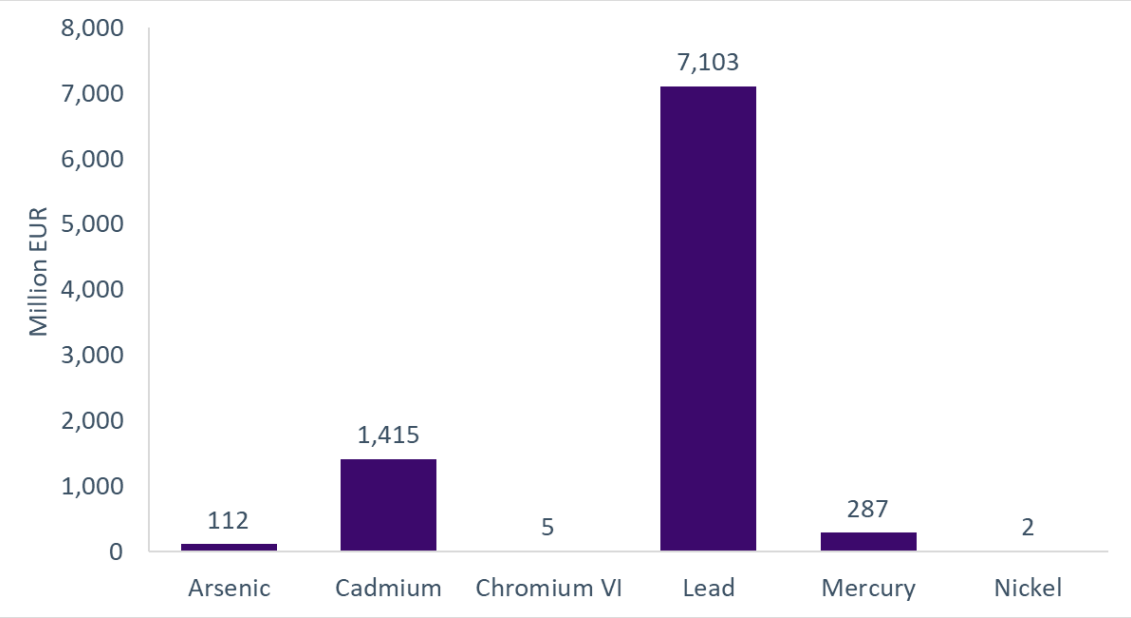
Figure 4.6 – Damage costs caused by emissions of organic pollutants (2021)



Euro price base: 2021

Data gaps: Czechia, Malta, Lithuania, and Slovakia (No data reported for 2021)

Figure 4.7 – Damage costs caused by emissions of heavy metals (2021)



Euro price base: 2021

Data gaps: Czechia, Malta, Lithuania, and Slovakia (No data reported for 2021)

4.5 Externalities at facility level

This section shows additional insights from the analysis at facility level. Map 4.1 (see above) shows the 129 facilities with the highest externalities from the main air pollutants.

The ETC-HE has also prepared rankings with the top facilities with the highest external costs. As noted in the briefing, a large proportion of these are power plants (Table 4.4).

Table 4.4 - The top 30 E-PRTR facilities with the highest absolute damage costs in 2021 (All pollutants)

Ranking (VOLY)	Ranking (VSL)	Facility Inspire ID	Facility name	City	Country	Main E-PRTR activity name	Damage - VOLY (million €)	Damage - VSL (million €)
1	1	PL.MŚ/000000349.FACILITY	PGE Górnictwo i Energetyka Konwencjonalna S.A. - Oddział Elektrownia Bełchatów	Rogowiec	Poland	Thermal power stations and other combustion installations	5,619	9,457
2	3	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-162008-100-0248923	RWE Power AG - Kraftwerk Neurath	Grevenbroich	Germany	Thermal power stations and other combustion installations	3,109	4,743
3	2	https://registry.gdi-de.org/id/de.bb.inspire.pf.eureg/45025564	LEAG, Kraftwerk Jänschwalde	Teichland	Germany	Thermal power stations and other combustion installations	2,674	4,858
4	4	https://registry.gdi-de.org/id/de.sn.sax4inspire.pf/70015796	Kraftwerk Boxberg	Boxberg/O.L.	Germany	Thermal power stations and other combustion installations	2,501	4,306
5	6	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-362008-300-0326774	RWE Power AG Kraftwerk Niederaußem	Bergheim	Germany	Thermal power stations and other combustion installations	2,427	4,004
6	7	PL.MŚ/000000031.FACILITY	ENEA Wytwarzanie Spółka z ograniczoną odpowiedzialnością	Świerże Górne	Poland	Thermal power stations and other combustion installations	2,194	3,203
7	5	https://registry.gdi-de.org/id/de.sn.sax4inspire.pf/80011277	LEAG Lausitz Energie Kraftwerke AG Kraftwerk Lippendorf	Neukieritzsch	Germany	Thermal power stations and other combustion installations	2,103	4,196
8	9	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-354012-300-0877384	RWE Power AG	Eschweiler	Germany	Thermal power stations and other combustion installations	2,057	3,142
9	8	https://registry.gdi-de.org/id/de.bb.inspire.pf.eureg/45025611	LEAG, Kraftwerk Schwarze Pumpe	Spremberg	Germany	Thermal power stations and other combustion installations	1,889	3,178

Ranking (VOLY)	Ranking (VSL)	Facility Inspire ID	Facility name	City	Country	Main E-PRTR activity name	Damage - VOLY (million €)	Damage - VSL (million €)
10	11	FR.CAED/10845.FACILITY	ARCELORMITTAL FRANCE DUNKERQUE	Dunkerque	France	Installations for the processing of ferrous metals, Hot-rolling mills	1,559	2,512
11	13	FR.CAED/7656.FACILITY	ARCELORMITTAL MÉDITERRANÉE	Fos-sur-Mer	France	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	1,476	2,306
12	27	FR.CAED/3998.FACILITY	ZIGNAGO VETRO BROSSE SAS	Vieux-Rouen-sur-Bresle	France	Installations for the manufacture of glass, including glass fibre	1,475	1,475
13	20	PL.MŚ/000000260.FACILITY	PGE Górnictwo i Energetyka Konwencjonalna S.A. - Oddział Elektrownia Opole	Opole	Poland	Thermal power stations and other combustion installations	1,450	1,913
14	19	PL.MŚ/000000350.FACILITY	PGE Górnictwo i Energetyka Konwencjonalna S.A. - Oddział Elektrownia Turów	Bogatynia	Poland	Thermal power stations and other combustion installations	1,388	1,953
15	16	https://registry.gdi-de.org/id/de.ni.mu/01211092310	Salzgitter Flachstahl GmbH	Salzgitter	Germany	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	1,236	2,164
16	10	BG.CAED/013000001.FACILITY	Maritsa East 3 Kontur Global power station	Медникарово	Bulgaria	Thermal power stations and other combustion installations	1,219	2,582
17	15	BG.CAED/013000002.FACILITY	Maritsa East 2 power station	Ковачево	Bulgaria	Thermal power stations and other combustion installations	1,156	2,209
18	17	IT.CAED/741231004.FACILITY	STABILIMENTO DI TARANTO	Taranto	Italy	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	1,136	2,122
19	21	NL.RIVM/000023301.FACILITY	Tata Steel IJmuiden BV	Velsen-Noord	Netherlands	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	1,072	1,873
20	12	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-112000-100-0077961	Hüttenwerke Krupp Mannesmann GmbH	Duisburg	Germany	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	1,068	2,325

Ranking (VOLY)	Ranking (VSL)	Facility Inspire ID	Facility name	City	Country	Main E-PRTR activity name	Damage - VOLY (million €)	Damage - VSL (million €)
21	26	https://registry.gdi-de.org/id/de.rp.inspire.pf.bube-eureg/5000671	BASF SE	Ludwigshafen am Rhein	Germany	Chemical installations for the production on an industrial scale of basic organic chemicals: Oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters, acetates, ethers, peroxides, epoxy resins	1,029	1,497
22	14	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-112000-100-0209686	thyssenkrupp Steel Europe AG Werk Schwelgern	Duisburg	Germany	Metal ore (including sulphide ore) roasting or sintering installations	1,007	2,269
23	18	https://data.ied_registry.omgeving.vlaanderen.be/id/productionfacility/BE.VL.000000605.FACILITY	ARCELORMITTAL BELGIUM - GENT	Gent	Belgium	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	984	2,066
24	32	PL.MŚ/000003640.FACILITY	Polski Koncern Naftowy ORLEN S.A.	Płock	Poland	Mineral oil and gas refineries	948	1,393
25	29	ES.CAED/003486000.FACILITY	ARCELORMITTAL ESPAÑA - PLANTA SIDERÚRGICA DE AVILÉS Y GIJÓN	La Granda	Spain	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	923	1,429
26	28	PL.MŚ/000000468.FACILITY	ENEA Elektrownia Połaniec Spółka Akcyjna	Połaniec	Poland	Thermal power stations and other combustion installations	901	1,442
27	33	RO.CAED/102GL0001.FACILITY	LIBERTY GALATI SA	Galati	Romania	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	889	1,298
28	22	PL.MŚ/000000058.FACILITY	ArcelorMittal Poland S.A. Oddział Dąbrowa Górnicza	Dąbrowa Górnicza	Poland	Metal ore (including sulphide ore) roasting or sintering installations	889	1,592
29	25	IT.CAED/090181001.FACILITY	Sarlux srl	Sarroch	Italy	Mineral oil and gas refineries	886	1,554
30	40	NL.RIVM/000203273.FACILITY	RWE Eemshaven Holding II B.V.	Eemshaven	Netherlands	Thermal power stations and other combustion installations	885	1,100

Ranking based on the VOLY estimate (VSL ranking indicated for comparison)

It is worth noting that this does not give an idea of efficiency, since it could be that they are also the largest facilities or those producing the most outputs, be it energy, steel, chemicals etc.

As production volume data will only be reported from 2024[15], a different metric is required as a proxy for efficiency. Using CO_2 emissions as a proxy of fuel consumption has traditionally been selected in earlier assessments of the externalities of industrial air pollution for assessing the efficiency of the power sector. Schucht et al. (2021) did this for all E-PRTR sectors but these were not easily comparable with each other.

For the current work, the ETC-HE has undertaken this analysis for the power, cement, iron and steel and refinery sectors but prepared a ranking for each sector individually for an easier comparison.

Table 4.5 shows that when normalising against CO_2 emissions, the top power plants of the ranking are no longer located in Germany and Poland but in Denmark. Romania, Spain, Bulgaria, France and Greece. In fact, Greece accounts for eight of the top 30 large combustion facilities with the highest external costs per tonne of CO_2 emitted. None of the plants in the ranking of Table 4.4 are in the normalised ranking of Table 4.5.

As for iron and steel facilities (Table 4.6), the top five with the highest external cost per tonne of CO_2 emitted are located in Poland, Germany, Italy and France. Germany accounts for 13 of the top 30.

As for the cement sector (Table 4.7), the top facilities with the highest external cost per CO_2 emitted are in Croatia, France, Belgium and Spain. France is the country with the largest share of the top 30 included in Table 4.7 with 11.

Finally, the refineries with the highest external costs per tonne of CO_2 emitted are located in Germany, Spain, Greece, Italy and France (Table 4.8).

[15] Individual facility data will not be published once production volume is reported under E-PRTR

Table 4.5 - The top 30 thermal power stations and other large combustion plants with the highest normalised damage costs in 2021 from emissions of all pollutants – Normalisation with CO_2 emissions

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL					VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
1	1	721	715	DK.CAED/000082980.FACILITY	Verdo Produktion A/S	Randers NØ	Denmark	3	10	92%	8%		
2	2	242	106	RO.CAED/101HD0001.FACILITY	Societatea Complexul Energetic Hunedoara S.A. - Sucursala Electrocentrale Deva S.A.	Mintia	Romania	76	231	85%	15%		
3	4	215	113	ES.CAED/006240000.FACILITY	CENTRAL DIESEL DE MELILLA	Melilla	Spain	87	221	82%	18%	0.0%	
4	3	58	27	BG.CAED/012000005.FACILITY	Sofia power station	София	Bulgaria	261	779	83%	17%		
5	5	193	94	FR.CAED/3810.FACILITY	CABOT CARBONE SAS	Lillebonne	France	97	256	76%	21%	2.9%	
6	7	227	120	EL.CAED/100015.FACILITY	PPC S.A. AES KOS	South Aegean, Kos	Greece	81	213	78%	22%	0.0%	
7	9	228	122	EL.CAED/100093.FACILITY	PPC S.A. AES LESVOS	North Aegean, Lesvos	Greece	80	211	77%	22%	0.0%	
8	10	312	172	EL.CAED/100046.FACILITY	PPC S.A. AES CHIOS	North Aegean, Chios	Greece	54	141	77%	23%	0.0%	
9	6	253	115	BG.CAED/017000005.FACILITY	Republika power station	Перник	Bulgaria	73	219	76%	24%		
10	8	162	72	BG.CAED/013000004.FACILITY	Brikel power station	Гълъбово	Bulgaria	110	323	75%	25%		
11	11	34	17	RO.CAED/101VL0001.FACILITY	SC CET GOVORA SA	Ramnicu Valcea	Romania	462	1 289	75%	25%		
12	12	164	89	FR.CAED/12029.FACILITY	EDF CORSE	Ajaccio	France	108	272	74%	26%	0.0%	0.0%
13	13	218	118	EL.CAED/100626.FACILITY	PPC S.A. SOUTHERN RHODES TPP	Kattavia	Greece	85	215	74%	26%	0.0%	
14	14	311	198	ES.CAED/001946000.FACILITY	PLANTA DE GENERACIÓN DE ENERGÍA ELÉCTRICA,	Navia	Spain	54	128	74%	26%		

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL					VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
					AGUA CALIENTE Y VAPOR								
15	15	183	99	EL.CAED/100009.FACILITY	PPC S.A. SES RODOY	Soroni	Greece	99	248	72%	28%	0.0%	
16	16	57	32	EL.CAED/100037.FACILITY	PPC S.A. SES ATHERINOLAKKOY	Lefki	Greece	288	704	69%	29%	1.8%	0.0%
17	40	308	352	ES.CAED/000135000.FACILITY	C.D.E. EIVISSA	Eivissa	Spain	55	62	7%	93%	0.0%	
18	20	166	98	ES.CAED/000138000.FACILITY	C.D.E. MAÓ	Mao	Spain	106	248	70%	30%	0.0%	
19	19	443	339	DK.CAED/000106181.FACILITY	Avedøreværket	Hvidovre	Denmark	28	66	65%	35%		
20	17	321	196	EL.CAED/100083.FACILITY	PPC S.A. - AES THIRA	Thiras	Greece	52	129	70%	30%	0.0%	
21	18	750	739	DK.CAED/000104564.FACILITY	Bornholms El-Produktion A/S	Rønne	Denmark	2	5	70%	30%		
22	22	374	257	PL.MŚ/000000028.FACILITY	ELEKTROCIEPŁOWNIA FENICE W RZESZOWIE	Rzeszów	Poland	38	95	66%	34%		
23	21	266	144	RO.CAED/102IS0001.FACILITY	MUNICIPIUL IASI - CET II	Holboca	Romania	70	178	66%	34%		
24	24	99	63	EL.CAED/100020.FACILITY	PPC S.A. SES LINOPERAMATON	Gazi	Greece	174	385	59%	39%	2.4%	
25	23	409	304	PL.MŚ/000000718.FACILITY	Ciepłownia MPEC	Włocławek	Poland	32	77	59%	41%		
26	30	224	163	BE.WA/215010000.FACILITY	INDUSTRIE DU BOIS VIELSALM & CIE - IBV	Vielsalm	Belgium	82	157	47%	41%	0.3%	11.0%
27	25	446	343	PL.MŚ/000000942.FACILITY	Elektrociepłownia ""Mikołaj""	Ruda Śląska	Poland	28	65	58%	42%		
28	26	182	108	PL.MŚ/000000462.FACILITY	Elektrociepłownia Czechnica	Siechnice	Poland	100	231	58%	42%		
29	27	296	189	PL.MŚ/000000454.FACILITY	MICHELIN POLSKA SPÓŁKA AKCYJNA	Olsztyn	Poland	60	131	53%	45%	0.4%	2.2%
30	28	76	56	PL.MŚ/000000346.FACILITY	Grupa Azoty Spółka Akcyjna	Tarnów	Poland	217	470	52%	48%		0.0%

Ranking based on the VOLY estimate (VSL ranking indicated for comparison)

Table 4.6 - The top 30 iron and steel plants with the highest normalised damage costs in 2021 from emissions of all pollutants – Normalisation with CO_2 emissions

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL					VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
1	1	18	20	PL.MŚ/000001740.FACILITY	TAMEH POLSKA sp. z o. o. - Zakład Wytwarzania Kraków (Elektrociepłownia)	Kraków	Poland	162	168	2%	12%	86.1%	
2	7	29	34	https://registry.gdi-de.org/id/de.th/5bf25e39-19d5-4254-adac-63f1b1cec499/86013077	Stahlwerk Thüringen GmbH	Unterwellenborn	Germany	42	55	13%	27%	60.0%	0.5%
3	8	23	23	IT.CAED/330502002.FACILITY	ACCIAIERIE BERTOLI SAFAU SPA	Pozzuolo Del Friuli	Italy	94	127	14%	30%	56.1%	
4	13	32	43	FR.CAED/5933.FACILITY	SAM RIVA	Neuves Maisons	France	37	37		30%	70.0%	0.1%
5	5	15	14	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-112000-100-0209697	thyssenkrupp Steel Europe AG Werk Bruckhausen	Duisburg	Germany	175	284	26%	32%	41.9%	0.0%
6	4	6	5	https://data.ied_registry.omgeving.vlaanderen.be/id/productionfacility/BE.VL.000000605.FACILITY	ARCELORMITTAL BELGIUM - GENT	Gent	Belgium	984	2 066	53%	41%	6.2%	0.1%
7	11	13	12	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-112000-100-0209707	thyssenkrupp Steel Europe AG Werk Beeckerwerth	Duisburg	Germany	217	333	23%	40%	37.1%	0.0%
8	2	30	26	https://registry.gdi-de.org/id/de.by.inspire.pf.ied/S01047	Lech-Stahlwerke GmbH	Meitingen	Germany	41	98	59%	41%		

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL					VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
9	28	25	29	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-112000-100-9973329	ArcelorMittal Hochfeld GmbH	Duisburg	Germany	64	64		43%	56.9%	0.0%
10	3	26	21	PL.MŚ/000000606.FACILITY	Huta Łaziska S.A. w upadłości układowej	Łaziska Górne	Poland	62	143	56%	44%		
11	6	31	27	https://registry.gdi-de.org/id/de.ni.mu/10285005160	Georgsmarienhütte GmbH	Georgsmarienhütte	Germany	39	88	54%	46%		
12	12	3	4	IT.CAED/741231004.FACILITY	STABILIMENTO DI TARANTO	Taranto	Italy	1 136	2 122	35%	50%	15.1%	0.0%
13	9	5	1	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-112000-100-0077961	Hüttenwerke Krupp Mannesmann GmbH	Duisburg	Germany	1 068	2 325	49%	51%		0.0%
14	10	35	31	https://registry.gdi-de.org/id/de.ni.mu/01244136460	Peiner Träger GmbH	Peine	Germany	31	62	43%	51%	6.0%	0.3%
15	15	1	2	FR.CAED/7656.FACILITY	ARCELORMITTAL MÉDITERRANÉE	Fos-sur-Mer	France	1 476	2 306	27%	51%	22.2%	0.0%
16	23	8	8	RO.CAED/102GL0001.FACILITY	LIBERTY GALATI SA	Galati	Romania	889	1 298	19%	54%	26.9%	0.3%
17	16	33	33	BE.WA/146010000.FACILITY	APERAM STAINLESS BELGIUM	Châtelet	Belgium	32	58	38%	60%	1.2%	0.1%
18	14	24	22	IT.CAED/051002002.FACILITY	ACCIAI SPECIALI TERNI S.P.A. - stabilimento di TERNI	Terni	Italy	68	132	39%	60%	0.7%	0.0%
19	20	4	6	NL.RIVM/000023301.FACILITY	Tata Steel IJmuiden BV	Velsen-Noord	Netherlands	1 072	1 873	35%	61%	4.6%	0.0%
20	19	49	46	IT.CAED/250172001.FACILITY	Feralpi Siderurgica S.p.A	Lonato	Italy	18	32	33%	62%	5.5%	

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL					VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
21	27	7	7	ES.CAED/003486000.FACILITY	ARCELORMITTAL ESPAÑA - PLANTA SIDERÚRGICA DE AVILÉS Y GIJÓN	La Granda	Spain	923	1 429	28%	63%	9.3%	0.0%
22	17	38	36	https://registry.gdi-de.org/id/de.bb.inspire.pf.eureg/16018546	B.E.S. Brandenburger Elektrostahlwerke GmbH	Brandenburg an der Havel	Germany	27	51	37%	62%	0.2%	0.4%
23	22	11	11	https://registry.gdi-de.org/id/de.bb.inspire.pf.eureg/23024102	ArcelorMittal Eisenhüttenstadt GmbH	Eisenhüttenstadt	Germany	353	610	31%	63%	6.3%	0.0%
24	18	21	15	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-112000-100-0388700	DK Recycling und Roheisen GmbH	Duisburg	Germany	109	204	36%	64%		0.1%
25	24	39	37	https://data.ied_registry.omgeving.vlaanderen.be/id/productionfacility/BE.VL.000000424.FACILITY	APERAM GENK	Genk	Belgium	27	48	35%	65%	0.3%	
26	21	9	9	https://registry.gdi-de.org/id/de.sl.inspire.pf/0078699-G	ROGESA Roheisengesellschaft Saar mbH	Dillingen/Saar	Germany	710	1 281	34%	66%	0.7%	0.0%
27	26	42	40	LU.CAED/000002000.FACILITY	ArcelorMittal Belval & Differdange S.A.	Esch-sur-Alzette	Luxembourg	26	44	34%	66%		0.1%
28	25	2	3	https://registry.gdi-de.org/id/de.ni.mu/01211092310	Salzgitter Flachstahl GmbH	Salzgitter	Germany	1 236	2 164	32%	68%		
29	33	20	24	http://paikkatiedot.fi/so/1002031/pf/ProductionFacility/0000002110.ProductionFacility	Outokumpu Chrome Oy, Outokumpu Stainless Oy, Tornion tehtaat	Tornio	Finland	110	123	6%	73%	20.8%	0.1%
30	29	10	10	AT.CAED/900839097570 1.FACILITY	voestalpine Stahl Donawitz GesmbH	Donawitz	Austria	447	720	27%	72%	0.5%	

Ranking based on the VOLY estimate (VSL ranking indicated for comparison)

Table 4.7 - The top 30 cement plants with the highest normalised damage costs in 2021 from emissions of all pollutants – Normalisation with CO_2 emissions

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Main E-PRTR activity name	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL						VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
1	1	160	123	HR.CAED/000000210.FACILITY	Proizvodnja aluminatnog cementa	Pula (Pola)	Croatia	Installations for the production of cement clinker or lime in other furnaces	33	78	59%	41%		
2	2	76	36	FR.CAED/12874.FACILITY	CIMENTS CALCIA-EPC FRANCE	Beffes	France	Installations for the production of cement clinker in rotary kilns	82	185	58%	42%		
3	3	4	1	BE.WA/028010000.FACILITY	HOLCIM Belgique - Usine d'OBOURG	Obourg	Belgium	Installations for the production of cement clinker in rotary kilns	269	586	56%	43%	0.5%	0.0%
4	5	164	133	ES.CAED/001662000.FACILITY	CAL DE CASTILLA S.A.	Arganda	Spain	Installations for the production of cement clinker or lime in other furnaces	31	64	53%	47%	0.0%	
5	4	94	60	FR.CAED/1422.FACILITY	CIMENTS CALCIA	Ranville	France	Installations for the production of cement clinker in rotary kilns	71	149	53%	47%		0.0%
6	8	9	6	BE.WA/029010000.FACILITY	CBR sa - Site d'Antoing	Antoing	Belgium	Installations for the production of cement clinker in rotary kilns	195	401	50%	49%	0.1%	0.0%
7	7	10	7	FR.CAED/5161.FACILITY	VICAT	Bouvesse Quirieu	France	Installations for the production of cement clinker in rotary kilns	189	390	51%	49%		0.0%
8	6	123	90	IT.CAED/090203012.FACILITY	Italcementi di Samatzai	Samatzai	Italy	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns,	52	116	49%	51%		

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Main E-PRTR activity name	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL						VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
								cement or lime in other furnaces.						
9	9	31	17	FR.CAED/11610.FACILITY	CIMENTS CALCIA SAS	Airvault	France	Installations for the production of cement clinker in rotary kilns	125	251	48%	52%		0.0%
10	10	93	66	FR.CAED/5952.FACILITY	VICAT (USINE DE XEUILLEY)	Xeuilley	France	Installations for the production of cement clinker in rotary kilns	71	142	47%	53%		0.0%
11	12	161	138	FR.CAED/10849.FACILITY	IMERYS (EX KERNEOS)	Dunkerque	France	Installations for the production of cement clinker or lime in other furnaces	32	62	45%	55%		
12	16	112	101	FR.CAED/4291.FACILITY	EQIOM (CIMENTERIE)	Rochefort-sur-Nenon	France	Installations for the production of cement clinker in rotary kilns	57	102	38%	55%	7.1%	
13	14	32	20	FR.CAED/10785.FACILITY	EQIOM CIMENTERIE DE LUMBRES	Lumbres	France	Installations for the production of cement clinker or lime in other furnaces	125	239	44%	56%	0.3%	
14	13	166	144	BE.WA/035010000.FACILITY	DOLOMIES DE MARCHE-LES-DAMES	Dolomies de Marche-Les-Dames	Belgium	Installations for the production of cement clinker or lime in other furnaces	31	60	44%	56%		
15	11	113	89	IT.CAED/900402001.FACILITY	Italcementi di Isola delle Femmine	Isola delle Femmine	Italy	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces.	56	118	44%	56%		
16	15	5	4	BE.WA/027010000.FACILITY	CCB - Site de Gaurain-Ramecroix	Gaurain-Ramecroix	Belgium	Installations for the production of cement clinker in rotary kilns	235	443	42%	57%	1.6%	0.0%

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Main E-PRTR activity name	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL						VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
17	18	78	57	FR.CAED/7788.FACILITY	LAFARGEHOLCIM CIMENTS	Bouc-Bel-Air	France	Installations for the production of cement clinker in rotary kilns	81	152	42%	58%		0.0%
18	23	81	68	ES.CAED/003718000.FACILITY	LEMONA INDUSTRIAL, S.A. (LEMONA INDUSTRIAL, S.A)	Estaziñoa	Spain	Installations for the production of cement clinker in rotary kilns	79	141	40%	59%	0.3%	
19	17	3	3	https://registry.gdi-de.org/id/de.bb.inspire.pf.eureg/23020947	CEMEX Zement GmbH	Rüdersdorf bei Berlin	Germany	Installations for the production of cement clinker in rotary kilns	271	529	40%	60%		
20	25	127	112	FR.CAED/12539.FACILITY	CALCIA (CIMENTS) (USINE)	Villers au Bouin	France	Installations for the production of cement clinker in rotary kilns	50	88	39%	61%		0.0%
21	20	85	62	IT.CAED/060242002.FACILITY	COLACEM S.P.A. - CEMENTERIA DI GHIGIANO	Gubbio	Italy	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces.	76	148	39%	61%		
22	19	82	56	IT.CAED/330922001.FACILITY	Cementeria di Fanna	Fanna	Italy	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces.	78	153	39%	61%		0.0%
23	21	105	84	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-570008-500-0050929	Phoenix Zementwerke Krogbeumker GmbH & Co. KG	Beckum	Germany	Installations for the production of cement clinker in rotary kilns	64	123	39%	61%		
24	26	39	23	HR.CAED/000000073.FACILITY	NEXE d.o.o.	Našice	Croatia	Installations for the production of cement clinker in rotary kilns	117	213	35%	63%	2.1%	

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Main E-PRTR activity name	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL						VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
25	22	69	43	IT.CAED/210322001.FACILITY	CONFIDENTIAL	CONFIDENTIAL	Italy	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces.	88	167	37%	63%		
26	24	34	21	IT.CAED/860782001.FACILITY	COLACEM S.P.A.	Sesto Campano	Italy	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces.	124	235	36%	64%		
27	36	70	61	IT.CAED/960112003.FACILITY	CEMENTERIA DI AUGUSTA	Augusta	Italy	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces.	87	148	28%	72%		0.0%
28	34	36	24	SI.ARSO/000000011.FACILITY	SALONIT ANHOVO gradbeni materiali	Deskle	Slovenia	Installations for the production of cement clinker in rotary kilns	120	208	35%	64%	0.73%	0.00%
29	39	62	54	FR.CAED/3507.FACILITY	CIMENTS CALCIA	Couvrot	France	Installations for the production of cement clinker in rotary kilns	93	156	34%	65%	0.62%	
30	27	57	38	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-570020-500-0055819	HeidelbergCement AG Zementwerk Ennigerloh	Ennigerloh	Germany	Installations for the production of cement clinker in rotary kilns	99	181	35%	65%	0.26%	0.00%

Ranking based on the VOLY estimate (VSL ranking indicated for comparison)

Table 4.8 - The top 30 refineries with the highest normalised damage costs in 2021 from emissions of all pollutants – Normalisation with CO_2 emissions

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL					VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
1	1	38	22	https://registry.gdi-de.org/id/de.by.inspire.pf.ied/S00135	Gunvor Raffinerie Ingolstadt GmbH	Kösching	Germany	212	545	66%	34%		
2	4	6	6	ES.CAED/003701000.FACILITY	PETROLEOS DEL NORTE, PETRONOR, S.A. (PETRONOR)	Muskiz	Spain	516	1 095	56%	43%	1.8%	
3	17	15	19	EL.CAED/100053.FACILITY	HELLENIC PETROLEUM S.A. - INDUSTRIAL DIVISION OF ASPROPYRGOS	Aspropyrgos	Greece	361	585	29%	44%	26.6%	0.0%
4	2	22	13	IT.CAED/961003163.FACILITY	Raffineria ISAB Impianti SUD	Priolo Gargallo	Italy	298	709	55%	45%	0.1%	0.0%
5	5	48	41	FR.CAED/7646.FACILITY	ESSO RAFFINAGE SAS	Fos-sur-Mer	France	169	354	51%	45%	3.4%	0.0%
6	3	7	5	IT.CAED/960111001.FACILITY	Sonatrach Raffineria Italiana-Raffineria di Augusta	Augusta	Italy	483	1 144	55%	45%	0.1%	0.0%
7	6	36	28	https://registry.gdi-de.org/id/de.sh/10039818	Raffinerie Heide GmbH	Hemmingstedt	Germany	218	476	50%	47%	2.6%	0.0%
8	8	9	9	FR.CAED/3834.FACILITY	ESSO RAFFINAGE	Notre Dame De Gravenchon	France	427	861	48%	48%	3.9%	0.0%
9	9	61	57	EL.CAED/100062.FACILITY	HELLENIC PETROLEUM S.A. - THESSALONIKI INDUSTRIAL COMPLEX	Echedoros	Greece	66	129	47%	48%	4.8%	
10	7	41	35	IT.CAED/280691001.FACILITY	RAFFINERIA SARPOM DI TRECATE	Trecate	Italy	186	418	50%	50%		0.0%
11	13	35	31	FR.CAED/5422.FACILITY	TOTAL RAFFINAGE FRANCE	Feyzin	France	223	449	48%	52%	0.0%	0.0%
12	16	3	1	https://data.ied_registry.omgeving.vlaanderen.be/id/	TotalEnergies Refinery Antwerp	Antwerpen	Belgium	794	1 567	47%	52%	0.9%	0.0%

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL					VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
				productionfacility/BE.VL.00000169.FACILITY									
13	18	29	26	ES.CAED/001528000.FACILITY	REPSOL PETROLEO S.A.	Puertollano	Spain	259	496	46%	54%		
14	21	33	33	ES.CAED/000704000.FACILITY	BP OIL ESPAÑA S.A.U. REFINERIA DE CASTELLÓN	Grao	Spain	236	441	44%	53%	3.3%	
15	11	34	27	https://registry.gdi-de.org/id/de.by.inspire.pf.ied/S00108	OMV Deutschland Operations GmbH & Co. KG, Werk Burghausen	Burghausen	Germany	227	478	47%	53%		0.0%
16	12	45	38	https://registry.gdi-de.org/id/de.by.inspire.pf.ied/S00323	BAYERNOIL Raffineriegesellschaft mbH, Betriebsteil Neustadt	Neustadt a.d.Donau	Germany	174	366	46%	54%		
17	10	20	15	IT.CAED/270391001.FACILITY	RAFFINERIA DI SANNAZZARO DE' BURGONDI	Sannazzaro de' Burgondi	Italy	323	693	46%	54%	0.3%	0.0%
18	14	37	32	https://registry.gdi-de.org/id/de.ni.mu/10257401440	BP Europa SE BP Lingen	Lingen	Germany	215	448	46%	54%		0.0%
19	15	4	3	https://registry.gdi-de.org/id/de.bb.inspire.pf.eureg/23020490	PCK Raffinerie GmbH Schwedt	Schwedt/Oder	Germany	675	1 403	45%	55%	0.0%	
20	22	8	8	NL.RIVM/000010061.FACILITY	Esso Nederland BV (Raffinaderij Rotterdam)	Botlek Rotterdam	Netherlands	463	903	44%	56%		0.0%
21	19	50	46	https://registry.gdi-de.org/id/de.bw.lubw.inspire.pf/pf-450-2719398-00000000	MIRO-Mineralölraffinerie Oberrhein GmbH & Co.KG Werk 2	Karlsruhe	Germany	144	293	44%	56%	0.0%	
22	27	24	24	ES.CAED/001482000.FACILITY	REFINERÍA LA RÁBIDA	Palos de la Frontera	Spain	283	529	43%	57%	0.0%	
23	20	18	17	https://registry.gdi-de.org/id/de.bw.lubw.inspire.pf/pf-450-2719371-00000000	MIRO-Mineralölraffinerie Oberrhein GmbH & Co.KG Werk 1	Karlsruhe	Germany	333	673	43%	57%		

CO_2 normalised ranking		Original ranking		Facility Inspire ID	Facility name	City	Country	Damage in million €		Damage in %			
VOLY	VSL	VOLY	VSL					VOLY	VSL	Main air pollutants	Greenhouse gases	Heavy metals	Organic pollutants
24	23	57	53	https://registry.gdi-de.org/id/de.st.lau.pf.anlagen-ied-euregistry/100864	ROMONTA Amsdorf	Amsdorf	Germany	79	156	42%	58%	0.4%	
25	24	42	37	https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-513000-500-0073211	Ruhr Oel GmbH Werk Horst	Gelsenkirchen	Germany	185	367	42%	58%		
26	26	51	49	HR.CAED/000000067.FACILITY	Rafinerija nafte Rijeka	Kostrena	Croatia	133	260	41%	59%		
27	31	10	11	ES.CAED/001529000.FACILITY	REPSOL PETRÓLEO, S.A. - C.I. CARTAGENA	Cartagena	Spain	425	757	39%	59%	1.8%	
28	28	12	12	NL.RIVM/000010058.FACILITY	BP Raffinaderij Rotterdam B.V.	Europoort Rotterdam	Netherlands	391	723	39%	61%	0.0%	0.0%
29	25	17	14	IT.CAED/980571001.FACILITY	Raffineria di Milazzo S.C.p.A.	Milazzo	Italy	347	695	40%	60%	0.0%	
30	33	13	16	EL.CAED/100066.FACILITY	MOTOR OIL (HELLAS) - CORINTHOS REFINERIES S.A.	Soussaki, Ag. Theodori	Greece	387	682	37%	60%	3.0%	0.0%

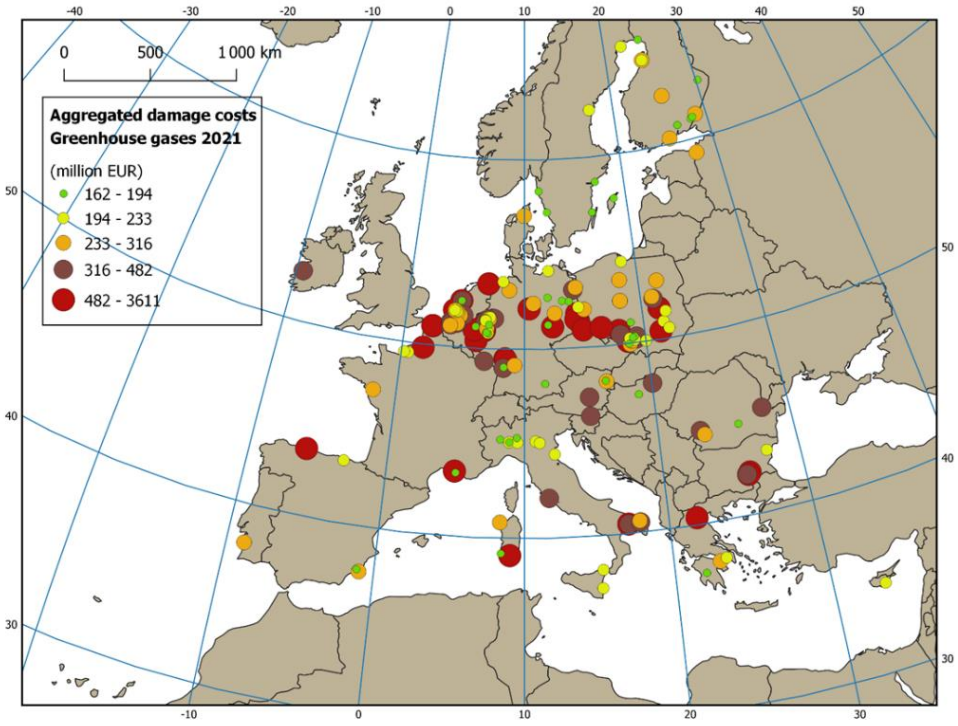
Ranking based on the VOLY estimate (VSL ranking indicated for comparison)

4.6 Additional maps

The map included in the briefing (Map 4.1) shows the location of the 129 facilities responsible for 50 % of the damage caused by emissions from the main air pollutants.

Three additional maps have been produced indicating the location of facilities responsible for 50 % of the damage caused by GHG, heavy metals and organic pollutants. Note that organic pollutants and heavy metals are reported in very low amounts by a small number of facilities (234 reported heavy metals emissions and 343 reported organic pollutants in 2021), which means that only a small selection of facilities are part of these two maps.

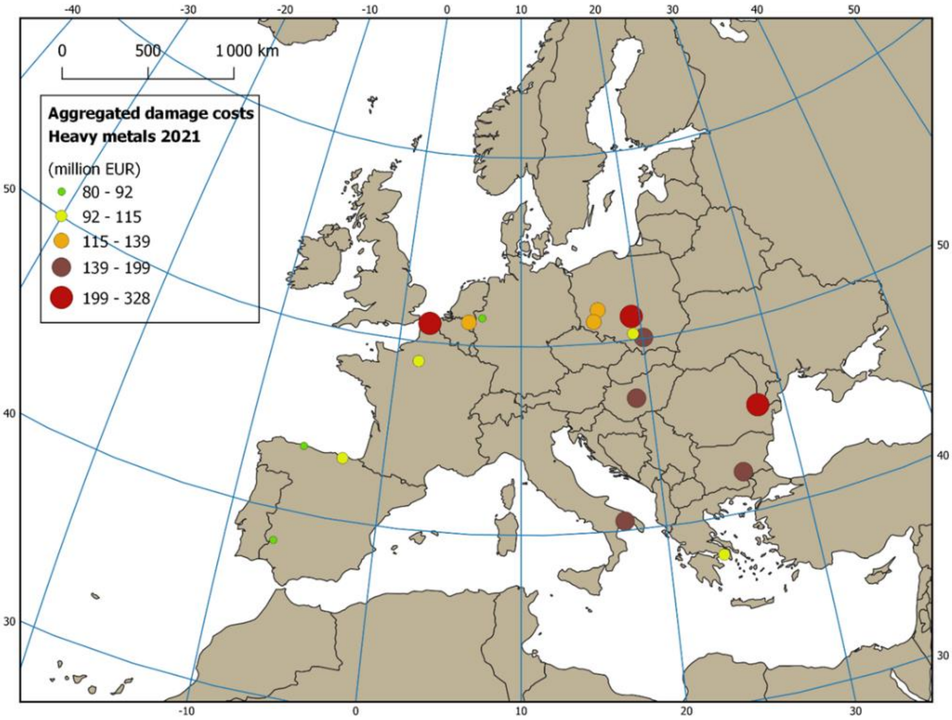
Map 4.2 Localisation of the 170 facilities accounting for 50 % of the aggregate damage costs from greenhouse gases (2021)



Notes: Euro price base: 2021

Data gaps: Czechia, Malta, Lithuania, and Slovakia (No data submitted for 2021)

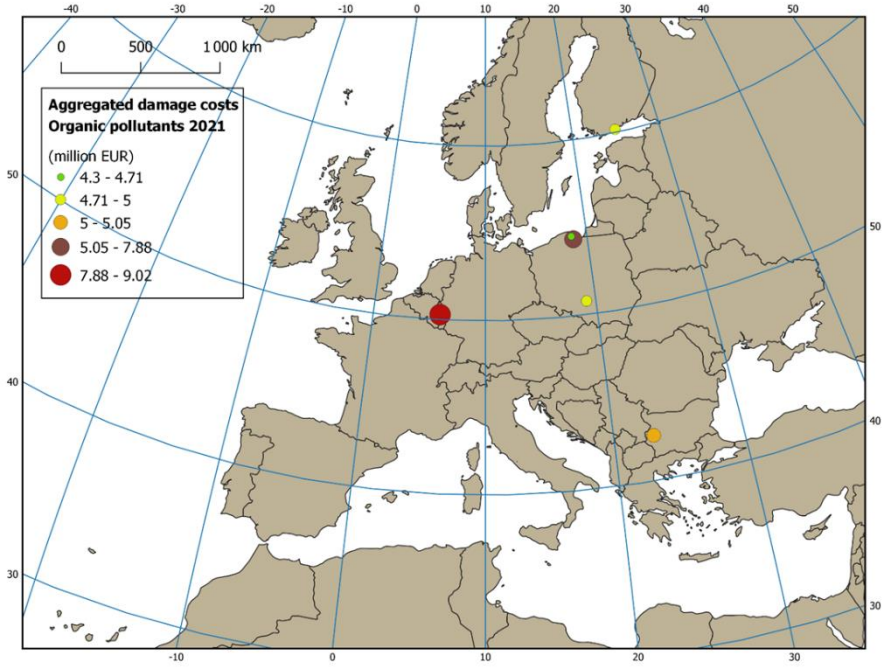
Map 4.3 Localisation of the 19 facilities accounting for 50 % of the aggregate damage costs from heavy metals (2021)



Notes: Euro price base: 2021

Data gaps: Czechia, Malta, Lithuania, and Slovakia (No data submitted for 2021)

Map 4.4 Localisation of the 6 facilities accounting for 50 % of the aggregate damage costs from organic pollutants (2021)



Notes: Euro price base: 2021

Data gaps: Czechia, Malta, Lithuania, and Slovakia (No data submitted for 2021)

List of abbreviations

Abbreviation	Name	Reference
BAT	Best available technique	
BAT-AEL	BAT associated emission levels	
BREF	BAT Reference document	
CCE	Coordination Centre for Effects	https://www.umweltbundesamt.de/en/Coordination_Centre_for_Effects
CAFÉ	Clean air for Europe	Archived
CH_4	Methane	
CLRTAP	UNECE Convention on Long-range Transboundary Air Pollution	
CO_2	Carbon dioxide	
EEA	European Environment Agency	www.eea.europa.eu
EEA38+UK	The 27 EU Member States, Albania, Bosnia and Herzegovina, Iceland, Kosovo, Liechtenstein, Montenegro, North Macedonia, Norway, Serbia, Switzerland and Turkey.	
EMEP	The co-operative programme for monitoring and evaluation of the long-range transmission of air pollutants in Europe	https://www.emep.int
E-PRTR	European pollutant release and transfer register	The data submitted under this Regulation is published via the European Industrial Emissions Portal: https://industry.eea.europa.eu/
ETC-HE	European Topic Centre on human health and the environment	https://www.eionet.europa.eu/etcs/etc-he
GHG	Greenhouse gases	
GNFR	Gridding nomenclature for reporting	
GTP	Global temperature change potential	
HRAPIE	Health risks of air pollution in Europe	
IED	Industrial emissions Directive	
IPA	Impact pathway approach	
JRC	Joint research centre	https://commission.europa.eu/about-european-commission/departments-and-executive-agencies/joint-research-centre_en
LCP	Large combustion plant	
LRTAP convention	UNECE Convention on Long-range Transboundary Air Pollution	https://unece.org/environmental-policy-1/air
MDC	Marginal damage cost per tonne	
MSC-W	Meteorological Synthesizing Centre – West	https://www.emep.int/mscw/index.html
NH_3	Ammonia	
N_2O	Nitrous oxide	
NO_X	Nitrogen oxides	

NMVOC	Non-methane volatile organic compounds	
PAH	Polycyclic aromatic hydrocarbons	
PM	Particulate matter	
SO_2	Sulphur oxides	
SRMs	Source-receptor matrices	
UNECE	United Nations Economic Commission for Europe	https://unece.org/
VOLY	Value of a life year	
VSL	Value of a statistical life	
WHO	World health organisation	https://www.who.int/

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Annex 1 Marginal damage costs (MDCs) for impacts on health, crops, forests, ecosystems and buildings – Main air pollutants - 2019

Table A1.1 contains the overall MDCs whereas subsequent tables contain the disaggregation by type of impact.

Also, note that the year-on-year variation of MDCs is only for health-related damage costs. No year-dependent calculation has been undertaken for other impacts (forests, crops, buildings and ecosystems).

Table A1.1 - Overall marginal damage costs of major air pollutants for 2019 (€2021 per tonne)

Emitter countries		Aggregate marginal damage costs over EEA38 + UK (*) for major air pollutants including impacts on health, crops & forests, ecosystems and material damage in €$_{2021}$/tonne of pollutant											
		NO_X VOLY	NO_X VSL	$PM_{2.5}$ VOLY	$PM_{2.5}$ VSL	PM_{10} VOLY	PM_{10} VSL	SO_2 VOLY	SO_2 VSL	VOC VOLY	VOC VSL	NH_3 VOLY	NH_3 VSL
AL	Albania	12 236	28 363	110 740	266 239	65 917	158 476	35 445	89 981	1 358	3 251	12 728	31 299
AT	Austria	34 229	100 089	192 899	560 117	103 155	299 528	68 976	204 910	4 040	10 753	28 733	83 566
BA	Bosnia and Herzegovina	14 426	41 088	84 591	270 777	50 352	161 177	23 929	74 100	1 623	4 147	20 669	65 243
BE	Belgium	29 987	88 276	232 224	672 768	155 855	451 522	61 928	180 455	4 812	12 263	64 366	188 576
BG	Bulgaria	16 253	47 712	84 610	299 314	53 892	190 646	26 409	83 165	1 277	2 948	22 435	74 112
CH	Switzerland	61 189	170 308	319 936	878 669	139 102	382 030	117 190	331 417	5 805	15 485	26 911	75 850
CY	Cyprus	7 382	6 136	55 244	23 796	27 901	12 018	12 026	14 428	856	1 290	8 986	3 093
CZ	Czechia	27 267	76 787	118 859	341 023	90 732	260 323	42 341	123 807	3 055	7 838	40 252	116 926
DE	Germany	32 097	95 870	209 939	651 472	94 995	294 784	52 366	158 323	3 716	9 495	34 790	105 619
DK	Denmark	11 132	31 241	59 066	170 951	33 183	96 040	21 960	62 918	1 278	2 953	15 168	43 399
EE	Estonia	4 912	9 436	27 533	47 354	17 537	30 162	4 466	11 488	793	1 640	5 939	12 224
ES	Spain	13 373	35 952	82 021	241 658	56 959	167 818	33 279	98 864	1 921	4 849	9 744	27 995
FI	Finland	4 936	12 609	45 471	125 667	25 122	69 429	8 626	23 545	560	1 320	6 014	16 255
FR	France	26 329	74 905	122 552	372 838	73 384	223 256	44 554	133 952	2 506	6 369	17 581	52 184
GB	United Kingdom	22 311	63 527	200 221	576 524	127 530	367 213	50 005	144 144	2 092	5 185	48 897	140 668
GR	Greece	10 654	30 730	76 442	254 219	46 329	154 072	18 762	53 073	2 054	5 111	17 474	56 724
HR	Croatia	23 845	69 316	79 719	260 692	55 747	182 302	42 591	133 514	2 384	6 173	19 959	62 161
HU	Hungary	26 608	76 781	110 074	347 813	70 560	222 957	40 979	124 546	2 157	5 378	27 033	81 943
IE	Ireland	13 614	33 124	34 514	77 599	14 749	33 162	30 184	78 025	1 237	2 977	7 664	20 024
IS	Iceland	977	2 506	19 547	8 537	10 509	4 590	3 944	6 584	665	1 667	-1 306	288
IT	Italy	35 597	112 136	189 825	626 021	154 330	508 960	43 597	139 819	5 008	14 022	29 410	94 948

Emitter countries		Aggregate marginal damage costs over EEA38 + UK (*) for major air pollutants including impacts on health, crops & forests, ecosystems and material damage in €$_{2021}$/tonne of pollutant											
		NO_X VOLY	NO_X VSL	$PM_{2.5}$ VOLY	$PM_{2.5}$ VSL	PM_{10} VOLY	PM_{10} VSL	SO_2 VOLY	SO_2 VSL	VOC VOLY	VOC VSL	NH_3 VOLY	NH_3 VSL
LT	Lithuania	8 265	23 245	73 701	232 826	34 280	108 291	11 388	33 256	624	1 325	7 389	21 950
LU	Luxembourg	30 520	85 204	93 006	240 058	60 393	155 882	67 917	197 049	3 487	8 738	30 722	83 720
LV	Latvia	8 276	24 146	42 306	137 496	28 585	92 903	11 966	36 346	749	1 736	6 532	19 313
MD	Moldova	5 118	14 021	18 202	53 035	10 835	31 569	14 014	39 767	984	2 326	6 606	18 253
ME	Montenegro	12 007	24 526	41 952	59 902	35 254	50 338	15 906	45 114	1 433	3 444	11 448	19 269
MK	North Macedonia	8 559	22 293	96 654	247 762	57 532	147 477	18 216	51 005	1 569	3 723	29 029	76 415
MT	Malta	4 774	4 389	70 063	33 636	26 539	12 741	385	385	1 396	2 888	40 595	15 609
NL	Netherlands	31 225	91 524	203 539	582 272	113 709	325 292	53 768	156 342	4 502	11 377	49 437	143 976
NO	Norway	8 938	20 360	27 050	61 281	19 889	45 060	10 850	27 714	824	1 965	6 402	15 165
PL	Poland	15 994	44 272	136 198	393 290	76 089	219 715	26 158	74 968	1 716	4 041	28 307	81 159
PT	Portugal	10 623	31 172	89 800	292 553	63 688	207 484	16 648	52 158	1 266	3 184	12 121	38 556
RO	Romania	21 973	64 132	80 282	256 341	58 600	187 110	32 687	100 154	1 449	3 421	17 522	53 438
RS	Serbia	10 635	32 428	108 106	364 098	64 349	216 725	22 720	70 351	1 057	2 455	26 651	86 775
SE	Sweden	7 975	20 355	36 366	96 528	17 400	46 186	11 546	31 633	931	2 234	10 499	28 305
SI	Slovenia	35 911	103 642	123 863	350 277	99 890	282 481	58 493	174 725	3 968	10 613	29 246	85 594
SK	Slovakia	24 622	65 434	96 760	255 846	74 431	196 805	38 676	109 784	2 104	5 171	36 171	99 897
TR	Turkey	8 189	12 633	132 024	202 440	78 585	120 500	20 574	32 939	1 305	2 044	22 452	35 149

(*) Missing emitter countries relative to EEA38+UK

For health damage for the $PM_{2.5}$ precursors (NO_X, SO_2, $PM_{2.5}$, NMVOC, NH_3): Liechtenstein, Kosovo

For health damage for the O_3 precursors (NO_X, NMVOC): Liechtenstein, Kosovo

For health damage for the NO_2 precursor (NO_X): Iceland, Liechtenstein, Albania, Bosnia and Herzegovina, North Macedonia and Serbia and Kosovo

For crop damage for the O_3 precursors (NO_X, NMVOC): Liechtenstein and Kosovo

Emitter countries	Aggregate marginal damage costs over EEA38 + UK (*) for major air pollutants including impacts on health, crops & forests, ecosystems and material damage in €$_{2021}$/tonne of pollutant											
	NO_X VOLY	NO_X VSL	$PM_{2.5}$ VOLY	$PM_{2.5}$ VSL	PM_{10} VOLY	PM_{10} VSL	SO_2 VOLY	SO_2 VSL	VOC VOLY	VOC VSL	NH_3 VOLY	NH_3 VSL
For forest damage for the O_3 precursors (NO_X, NMVOC): Albania, Iceland, Bosnia and Herzegovina, Liechtenstein, Montenegro, Norway, North Macedonia, Switzerland, Serbia and Kosovo, the UK and Turkey												
For building material damage from SO_2 and NO_X: Albania, Iceland, Bosnia and Herzegovina, Liechtenstein, Montenegro, Norway, North Macedonia, Switzerland, Serbia and Kosovo, Turkey												

Table A1.2 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2019 for the $PM_{2.5}$ precursors (€2021/t)

Iso code	Country	$PM_{2.5}$ precursor											
		NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SO_x (VOLY)	SO_x (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
AL	Albania	10 704	26 831	110 740	266 239	65 917	158 476	35 445	89 981	1 078	2 971	12 543	31 113
AT	Austria	26 872	81 164	192 899	560 117	103 155	299 528	68 444	204 378	3 353	10 066	27 960	82 793
BA	Bosnia and Herzegovina	12 316	38 978	84 591	270 777	50 352	161 177	23 929	74 100	1 310	3 834	20 508	65 082
BE	Belgium	21 202	63 138	232 224	672 768	155 855	451 522	61 228	179 754	3 820	11 271	64 188	188 398
BG	Bulgaria	9 828	30 722	84 610	299 314	53 892	190 646	26 098	82 854	963	2 634	21 828	73 505
CH	Switzerland	50 161	144 286	319 936	878 669	139 102	382 030	117 190	331 417	4 882	14 562	26 679	75 618
CY	Cyprus	3 914	4 143	55 244	23 796	27 901	12 018	11 641	14 043	665	1 099	8 986	3 093
CZ	Czechia	21 563	63 713	118 859	341 023	90 732	260 323	41 600	123 066	2 467	7 249	39 728	116 401
DE	Germany	22 925	69 244	209 939	651 472	94 995	294 784	51 710	157 667	2 921	8 699	34 576	105 405
DK	Denmark	7 113	20 798	59 066	170 951	33 183	96 040	21 601	62 558	908	2 582	15 083	43 314
EE	Estonia	1 754	4 803	27 533	47 354	17 537	30 162	4 324	11 346	506	1 352	5 778	12 063
ES	Spain	6 228	18 486	82 021	241 658	56 959	167 818	33 212	98 797	1 496	4 423	9 332	27 583
FI	Finland	1 420	4 036	45 471	125 667	25 122	69 429	8 515	23 435	443	1 202	5 861	16 102
FR	France	18 654	55 915	122 552	372 838	73 384	223 256	44 189	133 587	1 953	5 815	17 273	51 876
GB	United Kingdom	13 902	40 399	200 221	576 524	127 530	367 213	49 727	143 867	1 613	4 707	48 696	140 466

Iso code	Country	$PM_{2.5}$ precursor											
		NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SO_x (VOLY)	SO_x (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
GR	Greece	3 107	7 668	76 442	254 219	46 329	154 072	18 631	52 942	1 654	4 711	17 368	56 618
HR	Croatia	16 690	52 693	79 719	260 692	55 747	182 302	42 206	133 129	1 892	5 681	19 499	61 702
HU	Hungary	17 722	54 599	110 074	347 813	70 560	222 957	40 278	123 844	1 668	4 889	26 775	81 685
IE	Ireland	9 957	27 048	34 514	77 599	14 749	33 162	30 076	77 917	895	2 636	7 305	19 665
IS	Iceland	553	2 082	19 547	8 537	10 509	4 590	3 944	6 584	569	1 572	-1 306	288
IT	Italy	26 455	86 466	189 825	626 021	154 330	508 960	43 397	139 620	4 125	13 139	28 850	94 387
LT	Lithuania	4 081	12 238	73 701	232 826	34 280	108 291	11 109	32 977	419	1 120	7 166	21 726
LU	Luxembourg	26 879	79 710	93 006	240 058	60 393	155 882	67 268	196 400	2 671	7 921	30 561	83 558
LV	Latvia	2 977	8 814	42 306	137 496	28 585	92 903	11 781	36 161	572	1 559	6 354	19 135
ME	Montenegro	7 348	18 413	41 952	59 902	35 254	50 338	15 906	45 114	1 149	3 160	11 448	19 269
MK	North Macedonia	7 378	21 112	96 654	247 762	57 532	147 477	18 216	51 005	1 293	3 447	28 474	75 860
MT	Malta	542	2 365	70 063	33 636	26 539	12 741			1 122	2 614	40 433	15 447
NL	Netherlands	20 117	60 112	203 539	582 272	113 709	325 292	53 095	155 670	3 530	10 404	49 223	143 763
NO	Norway	2 522	7 151	27 050	61 281	19 889	45 060	10 850	27 714	630	1 771	6 389	15 152
PL	Poland	11 044	32 338	136 198	393 290	76 089	219 715	25 419	74 229	1 262	3 587	27 844	80 696
PT	Portugal	4 685	14 856	89 800	292 553	63 688	207 484	16 598	52 108	933	2 850	11 762	38 197
RO	Romania	14 059	44 134	80 282	256 341	58 600	187 110	32 131	99 597	1 101	3 074	17 411	53 327
RSXK	Serbia and Kosovo	10 030	31 823	108 106	364 098	64 349	216 725	22 720	70 351	793	2 192	26 651	86 775
SE	Sweden	3 530	10 132	36 366	96 528	17 400	46 186	11 379	31 465	717	2 020	10 294	28 100
SI	Slovenia	28 818	88 691	123 863	350 277	99 890	282 481	57 998	174 230	3 207	9 852	28 765	85 112
SK	Slovakia	17 430	50 927	96 760	255 846	74 431	196 805	37 978	109 086	1 614	4 681	35 842	99 568
TR	Turkey	7 676	12 120	132 024	202 440	78 585	120 500	20 574	32 939	1 064	1 803	22 452	35 149

Missing emitter countries: Liechtenstein and Kosovo

Table A1.3 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2019 for the O_3 precursors NO_X and NMVOC (€2021/t)

Iso code	Country	O_3 precursors	
		NO_X	NMVOC
AL	Albania	873	209
AT	Austria	657	447
BA	Bosnia and Herzegovina	1 265	222
BE	Belgium	-597	605
BG	Bulgaria	958	222
CH	Switzerland	717	665
CY	Cyprus	346	116
CZ	Czechia	562	373
DE	Germany	-49	485
DK	Denmark	45	208
EE	Estonia	98	82
ES	Spain	333	270
FI	Finland	139	68
FR	France	552	337
GB	United Kingdom	-372	314
GR	Greece	-14	302
HR	Croatia	1 298	307
HU	Hungary	905	296
IE	Ireland	413	202
IS	Iceland	246	65
IT	Italy	331	625
LT	Lithuania	263	114
LU	Luxembourg	480	480
LV	Latvia	151	100
ME	Montenegro	1 008	206
MK	North Macedonia	564	214
MT	Malta	-614	179
NL	Netherlands	-629	571
NO	Norway	244	111
PL	Poland	309	268
PT	Portugal	115	209
RO	Romania	912	221
RS	Serbia	605	264
SE	Sweden	263	112
SI	Slovenia	1 039	495
SK	Slovakia	1 003	298
TR	Turkey	12	150

Missing emitter countries: Liechtenstein and Kosovo

Table A1.4 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2019 for the NO_2 precursor NO_X (€2021/t)

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
AT	Austria	5 399	16 966
BE	Belgium	9 194	25 547
BG	Bulgaria	4 500	15 064
CH	Switzerland	9 266	24 259
CY	Cyprus	2 626	1 152
CZ	Czechia	4 110	11 479
DE	Germany	8 567	26 022
DK	Denmark	3 603	10 027
EE	Estonia	2 608	4 083
ES	Spain	5 730	16 051
FI	Finland	3 083	8 140
FR	France	5 917	17 232
GB	United Kingdom	8 565	23 284
GR	Greece	7 140	22 655
HR	Croatia	4 413	13 882
HU	Hungary	6 577	19 874
IE	Ireland	2 670	5 089
IT	Italy	7 889	24 416
LT	Lithuania	3 382	10 205
LU	Luxembourg	2 275	4 128
LV	Latvia	4 702	14 736
ME	Montenegro	3 057	4 511
MT	Malta	4 619	2 410
NL	Netherlands	11 674	31 979
NO	Norway	5 850	12 643
PL	Poland	3 845	10 829
PT	Portugal	4 951	15 330
RO	Romania	5 894	17 978
SE	Sweden	3 685	9 462
SI	Slovenia	4 588	12 445
SK	Slovakia	4 826	12 141

Missing emitter countries: Iceland, Liechtenstein, Albania, Bosnia and Herzegovina, North Macedonia and Serbia and Kosovo

Table A1.5 - Marginal damage costs of major air pollutants – impacts on crops (for all years) (€2021/t)

Emitter country		Damage over EEA38 + UK (*) - €$_{2021}$/tonne of pollutant emissions for O_3 precursors	
		NO_X	NMVOC
AL	Albania	544	71
AT	Austria	674	186
BA	Bosnia and Herzegovina	736	91
BE	Belgium	-4	326
BG	Bulgaria	614	74
CH	Switzerland	875	258
CY	Cyprus	388	74
CZ	Czechia	569	176
DE	Germany	353	258
DK	Denmark	183	159
EE	Estonia	147	53
ES	Spain	783	131
FI	Finland	134	36
FR	France	782	174
GB	United Kingdom	96	165
GR	Greece	301	89
HR	Croatia	885	146
HU	Hungary	824	154
IE	Ireland	366	115
IS	Iceland	179	31
IT	Italy	557	209
LT	Lithuania	280	73
LU	Luxembourg	480	282
LV	Latvia	214	59
ME	Montenegro	594	78
MK	North Macedonia	463	61
MT	Malta	76	78
NL	Netherlands	-118	340
NO	Norway	290	83
PL	Poland	388	151
PT	Portugal	586	92
RO	Romania	606	94
RS	Serbia	422	126
SE	Sweden	277	82
SI	Slovenia	751	200
SK	Slovakia	762	153
TR	Turkey	501	91

(*) Missing emitter countries: Liechtenstein, Kosovo

Table A1.6 - Marginal damage costs of major air pollutants – impacts on forests (for all years) (€2021/t)

Emitter country		Damage over EU27 - €$_{2021}$/tonne of pollutant emissions for O_3 precursors	
		NO_X	NMVOC
AT	Austria	172	53
BE	Belgium	-4	61
BG	Bulgaria	121	18
CY	Cyprus	3	1
CZ	Czechia	117	40
DE	Germany	61	53
DK	Denmark	23	4
EE	Estonia	197	152
ES	Spain	112	25
FI	Finland	102	13
FR	France	183	43
GR	Greece	22	9
HR	Croatia	251	38
HU	Hungary	201	38
IE	Ireland	68	25
IT	Italy	103	49
LT	Lithuania	110	19
LU	Luxembourg	79	54
LV	Latvia	119	18
MT	Malta	14	17
NL	Netherlands	-20	62
PL	Poland	83	35
PT	Portugal	141	33
RO	Romania	223	32
SE	Sweden	120	20
SI	Slovenia	261	65
SK	Slovakia	205	38

Table A1.7 - Marginal damage costs of major air pollutants – impacts on utilitarian buildings (for all years) (€2021/t)

Emitter country		Damage over EU27+UK - €$_{2021}$/tonne of pollutant emission	
		NO_X	SO_2
EU27 (*)		105	385
AT	Austria	214	532
BE	Belgium	123	701
BG	Bulgaria	135	311
CY	Cyprus	105	385
CZ	Czechia	189	742
DE	Germany	142	656
DK	Denmark	105	359
EE	Estonia	46	142
ES	Spain	27	66
FI	Finland	30	111
FR	France	106	365
GB	United Kingdom	64	278
GR	Greece	73	132
HR	Croatia	105	385
HU	Hungary	264	702
IE	Ireland	49	108
IT	Italy	85	199
LT	Lithuania	110	278
LU	Luxembourg	155	649
LV	Latvia	69	186
MT	Malta	105	385
NL	Netherlands	124	673
PL	Poland	197	739
PT	Portugal	20	50
RO	Romania	204	556
SE	Sweden	51	168
SI	Slovenia	191	495
SK	Slovakia	242	698

(*) The definition of EU27 is the one that was valid at the time when the research behind these values was done, i.e. it includes the UK and excludes Croatia. Cyprus, Croatia, Malta set at EU27 average.

Table A1.8 - Marginal damage costs of major air pollutants – impacts on ecosystems (for all years) (€2021/t)

Country	Country ISO	Damage over EEA38+UK (*) in €$_{2021}$/t of precursor	
		NH_3	NO_X
Albania	AL	186	115
Austria	AT	773	241

Country	Country ISO	Damage over EEA38+UK (*) in €$_{2021}$/t of precursor	
		NH_3	NO_X
Bosnia and Herzegovina	BA	161	109
Belgium	BE	178	73
Bulgaria	BG	607	98
Switzerland	CH	232	170
Cyprus	CY	0	0
Czechia	CZ	524	158
Germany	DE	214	97
Denmark	DK	85	61
Estonia	EE	162	61
Spain	ES	411	159
Finland	FI	153	28
France	FR	308	135
United Kingdom	GB	201	55
Greece	GR	106	26
Croatia	HR	459	202
Hungary	HU	258	115
Ireland	IE	359	91
Iceland	IS	0	0
Italy	IT	561	177
Lithuania	LT	223	41
Luxembourg	LU	161	172
Latvia	LV	178	43
Republic of Moldova	MD	74	32
North Macedonia	MK	555	154
Malta	MT	162	32
Netherlands	NL	213	77
Norway	NO	13	32
Poland	PL	463	130
Portugal	PT	359	125
Romania	RO	111	75
Serbia	RS	184	80
Sweden	SE	205	49
Slovenia	SI	482	262
Slovakia	SK	329	154

(*) Missing emitter countries: Liechtenstein, Turkey, Kosovo, Montenegro. Additional emitter countries: Republic of Moldova.

Annex 2 Marginal damage costs (MDCs) for heavy metals and organic pollutants – 2012-2021

Table A2.1 - Mean marginal damage costs of Chromium VI emissions 2012-2021 (€2021 per kg)

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Europe	**635**	**620**	**580**	**708**	**645**	**696**	**748**	**687**	**684**	**742**
Austria	635	619	580	707	645	696	747	687	684	741
Balkans	482	470	440	536	489	528	567	521	519	562
Belgium	1 048	1 022	958	1 168	1 064	1 149	1 234	1 134	1 129	1 224
Bulgaria	350	341	319	389	355	383	412	378	377	408
Croatia	624	609	570	695	633	684	734	675	672	728
Cyprus	421	411	385	469	427	462	496	455	453	492
Czechia	636	620	581	708	645	697	748	687	685	742
Denmark	312	304	285	348	317	342	367	337	336	364
Estonia	172	168	157	192	175	189	203	186	185	201
Finland	172	168	157	192	175	189	203	186	185	201
France	754	736	689	840	766	827	888	816	812	881
Germany	945	922	863	1 053	959	1 036	1 112	1 022	1 018	1 103
Greece	363	354	332	404	368	398	427	392	391	424
Hungary	601	586	549	670	610	659	708	650	647	702
Ireland	323	315	295	360	328	354	380	350	348	377
Italy	683	666	624	761	693	749	804	739	736	797
Latvia	209	203	191	232	212	229	245	226	225	244
Lithuania	271	264	248	302	275	297	319	293	292	317
Luxembourg	756	738	691	842	767	829	890	818	814	883
Malta	237	231	217	264	241	260	279	256	255	277
Netherlands	1 117	1 089	1 020	1 244	1 133	1 224	1 314	1 208	1 203	1 304
Norway	156	152	143	174	159	171	184	169	168	182
Poland	550	537	503	613	558	603	647	595	592	642
Portugal	371	362	339	413	377	407	437	401	400	433
Romania	414	404	378	461	420	454	487	448	446	483
Slovakia	591	576	540	658	600	648	695	639	636	690
Slovenia	624	609	570	695	633	684	734	675	672	728
Spain	356	347	325	396	361	390	419	385	383	415
Sweden	282	275	258	314	286	309	332	305	304	329
Switzerland	817	797	746	910	829	896	962	884	880	954
UK	668	652	611	745	678	733	787	723	720	781

* The impact domain covers all member states and cooperating countries of the EEA plus the UK (EEA38+UK).

Table A2.2 - Mean marginal damage costs of Nickel emissions 2012-2021 (€2021 per kg)

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Europe	**21.1**	**20.6**	**19.3**	**23.5**	**21.4**	**23.2**	**24.9**	**22.9**	**22.8**	**24.7**
Austria	21.1	20.6	19.3	23.5	21.4	23.2	24.9	22.8	22.7	24.7
Balkans	16.0	15.6	14.6	17.8	16.3	17.6	18.9	17.3	17.3	18.7
Belgium	34.9	34.0	31.9	38.8	35.4	38.2	41.0	37.7	37.6	40.7
Bulgaria	11.6	11.3	10.6	13.0	11.8	12.8	13.7	12.6	12.5	13.6
Croatia	20.8	20.2	19.0	23.1	21.1	22.8	24.4	22.4	22.4	24.2
Cyprus	14.0	13.7	12.8	15.6	14.2	15.4	16.5	15.1	15.1	16.4
Czechia	21.1	20.6	19.3	23.6	21.5	23.2	24.9	22.9	22.8	24.7
Denmark	10.4	10.1	9.5	11.6	10.5	11.4	12.2	11.2	11.2	12.1
Estonia	5.7	5.6	5.2	6.4	5.8	6.3	6.7	6.2	6.2	6.7
Finland	5.7	5.6	5.2	6.4	5.8	6.3	6.7	6.2	6.2	6.7
France	25.1	24.5	22.9	27.9	25.5	27.5	29.5	27.1	27.0	29.3
Germany	31.4	30.7	28.7	35.0	31.9	34.5	37.0	34.0	33.9	36.7
Greece	12.1	11.8	11.0	13.4	12.3	13.2	14.2	13.1	13.0	14.1
Hungary	20.0	19.5	18.3	22.3	20.3	21.9	23.5	21.6	21.5	23.4
Ireland	10.8	10.5	9.8	12.0	10.9	11.8	12.7	11.6	11.6	12.6
Italy	22.7	22.2	20.8	25.3	23.1	24.9	26.7	24.6	24.5	26.5
Latvia	6.9	6.8	6.3	7.7	7.0	7.6	8.2	7.5	7.5	8.1
Lithuania	9.0	8.8	8.2	10.0	9.2	9.9	10.6	9.8	9.7	10.5
Luxembourg	25.2	24.5	23.0	28.0	25.5	27.6	29.6	27.2	27.1	29.4
Malta	7.9	7.7	7.2	8.8	8.0	8.6	9.3	8.5	8.5	9.2
Netherlands	37.1	36.2	33.9	41.4	37.7	40.7	43.7	40.2	40.0	43.4
Norway	5.2	5.1	4.7	5.8	5.3	5.7	6.1	5.6	5.6	6.1
Poland	18.3	17.9	16.7	20.4	18.6	20.1	21.5	19.8	19.7	21.4
Portugal	12.3	12.0	11.3	13.8	12.5	13.5	14.5	13.4	13.3	14.4
Romania	13.8	13.4	12.6	15.3	14.0	15.1	16.2	14.9	14.8	16.1
Slovakia	19.7	19.2	18.0	21.9	19.9	21.5	23.1	21.3	21.2	22.9
Slovenia	20.8	20.2	19.0	23.1	21.1	22.8	24.4	22.4	22.4	24.2
Spain	11.8	11.5	10.8	13.2	12.0	13.0	13.9	12.8	12.7	13.8
Sweden	9.4	9.1	8.6	10.4	9.5	10.3	11.0	10.1	10.1	11.0
Switzerland	27.2	26.5	24.8	30.3	27.6	29.8	32.0	29.4	29.3	31.7
UK	22.2	21.7	20.3	24.8	22.6	24.4	26.2	24.1	23.9	26.0

* The impact domain covers all member states and cooperating countries of the EEA plus the UK (EEA38+UK).

Table A2.3 - Mean marginal damage costs of 1,3 butadiene emissions 2012-2021 (€2021 per kg)

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Europe	**3.83**	**3.74**	**3.50**	**4.27**	**3.89**	**4.20**	**4.51**	**4.15**	**4.13**	**4.47**
Austria	3.83	3.74	3.50	4.27	3.89	4.20	4.51	4.14	4.13	4.47
Balkans	2.91	2.83	2.65	3.24	2.95	3.19	3.42	3.14	3.13	3.39
Belgium	6.32	6.17	5.78	7.04	6.42	6.93	7.44	6.84	6.81	7.38
Bulgaria	2.11	2.06	1.93	2.35	2.14	2.31	2.48	2.28	2.27	2.46
Croatia	3.76	3.67	3.44	4.19	3.82	4.13	4.43	4.07	4.05	4.39
Cyprus	2.54	2.48	2.32	2.83	2.58	2.78	2.99	2.75	2.74	2.97
Czechia	3.83	3.74	3.50	4.27	3.89	4.20	4.51	4.15	4.13	4.48
Denmark	1.88	1.84	1.72	2.10	1.91	2.06	2.22	2.04	2.03	2.20
Estonia	1.04	1.01	0.95	1.16	1.05	1.14	1.22	1.12	1.12	1.21
Finland	1.04	1.01	0.95	1.16	1.05	1.14	1.22	1.12	1.12	1.21
France	4.55	4.44	4.16	5.07	4.62	4.99	5.36	4.92	4.90	5.31
Germany	5.70	5.56	5.21	6.35	5.79	6.25	6.71	6.17	6.14	6.66
Greece	2.19	2.14	2.00	2.44	2.22	2.40	2.58	2.37	2.36	2.56
Hungary	3.63	3.54	3.31	4.04	3.68	3.98	4.27	3.92	3.91	4.23
Ireland	1.95	1.90	1.78	2.17	1.98	2.14	2.30	2.11	2.10	2.28
Italy	4.12	4.02	3.76	4.59	4.18	4.52	4.85	4.46	4.44	4.81
Latvia	1.26	1.23	1.15	1.40	1.28	1.38	1.48	1.36	1.36	1.47
Lithuania	1.64	1.60	1.49	1.82	1.66	1.79	1.93	1.77	1.76	1.91
Luxembourg	4.56	4.45	4.17	5.08	4.63	5.00	5.37	4.93	4.91	5.33
Malta	1.43	1.40	1.31	1.59	1.45	1.57	1.68	1.55	1.54	1.67
Netherlands	6.74	6.57	6.16	7.50	6.84	7.39	7.93	7.29	7.26	7.87
Norway	0.94	0.92	0.86	1.05	0.96	1.03	1.11	1.02	1.01	1.10
Poland	3.32	3.24	3.03	3.70	3.37	3.64	3.91	3.59	3.57	3.88
Portugal	2.24	2.18	2.05	2.49	2.27	2.45	2.64	2.42	2.41	2.61
Romania	2.50	2.44	2.28	2.78	2.54	2.74	2.94	2.70	2.69	2.92
Slovakia	3.56	3.48	3.26	3.97	3.62	3.91	4.20	3.86	3.84	4.16
Slovenia	3.76	3.67	3.44	4.19	3.82	4.13	4.43	4.07	4.05	4.39
Spain	2.15	2.09	1.96	2.39	2.18	2.35	2.52	2.32	2.31	2.50
Sweden	1.70	1.66	1.55	1.89	1.73	1.86	2.00	1.84	1.83	1.99
Switzerland	4.93	4.81	4.50	5.49	5.00	5.40	5.80	5.33	5.31	5.76
UK	4.03	3.93	3.68	4.49	4.09	4.42	4.75	4.36	4.34	4.71

* The impact domain covers all member states and cooperating countries of the EEA plus the UK (EEA38+UK).

Table A2.4 - Mean marginal damage costs of benzene emissions 2012-2021 (€2021 per kg)

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Europe	**0.82**	**0.80**	**0.75**	**0.92**	**0.83**	**0.90**	**0.97**	**0.89**	**0.89**	**0.96**
Austria	0.82	0.80	0.75	0.92	0.83	0.90	0.97	0.89	0.89	0.96
Balkans	0.62	0.61	0.57	0.69	0.63	0.68	0.73	0.67	0.67	0.73
Belgium	1.36	1.32	1.24	1.51	1.38	1.49	1.60	1.47	1.46	1.58
Bulgaria	0.45	0.44	0.41	0.50	0.46	0.50	0.53	0.49	0.49	0.53
Croatia	0.81	0.79	0.74	0.90	0.82	0.89	0.95	0.87	0.87	0.94
Cyprus	0.54	0.53	0.50	0.61	0.55	0.60	0.64	0.59	0.59	0.64
Czechia	0.82	0.80	0.75	0.92	0.83	0.90	0.97	0.89	0.89	0.96
Denmark	0.40	0.39	0.37	0.45	0.41	0.44	0.48	0.44	0.43	0.47
Estonia	0.22	0.22	0.20	0.25	0.23	0.24	0.26	0.24	0.24	0.26
Finland	0.22	0.22	0.20	0.25	0.23	0.24	0.26	0.24	0.24	0.26
France	0.98	0.95	0.89	1.09	0.99	1.07	1.15	1.06	1.05	1.14
Germany	1.22	1.19	1.12	1.36	1.24	1.34	1.44	1.32	1.32	1.43
Greece	0.47	0.46	0.43	0.52	0.48	0.51	0.55	0.51	0.51	0.55
Hungary	0.78	0.76	0.71	0.87	0.79	0.85	0.92	0.84	0.84	0.91
Ireland	0.42	0.41	0.38	0.47	0.42	0.46	0.49	0.45	0.45	0.49
Italy	0.88	0.86	0.81	0.98	0.90	0.97	1.04	0.96	0.95	1.03
Latvia	0.27	0.26	0.25	0.30	0.27	0.30	0.32	0.29	0.29	0.32
Lithuania	0.35	0.34	0.32	0.39	0.36	0.38	0.41	0.38	0.38	0.41
Luxembourg	0.98	0.95	0.89	1.09	0.99	1.07	1.15	1.06	1.05	1.14
Malta	0.31	0.30	0.28	0.34	0.31	0.34	0.36	0.33	0.33	0.36
Netherlands	1.45	1.41	1.32	1.61	1.47	1.58	1.70	1.56	1.56	1.69
Norway	0.20	0.20	0.18	0.23	0.21	0.22	0.24	0.22	0.22	0.24
Poland	0.71	0.69	0.65	0.79	0.72	0.78	0.84	0.77	0.77	0.83
Portugal	0.48	0.47	0.44	0.54	0.49	0.53	0.57	0.52	0.52	0.56
Romania	0.54	0.52	0.49	0.60	0.54	0.59	0.63	0.58	0.58	0.63
Slovakia	0.76	0.75	0.70	0.85	0.78	0.84	0.90	0.83	0.82	0.89
Slovenia	0.81	0.79	0.74	0.90	0.82	0.89	0.95	0.87	0.87	0.94
Spain	0.46	0.45	0.42	0.51	0.47	0.50	0.54	0.50	0.50	0.54
Sweden	0.36	0.36	0.33	0.41	0.37	0.40	0.43	0.39	0.39	0.43
Switzerland	1.06	1.03	0.97	1.18	1.07	1.16	1.24	1.14	1.14	1.23
UK	0.87	0.84	0.79	0.96	0.88	0.95	1.02	0.94	0.93	1.01

* The impact domain covers all member states and cooperating countries of the EEA plus the UK (EEA38+UK).

Table A2.5 - Mean marginal damage costs of Benzo(a)pyrene emissions 2012-2021 (€2021 per kg)

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Europe	**1 327**	**1 294**	**1 212**	**1 478**	**1 346**	**1 454**	**1 561**	**1 435**	**1 429**	**1 549**
Austria	1 326	1 294	1 212	1 477	1 346	1 454	1 561	1 434	1 428	1 548
Balkans	1 006	981	919	1 120	1 021	1 103	1 184	1 088	1 083	1 174
Belgium	2 189	2 135	2 000	2 438	2 222	2 400	2 577	2 368	2 358	2 556
Bulgaria	730	712	667	813	741	801	859	790	786	853
Croatia	1 303	1 271	1 190	1 451	1 322	1 428	1 533	1 409	1 403	1 521
Cyprus	879	858	803	979	892	964	1 035	951	947	1 027
Czechia	1 327	1 295	1 213	1 479	1 347	1 455	1 562	1 436	1 430	1 550
Denmark	652	636	595	726	661	714	767	705	702	761
Estonia	359	351	328	400	365	394	423	389	387	420
Finland	359	351	328	400	365	394	423	389	387	420
France	1 575	1 537	1 439	1 755	1 599	1 727	1 854	1 704	1 697	1 839
Germany	1 973	1 925	1 803	2 198	2 003	2 164	2 323	2 135	2 125	2 304
Greece	758	739	692	844	769	831	892	820	816	885
Hungary	1 256	1 225	1 147	1 399	1 274	1 377	1 478	1 358	1 352	1 466
Ireland	675	659	617	752	685	740	795	730	727	788
Italy	1 426	1 391	1 303	1 589	1 448	1 564	1 679	1 543	1 536	1 665
Latvia	436	425	398	485	442	478	513	471	469	509
Lithuania	566	552	517	631	575	621	666	612	610	661
Luxembourg	1 579	1 540	1 443	1 759	1 603	1 731	1 859	1 708	1 701	1 844
Malta	495	483	452	551	503	543	583	536	533	578
Netherlands	2 332	2 275	2 131	2 598	2 367	2 557	2 745	2 523	2 512	2 723
Norway	326	318	298	363	331	358	384	353	351	381
Poland	1 149	1 121	1 050	1 280	1 166	1 260	1 352	1 243	1 237	1 342
Portugal	775	756	708	863	787	850	912	838	835	905
Romania	865	843	790	963	878	948	1 018	935	931	1 010
Slovakia	1 234	1 204	1 127	1 374	1 252	1 353	1 452	1 335	1 329	1 441
Slovenia	1 303	1 271	1 190	1 451	1 322	1 428	1 533	1 409	1 403	1 521
Spain	743	724	679	827	754	814	874	803	800	867
Sweden	589	574	538	656	598	646	693	637	634	687
Switzerland	1 706	1 664	1 559	1 901	1 732	1 871	2 008	1 846	1 838	1 992
UK	1 396	1 362	1 276	1 555	1 417	1 531	1 643	1 510	1 504	1 630

* The impact domain covers all member states and cooperating countries of the EEA plus the UK (EEA38+UK).

Table A2.6 - Mean marginal damage costs of formaldehyde emissions 2012-2021 (€2021 per kg)

Country	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021
Europe	**0.28**	**0.27**	**0.25**	**0.31**	**0.28**	**0.30**	**0.32**	**0.30**	**0.30**	**0.32**
Austria	0.27	0.27	0.25	0.31	0.28	0.30	0.32	0.30	0.30	0.32
Balkans	0.21	0.20	0.19	0.23	0.21	0.23	0.25	0.23	0.30	0.24
Belgium	0.45	0.44	0.41	0.51	0.46	0.50	0.53	0.49	0.22	0.53
Bulgaria	0.15	0.15	0.14	0.17	0.15	0.17	0.18	0.16	0.49	0.18
Croatia	0.27	0.26	0.25	0.30	0.27	0.30	0.32	0.29	0.16	0.32
Cyprus	0.18	0.18	0.17	0.20	0.19	0.20	0.21	0.20	0.29	0.21
Czechia	0.28	0.27	0.25	0.31	0.28	0.30	0.32	0.30	0.20	0.32
Denmark	0.14	0.13	0.12	0.15	0.14	0.15	0.16	0.15	0.30	0.16
Estonia	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.08	0.15	0.09
Finland	0.07	0.07	0.07	0.08	0.08	0.08	0.09	0.08	0.08	0.09
France	0.33	0.32	0.30	0.36	0.33	0.36	0.38	0.35	0.08	0.38
Germany	0.41	0.40	0.37	0.46	0.42	0.45	0.48	0.44	0.35	0.48
Greece	0.16	0.15	0.14	0.18	0.16	0.17	0.18	0.17	0.44	0.18
Hungary	0.26	0.25	0.24	0.29	0.26	0.29	0.31	0.28	0.17	0.30
Ireland	0.14	0.14	0.13	0.16	0.14	0.15	0.16	0.15	0.28	0.16
Italy	0.30	0.29	0.27	0.33	0.30	0.32	0.35	0.32	0.15	0.35
Latvia	0.09	0.09	0.08	0.10	0.09	0.10	0.11	0.10	0.32	0.11
Lithuania	0.12	0.11	0.11	0.13	0.12	0.13	0.14	0.13	0.10	0.14
Luxembourg	0.33	0.32	0.30	0.36	0.33	0.36	0.39	0.35	0.13	0.38
Malta	0.10	0.10	0.09	0.11	0.10	0.11	0.12	0.11	0.35	0.12
Netherlands	0.48	0.47	0.44	0.54	0.49	0.53	0.57	0.52	0.11	0.56
Norway	0.07	0.07	0.06	0.08	0.07	0.07	0.08	0.07	0.52	0.08
Poland	0.24	0.23	0.22	0.27	0.24	0.26	0.28	0.26	0.07	0.28
Portugal	0.16	0.16	0.15	0.18	0.16	0.18	0.19	0.17	0.26	0.19
Romania	0.18	0.17	0.16	0.20	0.18	0.20	0.21	0.19	0.17	0.21
Slovakia	0.26	0.25	0.23	0.28	0.26	0.28	0.30	0.28	0.19	0.30
Slovenia	0.27	0.26	0.25	0.30	0.27	0.30	0.32	0.29	0.28	0.32
Spain	0.15	0.15	0.14	0.17	0.16	0.17	0.18	0.17	0.29	0.18
Sweden	0.12	0.12	0.11	0.14	0.12	0.13	0.14	0.13	0.17	0.14
Switzerland	0.35	0.35	0.32	0.39	0.36	0.39	0.42	0.38	0.13	0.41
UK	0.29	0.28	0.26	0.32	0.29	0.32	0.34	0.31	0.38	0.34

* The impact domain covers all member states and cooperating countries of the EEA plus the UK (EEA38+UK).

Table A2.7 – Mean European marginal damage costs of heavy metals and dioxins emissions 2012-2021 (€2021 per kg)

Year	Arsenic	Cadmium	Lead	Mercury	Dioxins and furans
2012	9 086	226 081	40 941	16 964	122 600 000
2013	9 169	228 987	41 282	17 317	119 6000 000
2014	9 400	234 206	42 254	17 868	112 000 000
2015	9 659	239 636	43 161	17 787	136 600 000
2016	9 939	246 035	44 340	17 733	124 400 000
2017	10 204	252 540	45 402	17 658	134 400 000
2018	10 448	257 793	46 191	17 459	144 300 000
2019	10 328	253 058	45 201	16 755	132 600 000
2020	10 294	252 133	45 013	16 869	132 100 000
2021	10 563	259 949	46 231	17 475	143 200 000

The impact domain covers all member states and cooperating countries of the EEA plus the UK (EEA38+UK).

Annex 3 Marginal damage costs (MDCs) for impacts on health - Main air pollutants – 2012-2021

Table A3.1 – Damage to health in EEA38+UK per tonne of pollutant emissions in 2012 for the $PM_{2.5}$ precursors (€2021/t)

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SO_x (VOLY)	SO_x (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Albania	10 334	21 776	106 768	209 710	63 552	124 828	34 241	73 361	1 033	2 591	12 118	25 193
Austria	25 243	72 070	177 279	490 879	94 801	262 502	63 859	180 711	3 154	8 941	26 069	73 070
Bosnia and Herzegovina	12 153	33 529	84 733	215 406	50 436	128 218	23 455	64 024	1 261	3 388	20 468	52 465
Belgium	19 632	55 455	214 601	600 351	144 028	402 920	56 716	158 671	3 541	9 952	59 299	167 046
Bulgaria	9 751	28 021	85 405	275 251	54 398	175 319	25 850	75 207	925	2 345	21 830	67 323
Switzerland	45 901	127 425	288 755	773 673	125 546	336 380	106 776	292 203	4 546	12 929	24 335	66 599
Cyprus	3 528	3 440	49 719	20 128	25 111	10 166	10 495	11 634	603	916	8 091	2 650
Czechia	20 471	56 588	113 469	303 341	86 618	231 558	39 589	109 475	2 332	6 421	37 784	103 519
Germany	21 363	61 330	195 670	580 865	88 539	262 835	48 407	140 123	2 734	7 707	32 280	93 716
Denmark	6 629	18 310	54 848	146 070	30 813	82 062	20 207	54 919	853	2 288	14 073	37 938
Estonia	1 681	4 288	26 946	43 288	17 163	27 572	4 150	10 162	475	1 196	5 589	11 007
Spain	5 927	16 393	78 200	214 671	54 306	149 077	31 613	87 620	1 420	3 922	8 885	24 481
Finland	1 344	3 650	42 762	117 489	23 625	64 911	8 052	21 517	415	1 064	5 517	14 980
France	17 285	48 987	113 663	323 463	68 062	193 690	41 117	117 107	1 827	5 138	16 001	45 330
United Kingdom	12 709	35 537	181 130	509 545	115 369	324 551	45 248	127 020	1 491	4 156	44 272	123 902
Greece	2 937	6 605	74 797	220 815	45 332	133 827	17 911	45 979	1 587	4 103	16 971	49 232
Croatia	16 263	47 248	79 119	238 341	55 328	166 672	40 997	119 830	1 812	5 066	19 117	55 446
Hungary	17 252	49 012	107 218	309 712	68 729	198 533	39 131	110 741	1 596	4 347	25 981	72 945
Ireland	9 068	23 531	31 245	64 852	13 353	27 715	27 364	67 235	835	2 331	6 680	17 080
Iceland	529	1 837	16 113	7 165	8 663	3 852	3 448	5 776	528	1 390	-1 042	284
Italy	25 387	78 303	182 419	568 155	148 308	461 915	41 614	125 946	3 947	11 843	27 700	85 470
Lithuania	4 023	10 754	76 888	205 056	35 762	95 375	11 032	29 021	392	989	7 230	19 130
Luxembourg	24 889	70 294	84 635	212 298	54 958	137 856	62 269	174 010	2 490	7 011	28 006	73 881
Latvia	2 911	7 712	43 947	114 975	29 694	77 686	11 901	30 896	539	1 374	6 388	16 439

Country	PM2.5 precursor											
	NOX (VOLY)	NOX (VSL)	PM2.5 (VOLY)	PM2.5 (VSL)	PM10 (VOLY)	PM10 (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH3 (VOLY)	NH3 (VSL)
Moldova	4 558	12 369	18 018	48 559	10 725	28 904	13 754	36 090	831	1 958	6 388	16 464
Montenegro	7 138	16 119	40 311	52 473	33 874	44 095	15 476	39 826	1 102	2 785	11 049	17 037
North Macedonia	7 202	18 262	94 994	198 532	56 544	118 174	17 751	44 047	1 249	2 942	27 988	62 143
Malta	550	2 122	59 047	28 333	22 366	10 732			1 040	2 316	33 898	12 794
Netherlands	18 633	53 035	187 398	499 220	104 691	278 894	49 155	135 682	3 276	9 162	45 446	125 283
Norway	2 338	6 465	24 476	63 583	17 997	46 752	9 969	26 629	589	1 582	5 823	15 259
Poland	10 602	28 487	131 302	343 596	73 353	191 953	24 439	65 608	1 198	3 173	26 792	70 908
Portugal	4 546	13 152	87 829	258 808	62 290	183 551	16 056	46 148	894	2 524	11 493	33 793
Romania	14 148	40 935	81 601	239 920	59 563	175 124	32 142	91 798	1 063	2 753	17 410	49 254
Serbia and Kosovo	9 885	28 711	107 334	332 598	63 889	197 975	22 250	63 133	755	1 940	26 341	78 581
Sweden	3 284	9 084	32 700	91 193	15 646	43 633	10 523	28 799	675	1 793	9 422	25 929
Slovenia	27 570	78 519	118 069	293 315	95 217	236 545	55 255	152 674	3 059	8 781	27 454	73 877
Slovakia	16 828	45 843	93 183	239 076	71 679	183 905	36 595	98 789	1 538	4 153	34 520	91 060
Turkey	6 937	10 050	118 945	166 829	70 801	99 303	18 626	27 396	968	1 512	20 268	29 076

Missing emitter countries: Liechtenstein and Kosovo

Table A3.2 – Damage to health in EEA38+UK per tonne of pollutant emissions in 2013 for the PM2.5 precursors (€2021/t)

Country	PM2.5 precursor											
	NOX (VOLY)	NOX (VSL)	PM2.5 (VOLY)	PM2.5 (VSL)	PM10 (VOLY)	PM10 (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH3 (VOLY)	NH3 (VSL)
Albania	10 321	21 794	106 854	210 590	63 604	125 351	34 183	73 486	1 029	2 587	12 101	25 249
Austria	25 301	73 073	177 970	496 678	95 171	265 603	64 043	183 209	3 160	9 043	26 140	74 034
Bosnia and Herzegovina	12 130	35 127	85 377	245 592	50 819	146 186	23 408	66 489	1 256	3 415	20 597	59 012
Belgium	19 755	56 445	215 956	615 452	144 937	413 055	57 045	161 890	3 562	10 135	59 706	170 806
Bulgaria	9 622	27 368	84 036	264 765	53 526	168 640	25 514	73 395	918	2 322	21 511	64 982
Switzerland	46 302	130 302	292 078	795 789	126 991	345 995	107 799	299 468	4 567	13 117	24 559	68 151

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SO_x (VOLY)	SO_x (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Cyprus	3 537	3 431	50 026	20 271	25 266	10 238	10 512	11 592	602	912	8 144	2 678
Czechia	20 503	57 457	113 599	306 724	86 717	234 140	39 625	110 963	2 334	6 498	37 839	105 041
Germany	21 498	62 806	197 279	599 428	89 266	271 234	48 689	143 675	2 745	7 836	32 500	96 317
Denmark	6 661	18 817	55 073	151 949	30 940	85 364	20 274	56 502	854	2 316	14 124	39 093
Estonia	1 677	4 389	26 595	47 366	16 940	30 169	4 134	10 364	475	1 207	5 540	11 575
Spain	5 879	16 092	77 416	209 807	53 761	145 699	31 358	86 013	1 412	3 877	8 806	23 987
Finland	1 345	3 676	42 737	114 394	23 612	63 201	8 045	21 373	415	1 074	5 514	14 699
France	17 374	49 510	114 122	324 028	68 337	194 029	41 278	117 986	1 832	5 182	16 082	45 706
United Kingdom	12 823	36 167	183 272	518 908	116 734	330 515	45 714	129 298	1 500	4 218	44 736	126 191
Greece	2 914	6 521	73 627	216 784	44 623	131 384	17 713	45 280	1 571	4 049	16 716	48 344
Croatia	16 168	47 497	78 347	238 557	54 788	166 823	40 768	119 984	1 806	5 069	18 996	55 949
Hungary	17 125	49 071	106 164	309 536	68 054	198 420	38 844	110 891	1 591	4 362	25 805	73 185
Ireland	9 145	24 114	31 442	68 071	13 437	29 090	27 575	69 247	838	2 358	6 729	17 533
Iceland	529	1 870	16 601	7 275	8 925	3 911	3 509	5 875	530	1 407	-1 081	289
Italy	25 300	77 644	181 734	562 511	147 752	457 326	41 465	124 975	3 935	11 764	27 602	84 728
Lithuania	4 006	10 954	76 255	206 769	35 468	96 172	10 972	29 473	392	995	7 182	19 430
Luxembourg	25 052	71 697	85 339	217 233	55 415	141 060	62 700	178 164	2 501	7 126	28 226	75 538
Latvia	2 898	7 906	43 182	119 784	29 177	80 935	11 759	31 899	538	1 388	6 315	16 998
Moldova	4 506	12 281	17 813	48 193	10 603	28 686	13 614	35 830	827	1 953	6 329	16 371
Montenegro	7 104	16 176	40 186	52 740	33 770	44 319	15 387	39 989	1 097	2 783	11 007	17 191
North Macedonia	7 124	18 078	93 443	198 835	55 621	118 354	17 564	43 734	1 237	2 937	27 545	62 029
Malta	546	2 103	59 216	28 488	22 430	10 791			1 037	2 304	34 006	12 924
Netherlands	18 764	54 242	188 337	504 043	105 216	281 588	49 424	137 868	3 294	9 322	45 729	127 408
Norway	2 353	6 590	24 756	63 181	18 203	46 457	10 046	26 845	591	1 598	5 880	15 236
Poland	10 590	28 941	131 053	349 542	73 214	195 275	24 388	66 472	1 197	3 201	26 750	72 109

Country	PM2.5 precursor											
	NOX (VOLY)	NOX (VSL)	PM2.5 (VOLY)	PM2.5 (VSL)	PM10 (VOLY)	PM10 (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH3 (VOLY)	NH3 (VSL)
Portugal	4 507	12 892	87 040	253 463	61 731	179 761	15 919	45 252	888	2 492	11 390	33 102
Romania	13 951	40 564	80 350	237 752	58 650	173 542	31 727	90 981	1 056	2 747	17 188	48 825
Serbia and Kosovo	9 781	28 399	105 995	324 974	63 092	193 437	22 058	62 676	752	1 943	26 059	77 457
Sweden	3 299	9 325	32 974	95 291	15 777	45 594	10 571	29 634	675	1 813	9 479	26 875
Slovenia	27 498	78 908	117 925	302 505	95 101	243 956	55 168	154 224	3 052	8 787	27 408	75 028
Slovakia	16 756	46 055	92 806	238 557	71 389	183 505	36 450	99 105	1 535	4 185	34 397	91 364
Turkey	6 932	9 996	118 910	166 059	70 779	98 844	18 609	27 242	966	1 505	20 256	28 920

Missing emitter countries: Liechtenstein and Kosovo

Table A3.3 – Damage to health in EEA38+UK per tonne of pollutant emissions in 2014 for the PM2.5 precursors (€2021/t)

Country	PM2.5 precursor											
	NOX (VOLY)	NOX (VSL)	PM2.5 (VOLY)	PM2.5 (VSL)	PM10 (VOLY)	PM10 (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH3 (VOLY)	NH3 (VSL)
Albania	10 416	21 604	107 711	206 036	64 114	122 640	34 506	73 062	1 041	2 639	12 211	24 998
Austria	25 524	73 829	180 120	506 178	96 321	270 683	64 674	185 708	3 190	9 131	26 399	75 095
Bosnia and Herzegovina	12 306	37 592	87 225	278 014	51 920	165 484	23 739	70 509	1 271	3 522	21 011	66 135
Belgium	19 930	56 635	217 530	615 018	145 993	412 764	57 505	162 443	3 597	10 198	60 226	171 096
Bulgaria	9 792	28 374	85 738	274 197	54 610	174 648	25 952	75 988	933	2 392	21 935	67 290
Switzerland	46 885	127 880	296 539	769 240	128 930	334 452	109 228	292 560	4 616	13 083	24 880	66 672
Cyprus	3 609	3 579	50 835	20 985	25 674	10 598	10 740	12 103	616	951	8 270	2 761
Czechia	20 600	58 005	113 774	311 686	86 851	237 928	39 827	112 254	2 353	6 571	37 993	106 239
Germany	21 665	62 796	198 641	597 039	89 883	270 153	49 030	143 701	2 770	7 885	32 733	96 178
Denmark	6 721	18 691	55 682	147 598	31 282	82 920	20 460	55 929	863	2 337	14 261	38 574
Estonia	1 691	4 387	26 936	44 252	17 157	28 186	4 174	10 389	481	1 223	5 610	11 193
Spain	5 929	16 458	78 088	214 842	54 228	149 196	31 625	87 937	1 425	3 954	8 883	24 544
Finland	1 359	3 698	43 475	116 283	24 019	64 245	8 153	21 606	420	1 088	5 603	14 898

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
France	17 531	49 659	115 046	324 734	68 890	194 451	41 633	118 465	1 850	5 229	16 227	45 882
United Kingdom	12 993	36 502	186 372	525 440	118 708	334 675	46 406	130 708	1 518	4 259	45 418	127 600
Greece	2 965	6 758	74 532	225 710	45 171	136 794	17 982	46 995	1 594	4 197	16 931	50 271
Croatia	16 318	48 872	79 060	247 099	55 287	172 796	41 137	122 897	1 825	5 170	19 175	57 878
Hungary	17 266	50 280	107 082	317 045	68 642	203 234	39 177	113 423	1 607	4 447	26 010	74 778
Ireland	9 271	24 576	31 874	71 498	13 622	30 555	27 955	71 063	846	2 378	6 814	17 869
Iceland	535	1 885	16 763	7 429	9 012	3 994	3 546	5 933	536	1 421	-1 091	285
Italy	25 580	78 922	183 777	572 140	149 412	465 155	41 919	127 124	3 978	11 961	27 905	86 139
Lithuania	4 010	11 062	75 592	205 976	35 159	95 803	10 977	29 765	397	1 013	7 168	19 592
Luxembourg	25 267	71 804	86 270	217 336	56 019	141 127	63 225	178 175	2 525	7 177	28 522	75 628
Latvia	2 908	8 057	43 146	129 605	29 153	87 571	11 777	33 604	545	1 412	6 333	17 842
Moldova	4 572	12 682	18 077	49 795	10 760	29 640	13 813	36 963	840	2 007	6 420	16 857
Montenegro	7 190	16 701	40 704	54 534	34 205	45 827	15 583	41 449	1 111	2 850	11 149	17 912
North Macedonia	7 222	18 426	94 924	193 612	56 502	115 245	17 810	44 409	1 255	2 961	27 967	61 148
Malta	553	2 147	60 066	29 306	22 752	11 101			1 051	2 355	34 494	13 315
Netherlands	18 933	54 381	190 332	514 033	106 331	287 169	49 880	139 247	3 326	9 393	46 189	128 771
Norway	2 377	6 559	25 149	60 683	18 492	44 620	10 176	26 336	597	1 611	5 965	14 764
Poland	10 614	29 012	130 897	348 181	73 127	194 515	24 477	66 845	1 208	3 243	26 770	72 046
Portugal	4 519	13 377	87 076	264 400	61 756	187 518	15 978	46 851	894	2 562	11 398	34 512
Romania	14 153	42 037	81 561	246 831	59 534	180 169	32 187	94 240	1 070	2 824	17 436	50 532
Serbia and Kosovo	9 893	29 406	107 147	338 981	63 778	201 774	22 317	64 858	762	1 987	26 351	80 587
Sweden	3 331	9 293	33 543	94 224	16 049	45 083	10 699	29 493	682	1 833	9 609	26 637
Slovenia	27 727	79 770	118 433	299 363	95 511	241 421	55 580	155 458	3 082	8 912	27 585	75 293
Slovakia	16 852	46 726	93 399	240 468	71 845	184 975	36 707	100 567	1 549	4 246	34 603	92 279
Turkey	7 100	10 446	121 826	173 646	72 516	103 361	19 053	28 454	989	1 567	20 749	30 230

Missing emitter countries: Liechtenstein and Kosovo

Table A3.4 – Damage to health in EEA38+UK per tonne of pollutant emissions in 2015 for the $PM_{2.5}$ precursors (€2021/t)

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Albania	10 567	23 077	109 043	220 544	64 907	131 276	35 018	78 088	1 066	2 810	12 383	26 711
Austria	26 272	79 143	185 929	538 220	99 427	287 818	66 615	198 303	3 283	9 807	27 190	80 141
Bosnia and Herzegovina	12 463	38 589	87 175	274 281	51 890	163 263	24 095	73 031	1 300	3 724	21 046	65 633
Belgium	20 542	60 762	224 294	650 858	150 533	436 817	59 258	173 329	3 706	10 921	62 095	182 349
Bulgaria	9 918	29 859	85 567	289 601	54 501	184 459	26 259	80 104	954	2 530	21 986	71 021
Switzerland	48 466	139 483	307 130	846 476	133 535	368 033	112 963	319 722	4 760	14 171	25 725	72 803
Cyprus	3 724	3 761	52 063	21 818	26 295	11 019	11 101	12 729	639	1 003	8 459	2 858
Czechia	21 147	61 927	116 642	333 143	89 040	254 307	40 867	119 861	2 418	7 026	38 980	113 411
Germany	22 316	67 416	204 746	641 475	92 645	290 260	50 478	154 119	2 851	8 455	33 711	103 188
Denmark	6 901	20 163	56 922	162 988	31 979	91 566	20 969	60 485	887	2 499	14 610	41 823
Estonia	1 722	4 619	27 051	45 322	17 230	28 867	4 251	10 899	494	1 301	5 658	11 474
Spain	6 072	17 931	79 947	235 261	55 519	163 376	32 396	95 830	1 462	4 291	9 097	26 803
Finland	1 386	3 845	43 965	114 570	24 290	63 298	8 283	21 960	432	1 156	5 674	14 824
France	18 075	53 365	118 658	349 174	71 053	209 086	42 905	127 383	1 904	5 624	16 731	49 283
United Kingdom	13 410	39 117	192 635	562 778	122 697	358 458	47 924	140 014	1 564	4 563	46 906	136 683
Greece	3 049	7 143	76 302	237 517	46 244	143 950	18 437	49 577	1 635	4 431	17 324	52 945
Croatia	16 701	51 771	80 898	258 199	56 572	180 559	42 164	130 857	1 873	5 539	19 601	60 731
Hungary	17 654	53 244	109 518	338 041	70 204	216 693	40 069	120 517	1 648	4 740	26 598	79 340
Ireland	9 558	26 283	32 750	75 958	13 996	32 461	28 788	75 872	871	2 551	7 018	19 100
Iceland	550	2 020	17 388	7 766	9 348	4 175	3 665	6 334	551	1 521	-1 134	320
Italy	26 315	86 053	189 069	624 535	153 715	507 752	43 103	138 312	4 092	13 001	28 705	93 907
Lithuania	4 090	11 849	76 812	224 963	35 727	104 634	11 188	31 895	409	1 079	7 291	21 090

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Luxembourg	26 048	76 978	89 056	232 288	57 829	150 836	65 176	190 934	2 600	7 697	29 424	81 020
Latvia	2 961	8 565	43 280	136 736	29 243	92 389	11 898	35 536	560	1 504	6 393	18 805
Moldova	4 668	13 318	18 464	52 283	10 991	31 121	14 116	38 860	862	2 123	6 563	17 739
Montenegro	7 315	17 523	41 398	56 844	34 788	47 768	15 876	43 566	1 137	3 027	11 335	18 563
North Macedonia	7 360	19 659	96 721	217 952	57 572	129 733	18 167	47 639	1 284	3 207	28 496	67 882
Malta	567	2 325	62 102	31 198	23 523	11 817			1 082	2 537	35 672	14 109
Netherlands	19 511	58 338	195 992	553 088	109 493	308 987	51 371	149 505	3 426	10 070	47 580	138 297
Norway	2 443	7 028	25 783	64 827	18 958	47 667	10 439	28 111	614	1 722	6 116	15 759
Poland	10 872	30 824	133 951	368 759	74 833	206 011	25 064	70 932	1 240	3 455	27 402	76 425
Portugal	4 599	14 169	88 374	277 188	62 676	196 587	16 277	49 838	914	2 738	11 571	36 215
Romania	14 433	44 060	83 171	258 294	60 709	188 536	32 822	98 864	1 096	2 984	17 785	52 983
Serbia and Kosovo	10 067	30 799	108 660	350 934	64 679	208 889	22 726	68 060	782	2 113	26 746	83 777
Sweden	3 421	9 935	34 530	100 150	16 522	47 919	10 979	31 341	701	1 957	9 872	28 400
Slovenia	28 483	86 646	121 432	331 423	97 929	267 277	57 079	168 808	3 167	9 644	28 312	82 026
Slovakia	17 255	49 512	95 719	252 893	73 630	194 533	37 594	106 442	1 589	4 526	35 442	97 424
Turkey	7 365	11 000	126 471	182 864	75 280	108 847	19 756	29 963	1 024	1 652	21 530	31 835

Missing emitter countries: Liechtenstein and Kosovo

Table A3.5 – Damage to health in EEA38+UK per tonne of pollutant emissions in 2016 for the $PM_{2.5}$ precursors (€2021/t)

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Albania	10 710	23 400	110 596	224 557	65 831	133 665	35 480	79 040	1 079	2 822	12 553	27 098
Austria	26 633	79 073	189 401	538 506	101 284	287 971	67 658	198 393	3 330	9 807	27 620	80 190
Bosnia and Herzegovina	12 470	38 214	86 610	269 474	51 554	160 401	24 170	72 424	1 313	3 722	20 946	64 623
Belgium	20 934	61 415	228 459	653 120	153 328	438 336	60 381	174 571	3 776	11 010	63 282	183 718

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Bulgaria	10 011	30 001	86 179	289 175	54 891	184 188	26 496	80 330	969	2 552	22 185	71 070
Switzerland	49 214	138 802	311 913	836 996	135 614	363 911	114 732	317 781	4 828	14 135	26 130	72 464
Cyprus	3 848	3 964	53 604	22 763	27 073	11 497	11 483	13 436	661	1 054	8 702	2 958
Czechia	21 405	62 179	117 868	335 863	89 976	256 384	41 346	120 314	2 452	7 053	39 440	113 979
Germany	22 701	67 800	208 400	644 780	94 299	291 755	51 310	154 883	2 897	8 496	34 293	103 748
Denmark	7 031	20 127	58 154	159 288	32 671	89 487	21 356	60 087	902	2 511	14 890	41 447
Estonia	1 751	4 739	27 566	50 547	17 558	32 196	4 325	11 220	503	1 318	5 771	12 408
Spain	6 147	17 871	80 833	233 159	56 134	161 916	32 784	95 460	1 480	4 280	9 204	26 643
Finland	1 413	3 962	45 188	123 526	24 966	68 246	8 475	23 060	440	1 172	5 824	15 855
France	18 401	54 045	120 745	356 138	72 302	213 256	43 631	128 890	1 934	5 654	17 036	50 065
United Kingdom	13 701	39 694	197 203	572 585	125 607	364 704	49 006	142 229	1 595	4 610	47 977	138 864
Greece	3 108	7 252	76 589	237 248	46 418	143 786	18 664	49 897	1 656	4 458	17 414	52 948
Croatia	16 765	51 328	80 761	255 245	56 476	178 493	42 357	129 687	1 891	5 514	19 647	60 227
Hungary	17 750	53 036	110 002	336 025	70 514	215 401	40 315	120 057	1 667	4 741	26 770	79 074
Ireland	9 779	26 706	33 608	77 441	14 362	33 094	29 475	77 146	886	2 569	7 176	19 380
Iceland	558	2 041	18 123	7 984	9 743	4 292	3 777	6 417	562	1 533	-1 190	314
Italy	26 478	84 603	190 131	613 186	154 578	498 525	43 402	136 293	4 124	12 831	28 879	92 342
Lithuania	4 136	12 022	77 157	233 776	35 887	108 733	11 307	32 465	417	1 090	7 358	21 615
Luxembourg	26 535	77 708	90 973	234 216	59 074	152 088	66 396	192 307	2 646	7 742	30 023	81 755
Latvia	3 001	8 645	43 736	135 487	29 552	91 545	12 038	35 545	570	1 519	6 477	18 889
Moldova	4 711	13 441	18 638	52 786	11 094	31 420	14 275	39 252	878	2 152	6 646	17 949
Montenegro	7 388	17 541	42 017	56 974	35 308	47 877	16 014	43 529	1 151	3 035	11 486	18 596
North Macedonia	7 449	19 801	98 580	221 848	58 678	132 053	18 407	47 999	1 305	3 241	28 991	68 882
Malta	565	2 301	64 519	31 665	24 439	11 994			1 102	2 528	37 104	14 419
Netherlands	19 887	58 830	200 495	560 136	112 009	312 925	52 418	150 991	3 491	10 153	48 583	139 759

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Norway	2 491	7 044	26 454	63 686	19 451	46 828	10 673	27 957	625	1 731	6 264	15 551
Poland	10 986	30 903	135 146	369 165	75 501	206 237	25 321	71 076	1 258	3 471	27 670	76 563
Portugal	4 673	14 616	89 928	289 587	63 779	205 381	16 527	51 128	927	2 784	11 773	37 793
Romania	14 497	44 310	83 404	259 951	60 879	189 745	33 005	99 397	1 111	3 006	17 894	53 334
Serbia and Kosovo	10 126	30 819	109 154	351 557	64 973	209 260	22 892	68 086	793	2 123	26 892	83 870
Sweden	3 487	9 972	35 447	99 624	16 960	47 667	11 213	31 435	713	1 968	10 100	28 321
Slovenia	28 726	85 989	122 869	333 349	99 088	268 830	57 671	168 273	3 198	9 577	28 606	81 932
Slovakia	17 380	49 387	96 306	250 932	74 081	193 025	37 891	106 120	1 610	4 536	35 704	97 013
Turkey	7 632	11 612	131 181	193 726	78 084	115 313	20 459	31 564	1 059	1 730	22 319	33 651

Missing emitter countries: Liechtenstein and Kosovo

Table A3.6 – Damage to health in EEA38+UK per tonne of pollutant emissions in 2017 for the $PM_{2.5}$ precursors (€2021/t)

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Albania	10 891	24 228	112 418	231 214	66 916	137 628	36 090	82 107	1 101	2 952	12 761	28 104
Austria	27 312	82 815	194 574	557 037	104 050	297 881	69 386	206 780	3 412	10 303	28 331	83 560
Bosnia and Herzegovina	12 686	39 648	87 592	274 069	52 138	163 136	24 611	75 355	1 341	3 899	21 202	65 917
Belgium	21 435	64 287	234 120	687 355	157 127	461 312	61 830	183 047	3 867	11 523	64 831	192 630
Bulgaria	10 122	31 028	87 293	306 587	55 600	195 279	26 858	83 810	986	2 655	22 486	75 139
Switzerland	50 639	146 124	321 707	881 534	139 872	383 275	118 115	334 293	4 957	14 901	26 894	76 249
Cyprus	3 934	4 110	54 850	23 550	27 702	11 894	11 735	13 934	675	1 094	8 906	3 058
Czechia	21 908	65 039	120 627	349 184	92 082	266 553	42 302	125 760	2 509	7 397	40 359	118 987
Germany	23 244	71 010	213 255	675 091	96 496	305 471	52 509	162 224	2 966	8 908	35 098	108 640
Denmark	7 194	21 098	59 417	168 239	33 380	94 516	21 838	63 085	922	2 631	15 228	43 518
Estonia	1 786	5 053	28 056	60 488	17 870	38 527	4 407	11 957	514	1 381	5 879	14 054

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Spain	6 294	18 764	82 814	245 196	57 510	170 275	33 572	100 302	1 516	4 502	9 427	27 996
Finland	1 442	4 156	46 057	128 795	25 446	71 157	8 642	24 150	450	1 226	5 938	16 578
France	18 852	56 694	123 676	374 292	74 057	224 127	44 699	135 426	1 981	5 938	17 450	52 490
United Kingdom	14 043	41 343	202 327	594 271	128 871	378 516	50 255	147 871	1 634	4 816	49 199	144 328
Greece	3 174	7 591	78 534	248 409	47 596	150 551	19 083	52 213	1 693	4 661	17 839	55 491
Croatia	17 151	53 940	82 448	266 560	57 656	186 406	43 366	136 597	1 937	5 816	20 066	62 996
Hungary	18 126	55 429	112 485	352 320	72 106	225 846	41 177	125 606	1 704	4 975	27 348	82 762
Ireland	10 021	27 638	34 406	78 610	14 703	33 594	30 196	79 475	908	2 692	7 350	20 056
Iceland	570	2 130	18 617	8 343	10 009	4 486	3 873	6 693	575	1 604	-1 223	326
Italy	27 251	90 652	195 754	658 027	159 149	534 982	44 633	145 706	4 239	13 698	29 720	98 949
Lithuania	4 193	12 605	77 040	240 355	35 832	111 793	11 442	33 942	426	1 138	7 417	22 541
Luxembourg	27 183	81 408	93 603	245 632	60 781	159 501	68 054	201 527	2 709	8 112	30 839	85 613
Latvia	3 052	9 171	44 251	147 636	29 899	99 754	12 208	38 265	582	1 590	6 573	20 395
Moldova	4 737	13 489	18 749	52 975	11 160	31 532	14 405	39 777	894	2 229	6 710	18 226
Montenegro	7 516	18 305	42 687	59 404	35 871	49 920	16 306	45 518	1 174	3 176	11 666	19 373
North Macedonia	7 571	20 957	99 563	247 898	59 264	147 558	18 696	50 956	1 326	3 469	29 319	76 133
Malta	579	2 449	66 657	33 512	25 249	12 694			1 132	2 679	38 345	15 242
Netherlands	20 360	61 534	205 027	582 451	114 540	325 392	53 632	157 622	3 574	10 618	49 715	145 722
Norway	2 550	7 335	27 111	64 222	19 934	47 222	10 930	28 726	639	1 809	6 417	15 797
Poland	11 232	32 586	138 363	392 757	77 298	219 417	25 876	74 809	1 286	3 640	28 305	81 043
Portugal	4 746	15 065	91 032	296 509	64 562	210 290	16 808	52 859	946	2 897	11 921	38 715
Romania	14 530	44 096	83 204	255 132	60 733	186 228	33 164	99 667	1 128	3 095	17 967	53 328
Serbia and Kosovo	10 302	32 323	111 225	373 741	66 206	222 465	23 315	71 487	810	2 221	27 386	88 688
Sweden	3 570	10 413	36 475	102 360	17 452	48 976	11 490	32 670	729	2 060	10 365	29 324
Slovenia	29 512	91 401	126 255	355 875	101 818	286 996	59 213	178 355	3 283	10 162	29 370	86 987

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Slovakia	17 770	51 652	98 525	260 187	75 789	200 144	38 727	110 696	1 645	4 758	36 509	101 098
Turkey	7 793	12 032	133 984	200 893	79 752	119 579	20 888	32 715	1 081	1 795	22 792	34 896

Missing emitter countries: Liechtenstein and Kosovo

Table A3.7 – Damage to health in EEA38+UK per tonne of pollutant emissions in 2018 for the $PM_{2.5}$ precursors (€2021/t)

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Albania	10 993	27 453	113 635	272 060	67 640	161 940	36 405	92 066	1 110	3 048	12 879	31 826
Austria	27 671	83 827	198 029	575 262	105 898	307 627	70 408	210 565	3 454	10 392	28 763	85 336
Bosnia and Herzegovina	12 748	40 351	87 764	278 665	52 240	165 872	24 743	76 628	1 352	3 961	21 267	67 049
Belgium	21 799	64 905	238 507	698 180	160 072	468 577	62 915	185 357	3 933	11 674	66 018	195 282
Bulgaria	10 161	31 529	87 664	308 275	55 837	196 353	26 967	84 921	993	2 698	22 596	75 688
Switzerland	51 446	147 144	327 462	891 290	142 375	387 517	120 104	337 315	5 021	14 964	27 347	76 981
Cyprus	3 996	4 185	56 094	24 071	28 330	12 157	11 902	14 181	682	1 113	9 117	3 130
Czechia	22 235	65 882	122 486	352 131	93 501	268 802	42 890	127 174	2 543	7 490	40 961	120 377
Germany	23 599	71 364	216 158	671 300	97 809	303 756	53 252	162 543	3 008	8 984	35 616	108 844
Denmark	7 331	21 673	60 856	178 179	34 189	100 100	22 269	65 323	936	2 678	15 549	45 327
Estonia	1 812	5 095	28 465	57 263	18 131	36 474	4 466	12 053	521	1 401	5 967	13 703
Spain	6 399	19 339	84 223	253 580	58 488	176 097	34 121	103 271	1 538	4 605	9 586	28 900
Finland	1 465	4 226	46 756	130 971	25 832	72 360	8 772	24 561	456	1 245	6 029	16 846
France	19 164	57 264	125 659	377 448	75 245	226 017	45 392	136 619	2 010	6 005	17 746	53 082
United Kingdom	14 340	42 249	207 195	612 323	131 971	390 015	51 389	151 803	1 664	4 905	50 322	148 231
Greece	3 188	7 678	78 274	248 925	47 439	150 863	19 113	52 654	1 697	4 698	17 795	55 670
Croatia	17 266	54 786	82 780	271 164	57 888	189 625	43 658	138 372	1 952	5 884	20 197	64 092
Hungary	18 302	56 626	113 543	359 252	72 784	230 290	41 577	128 178	1 720	5 050	27 640	84 576

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Ireland	10 243	28 162	35 228	79 013	15 055	33 766	30 879	80 781	922	2 733	7 508	20 395
Iceland	577	2 164	19 352	8 653	10 404	4 652	3 984	6 830	585	1 628	-1 278	322
Italy	27 347	90 100	196 297	652 834	159 591	530 760	44 831	145 265	4 261	13 661	29 824	98 355
Lithuania	4 237	12 800	77 167	244 024	35 892	113 500	11 543	34 484	431	1 155	7 466	22 836
Luxembourg	27 634	81 997	95 392	247 303	61 943	160 586	69 149	202 222	2 751	8 206	31 401	86 255
Latvia	3 088	9 257	44 353	145 589	29 968	98 371	12 285	38 138	589	1 613	6 621	20 301
Moldova	4 761	13 900	18 839	54 555	11 214	32 473	14 490	40 872	902	2 272	6 755	18 721
Montenegro	7 566	19 037	43 000	61 920	36 134	52 034	16 404	46 595	1 183	3 255	11 751	19 962
North Macedonia	7 584	21 558	98 769	252 931	58 791	150 554	18 729	52 233	1 328	3 528	29 135	77 463
Malta	569	2 450	69 765	34 178	26 426	12 946			1 148	2 695	40 204	15 630
Netherlands	20 706	62 089	208 966	594 997	116 741	332 400	54 573	159 826	3 634	10 756	50 630	148 103
Norway	2 596	7 484	27 660	66 723	20 338	49 061	11 138	29 584	648	1 840	6 544	16 370
Poland	11 416	33 503	140 924	407 042	78 729	227 398	26 267	76 834	1 302	3 706	28 798	83 667
Portugal	4 830	15 562	92 692	306 561	65 739	217 419	17 101	54 563	960	2 971	12 139	40 032
Romania	14 572	45 507	83 314	264 137	60 813	192 801	33 277	102 603	1 137	3 161	18 037	54 983
Serbia and Kosovo	10 358	33 030	111 646	380 734	66 456	226 627	23 455	72 905	817	2 256	27 525	90 407
Sweden	3 637	10 655	37 344	106 149	17 868	50 789	11 714	33 584	739	2 095	10 589	30 317
Slovenia	29 741	92 604	127 508	370 446	102 829	298 747	59 789	181 775	3 309	10 235	29 656	89 138
Slovakia	18 002	52 969	99 987	269 968	76 913	207 668	39 219	113 608	1 665	4 834	37 029	104 225
Turkey	7 873	12 243	135 401	204 402	80 596	121 668	21 104	33 287	1 092	1 826	23 030	35 499

Missing emitter countries: Liechtenstein and Kosovo

Table A3.8 – Damage to health in EEA38+UK per tonne of pollutant emissions in 2020 for the $PM_{2.5}$ precursors (€2021/t)

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Albania	11 346	29 412	118 107	289 145	70 302	172 110	37 496	98 961	1 119	3 316	13 287	34 193
Austria	27 328	88 731	195 613	599 317	104 606	320 490	69 532	221 792	3 423	11 124	28 419	89 931
Bosnia and Herzegovina	12 610	42 918	86 353	296 374	51 401	176 413	24 548	82 289	1 350	4 293	20 941	71 447
Belgium	21 574	68 918	238 096	762 193	159 796	511 539	62 445	199 099	3 906	12 459	65 673	209 834
Bulgaria	10 189	35 024	87 608	347 910	55 801	221 599	26 998	94 125	1 001	2 988	22 643	85 355
Switzerland	51 122	159 389	326 675	976 845	142 033	424 715	119 487	366 398	4 982	16 140	27 211	83 611
Cyprus	4 091	4 981	55 961	26 294	28 263	13 280	12 263	17 023	712	1 336	9 054	3 256
Czechia	21 960	70 768	120 905	384 310	92 294	293 366	42 380	136 897	2 524	8 063	40 444	129 747
Germany	23 284	75 525	212 336	703 571	96 079	318 358	52 465	171 768	2 981	9 593	35 084	114 746
Denmark	7 223	22 699	59 274	179 787	33 300	101 004	21 899	68 115	932	2 881	15 278	47 033
Estonia	1 778	5 347	27 785	60 815	17 697	38 736	4 401	12 735	522	1 519	5 830	14 275
Spain	6 449	21 269	85 224	280 689	59 183	194 923	34 382	113 579	1 545	5 044	9 680	31 873
Finland	1 437	4 355	45 421	126 119	25 094	69 679	8 583	24 689	456	1 344	5 870	16 445
France	19 005	61 147	124 462	403 273	74 528	241 481	44 999	146 213	1 998	6 452	17 604	56 612
United Kingdom	14 318	44 841	208 328	649 091	132 693	413 433	51 504	161 032	1 658	5 237	50 435	157 192
Greece	3 235	8 478	76 841	256 369	46 570	155 375	19 130	56 382	1 697	5 026	17 537	57 904
Croatia	17 046	57 519	81 077	276 360	56 697	193 259	43 118	146 230	1 943	6 348	19 889	66 870
Hungary	18 110	59 658	112 246	368 068	71 953	235 941	41 175	134 877	1 715	5 457	27 358	89 061
Ireland	10 221	29 837	34 989	83 199	14 952	35 555	30 777	85 457	917	2 928	7 473	21 599
Iceland	569	2 307	19 768	8 925	10 628	4 798	4 015	7 220	583	1 743	-1 315	365
Italy	27 118	98 701	194 621	716 775	158 229	582 744	44 503	158 819	4 233	14 947	29 571	107 729
Lithuania	4 156	13 690	75 275	264 684	35 012	123 109	11 338	37 040	433	1 260	7 296	24 425
Luxembourg	27 352	87 125	94 952	263 536	61 657	171 127	68 390	214 447	2 731	8 761	31 187	91 504
Latvia	3 018	9 764	42 016	147 601	28 389	99 731	11 836	39 496	589	1 747	6 375	20 902

Country	PM2.5 precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Moldova	4 764	15 267	18 862	59 930	11 227	35 672	14 538	45 033	912	2 522	6 783	20 680
Montenegro	7 604	20 533	43 145	66 208	36 256	55 637	16 419	50 580	1 188	3 537	11 757	21 450
North Macedonia	7 689	23 985	102 957	311 197	61 284	185 236	19 022	58 819	1 355	4 043	30 150	93 290
Malta	563	2 696	71 276	36 363	26 998	13 774			1 156	2 956	41 106	16 462
Netherlands	20 479	65 713	206 463	630 418	115 342	352 189	53 934	169 514	3 604	11 451	50 087	156 780
Norway	2 564	7 823	27 071	63 825	19 905	46 930	10 958	29 855	646	1 968	6 420	16 031
Poland	11 299	36 383	139 602	447 751	77 990	250 140	26 033	83 508	1 299	4 026	28 503	91 326
Portugal	4 794	16 729	91 425	326 750	64 841	231 738	17 014	58 854	957	3 215	11 981	42 696
Romania	14 502	49 358	82 779	286 500	60 422	209 124	33 161	111 597	1 141	3 461	17 987	59 984
Serbia and Kosovo	10 342	35 702	111 734	416 427	66 508	247 873	23 430	79 241	820	2 466	27 500	98 681
Sweden	3 592	11 214	37 196	111 810	17 797	53 498	11 597	35 297	737	2 257	10 500	31 861
Slovenia	29 503	98 464	127 318	376 525	102 676	303 649	59 366	192 296	3 288	11 061	29 473	93 287
Slovakia	17 802	56 827	98 675	293 820	75 904	226 015	38 809	122 495	1 657	5 229	36 587	112 872
Turkey	8 223	14 824	141 653	249 285	84 317	148 384	22 012	40 130	1 136	2 177	24 071	43 118

Missing emitter countries: Liechtenstein and Kosovo

Table A3.9 – Damage to health in EEA38+UK per tonne of pollutant emissions in 2021 for the $PM_{2.5}$ precursors (€2021/t)

Country	PM2.5 precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Albania	11 705	33 029	120 893	326 478	71 960	194 332	38 754	110 800	1 171	3 595	13 743	38 584
Austria	28 606	94 535	203 996	634 616	109 089	339 367	72 043	235 404	3 543	11 663	29 496	95 463
Bosnia and Herzegovina	13 281	47 343	90 519	325 564	53 880	193 788	25 719	89 518	1 412	4 627	22 011	78 787
Belgium	22 068	70 821	252 183	734 720	169 250	493 101	64 669	199 775	4 001	12 734	68 210	209 584
Bulgaria	11 156	40 045	95 780	402 094	61 006	256 111	29 474	107 535	1 065	3 296	24 628	98 199
Switzerland	64 884	176 039	464 124	1 123 902	201 793	488 653	157 281	410 785	5 601	17 120	35 436	93 160

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Cyprus	4 301	5 265	60 947	30 186	30 781	15 245	12 781	17 861	728	1 394	9 922	3 912
Czechia	22 764	76 245	125 905	417 808	96 111	318 937	44 020	147 646	2 600	8 524	41 973	140 424
Germany	23 963	79 788	212 658	750 899	96 225	339 773	53 314	182 661	3 064	10 040	35 511	121 845
Denmark	7 434	23 672	60 772	186 662	34 142	104 866	22 689	71 347	965	3 016	15 854	49 043
Estonia	1 838	5 862	28 903	79 864	18 409	50 869	4 581	14 107	541	1 606	6 030	17 332
Spain	6 894	20 954	92 125	274 775	63 975	190 816	36 735	111 947	1 632	5 045	10 398	31 314
Finland	1 474	4 642	45 118	135 201	24 927	74 697	8 738	26 528	472	1 412	5 884	17 668
France	19 738	62 339	128 408	406 772	76 891	243 576	46 536	148 622	2 063	6 621	18 128	57 506
United Kingdom	14 689	45 372	213 991	651 259	136 300	414 815	52 905	162 429	1 703	5 347	51 777	158 439
Greece	3 482	9 488	88 627	302 484	53 713	183 324	21 123	64 491	1 865	5 700	20 062	68 021
Croatia	17 999	62 459	84 161	302 845	58 854	211 779	44 934	155 639	2 010	6 647	20 837	73 104
Hungary	19 671	67 179	122 820	420 065	78 731	269 272	44 523	151 059	1 793	5 861	29 582	100 083
Ireland	10 464	30 356	35 599	86 597	15 213	37 007	31 484	87 431	944	3 005	7 650	22 135
Iceland	520	2 296	26 718	15 476	14 364	8 321	4 770	8 062	612	1 818	-1 893	-152
Italy	26 870	96 979	190 794	698 535	155 117	567 914	44 472	157 425	4 228	14 833	29 258	105 808
Lithuania	4 351	14 844	80 000	289 515	37 209	134 658	11 928	40 391	449	1 325	7 736	26 730
Luxembourg	28 046	89 757	96 585	268 135	62 717	174 114	69 590	222 568	2 798	9 058	31 773	94 526
Latvia	3 158	10 677	45 516	170 640	30 754	115 297	12 622	44 686	612	1 850	6 798	23 695
Moldova	5 226	17 197	20 707	67 569	12 326	40 220	15 799	50 510	962	2 746	7 332	23 088
Montenegro	7 959	22 811	44 910	73 842	37 739	62 052	17 260	55 622	1 244	3 824	12 317	24 181
North Macedonia	8 283	27 253	111 749	357 563	66 517	212 835	20 404	66 193	1 446	4 492	32 787	107 259
Malta	562	2 718	73 338	36 905	27 780	13 979			1 182	3 023	42 318	16 718
Netherlands	20 842	68 008	208 190	643 911	116 307	359 727	54 739	174 598	3 678	11 800	50 765	161 428
Norway	2 650	8 105	28 383	63 604	20 870	46 767	11 479	30 589	668	2 051	6 733	16 200
Poland	11 599	39 098	141 107	479 260	78 831	267 743	26 905	90 144	1 346	4 281	29 165	98 167

Country	$PM_{2.5}$ precursor											
	NO_X (VOLY)	NO_X (VSL)	$PM_{2.5}$ (VOLY)	$PM_{2.5}$ (VSL)	PM_{10} (VOLY)	PM_{10} (VSL)	SOx (VOLY)	SOx (VSL)	VOC (VOLY)	VOC (VSL)	NH_3 (VOLY)	NH_3 (VSL)
Portugal	4 880	16 581	91 161	324 377	64 653	230 055	17 453	58 305	988	3 223	11 972	42 383
Romania	16 247	56 429	93 838	328 578	68 495	239 838	36 832	126 950	1 217	3 805	19 982	68 249
Serbia and Kosovo	11 091	40 707	117 823	480 564	70 133	286 050	24 898	88 952	856	2 640	29 179	113 072
Sweden	3 767	11 636	42 615	110 097	20 390	52 678	12 533	36 335	766	2 373	11 601	32 251
Slovenia	32 233	105 402	165 663	463 132	133 599	373 493	66 318	210 162	3 419	11 430	34 260	105 240
Slovakia	19 391	63 517	116 788	344 750	89 837	265 193	42 731	137 182	1 723	5 602	41 294	128 676
Turkey	8 417	15 436	144 568	258 039	86 053	153 594	22 571	41 926	1 167	2 282	24 605	44 809

Missing emitter countries: Liechtenstein and Kosovo

Table A3.10 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2012 for the O_3 precursors NO_X and NMVOC (€2021/t)

Iso code	Country	O_3 precursor	
		NO_X	VOC
AL	Albania	778	185
AT	Austria	593	400
BA	Bosnia and Herzegovina	1 139	199
BE	Belgium	-535	538
BG	Bulgaria	872	202
CH	Switzerland	640	588
CY	Cyprus	291	98
CZ	Czechia	504	334
DE	Germany	-45	433
DK	Denmark	41	185
EE	Estonia	85	73
ES	Spain	297	242
FI	Finland	126	61
FR	France	494	299
GB	United Kingdom	-329	279
GR	Greece	-21	273
HR	Croatia	1 175	278
HU	Hungary	819	268
IE	Ireland	368	179
IS	Iceland	224	57
IT	Italy	296	567
LT	Lithuania	231	102
LU	Luxembourg	431	427
LV	Latvia	127	90
MD	Moldova	441	98
ME	Montenegro	900	184
MK	North Macedonia	506	193
MT	Malta	-495	157
NL	Netherlands	-550	507
NO	Norway	217	99
PL	Poland	278	239
PT	Portugal	101	188
RO	Romania	838	202
RS	Serbia	548	238
SE	Sweden	234	100
SI	Slovenia	939	446
SK	Slovakia	905	268
TR	Turkey	13	127

Missing emitter countries: Liechtenstein and Kosovo

Table A3.11 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2013 for the O_3 precursors NO_X and NMVOC (€2021/t)

Iso code	Country	O_3 precursor	
		NO_X	VOC
AL	Albania	780	186
AT	Austria	596	403
BA	Bosnia and Herzegovina	1 150	201
BE	Belgium	-542	546
BG	Bulgaria	862	200
CH	Switzerland	645	595
CY	Cyprus	293	99
CZ	Czechia	508	336
DE	Germany	-49	439
DK	Denmark	41	187
EE	Estonia	87	74
ES	Spain	298	240
FI	Finland	127	61
FR	France	498	302
GB	United Kingdom	-335	282
GR	Greece	-15	268
HR	Croatia	1 176	278
HU	Hungary	819	268
IE	Ireland	373	181
IS	Iceland	225	58
IT	Italy	297	565
LT	Lithuania	232	103
LU	Luxembourg	438	432
LV	Latvia	130	91
MD	Moldova	438	98
ME	Montenegro	902	184
MK	North Macedonia	504	191
MT	Malta	-493	157
NL	Netherlands	-557	514
NO	Norway	220	100
PL	Poland	279	241
PT	Portugal	100	187
RO	Romania	831	201
RS	Serbia	546	238
SE	Sweden	236	100
SI	Slovenia	939	446
SK	Slovakia	907	269
TR	Turkey	13	127

Missing emitter countries: Liechtenstein and Kosovo

Table A3.12 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2014 for the O_3 precursors NO_X and NMVOC (€2021/t)

Iso code	Country	O_3 precursor	
		NO_X	VOC
AL	Albania	799	191
AT	Austria	605	408
BA	Bosnia and Herzegovina	1 187	207
BE	Belgium	-541	550
BG	Bulgaria	890	207
CH	Switzerland	653	602
CY	Cyprus	302	101
CZ	Czechia	515	340
DE	Germany	-47	443
DK	Denmark	42	189
EE	Estonia	87	75
ES	Spain	302	245
FI	Finland	127	62
FR	France	504	305
GB	United Kingdom	-341	286
GR	Greece	-15	275
HR	Croatia	1 201	283
HU	Hungary	836	273
IE	Ireland	377	183
IS	Iceland	228	59
IT	Italy	303	576
LT	Lithuania	237	104
LU	Luxembourg	440	436
LV	Latvia	132	92
MD	Moldova	451	100
ME	Montenegro	926	189
MK	North Macedonia	518	197
MT	Malta	-499	160
NL	Netherlands	-563	518
NO	Norway	222	101
PL	Poland	284	244
PT	Portugal	104	190
RO	Romania	856	206
RS	Serbia	561	244
SE	Sweden	239	102
SI	Slovenia	955	453
SK	Slovakia	921	273
TR	Turkey	13	132

Missing emitter countries: Liechtenstein and Kosovo

Table A3.13 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2015 for the O_3 precursors NO_X and NMVOC (€2021/t)

Iso code	Country	O_3 precursor	
		NO_X	VOC
AL	Albania	831	198
AT	Austria	638	431
BA	Bosnia and Herzegovina	1 233	216
BE	Belgium	-572	580
BG	Bulgaria	927	215
CH	Switzerland	691	637
CY	Cyprus	316	106
CZ	Czechia	542	358
DE	Germany	-51	467
DK	Denmark	46	199
EE	Estonia	95	79
ES	Spain	319	259
FI	Finland	135	65
FR	France	533	322
GB	United Kingdom	-360	301
GR	Greece	-17	289
HR	Croatia	1 264	299
HU	Hungary	876	287
IE	Ireland	398	193
IS	Iceland	240	62
IT	Italy	319	612
LT	Lithuania	248	109
LU	Luxembourg	465	461
LV	Latvia	142	96
MD	Moldova	471	105
ME	Montenegro	965	197
MK	North Macedonia	541	205
MT	Malta	-514	168
NL	Netherlands	-594	547
NO	Norway	234	106
PL	Poland	298	256
PT	Portugal	113	199
RO	Romania	892	216
RS	Serbia	585	255
SE	Sweden	251	107
SI	Slovenia	1 011	480
SK	Slovakia	966	287
TR	Turkey	13	138

Missing emitter countries: Liechtenstein and Kosovo

Table A3.14 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2016 for the O_3 precursors NO_X and NMVOC (€2021/t)

Iso code	Country	O_3 precursor	
		NO_X	VOC
AL	Albania	844	202
AT	Austria	642	435
BA	Bosnia and Herzegovina	1 234	216
BE	Belgium	-579	589
BG	Bulgaria	937	217
CH	Switzerland	698	642
CY	Cyprus	330	110
CZ	Czechia	547	362
DE	Germany	-53	473
DK	Denmark	46	202
EE	Estonia	95	80
ES	Spain	324	261
FI	Finland	136	66
FR	France	538	327
GB	United Kingdom	-367	306
GR	Greece	-11	291
HR	Croatia	1 265	300
HU	Hungary	882	288
IE	Ireland	404	196
IS	Iceland	242	63
IT	Italy	322	612
LT	Lithuania	253	111
LU	Luxembourg	471	467
LV	Latvia	143	98
MD	Moldova	479	107
ME	Montenegro	978	200
MK	North Macedonia	547	209
MT	Malta	-538	171
NL	Netherlands	-609	556
NO	Norway	238	108
PL	Poland	301	259
PT	Portugal	110	203
RO	Romania	901	218
RS	Serbia	590	257
SE	Sweden	255	109
SI	Slovenia	1 013	482
SK	Slovakia	973	290
TR	Turkey	12	144

Missing emitter countries: Liechtenstein and Kosovo

Table A3.15 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2017 for the O_3 precursors NO_X and NMVOC (€2021/t)

Iso code	Country	O_3 precursor	
		NO_X	VOC
AL	Albania	875	209
AT	Austria	670	454
BA	Bosnia and Herzegovina	1 283	225
BE	Belgium	-600	612
BG	Bulgaria	966	224
CH	Switzerland	729	671
CY	Cyprus	340	113
CZ	Czechia	570	377
DE	Germany	-54	492
DK	Denmark	48	209
EE	Estonia	99	83
ES	Spain	336	272
FI	Finland	141	69
FR	France	561	340
GB	United Kingdom	-380	318
GR	Greece	-16	305
HR	Croatia	1 323	313
HU	Hungary	915	300
IE	Ireland	420	204
IS	Iceland	252	65
IT	Italy	336	645
LT	Lithuania	263	115
LU	Luxembourg	488	486
LV	Latvia	149	102
MD	Moldova	489	109
ME	Montenegro	1 014	207
MK	North Macedonia	568	216
MT	Malta	-555	178
NL	Netherlands	-629	577
NO	Norway	247	112
PL	Poland	312	269
PT	Portugal	119	209
RO	Romania	918	222
RS	Serbia	611	267
SE	Sweden	264	113
SI	Slovenia	1 063	506
SK	Slovakia	1 012	302
TR	Turkey	13	149

Missing emitter countries: Liechtenstein and Kosovo

Table A3.16 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2018 for the O_3 precursors NO_X and NMVOC (€2021/t)

Iso code	Country	O_3 precursor	
		NO_X	VOC
AL	Albania	887	212
AT	Austria	676	460
BA	Bosnia and Herzegovina	1 298	228
BE	Belgium	-614	622
BG	Bulgaria	978	227
CH	Switzerland	737	680
CY	Cyprus	349	117
CZ	Czechia	578	383
DE	Germany	-51	499
DK	Denmark	46	214
EE	Estonia	100	84
ES	Spain	342	278
FI	Finland	144	70
FR	France	568	346
GB	United Kingdom	-392	324
GR	Greece	-10	304
HR	Croatia	1 336	316
HU	Hungary	929	304
IE	Ireland	428	208
IS	Iceland	256	66
IT	Italy	340	646
LT	Lithuania	269	117
LU	Luxembourg	494	493
LV	Latvia	153	103
MD	Moldova	498	111
ME	Montenegro	1 028	210
MK	North Macedonia	575	217
MT	Malta	-599	182
NL	Netherlands	-646	588
NO	Norway	252	114
PL	Poland	317	275
PT	Portugal	118	215
RO	Romania	934	226
RS	Serbia	619	270
SE	Sweden	270	115
SI	Slovenia	1 072	510
SK	Slovakia	1 030	307
TR	Turkey	13	152

Missing emitter countries: Liechtenstein and Kosovo

Table A3.17 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2020 for the O_3 precursors NO_X and NMVOC (€2021/t)

Iso code	Country	O_3 precursor	
		NO_X	VOC
AL	Albania	966	231
AT	Austria	708	479
BA	Bosnia and Herzegovina	1 368	240
BE	Belgium	-648	646
BG	Bulgaria	1 037	241
CH	Switzerland	767	710
CY	Cyprus	377	124
CZ	Czechia	601	400
DE	Germany	-47	516
DK	Denmark	57	221
EE	Estonia	108	88
ES	Spain	357	295
FI	Finland	151	72
FR	France	593	360
GB	United Kingdom	-405	336
GR	Greece	6	315
HR	Croatia	1 400	332
HU	Hungary	975	319
IE	Ireland	444	216
IS	Iceland	264	69
IT	Italy	357	681
LT	Lithuania	280	122
LU	Luxembourg	510	512
LV	Latvia	167	107
MD	Moldova	530	118
ME	Montenegro	1 096	224
MK	North Macedonia	608	238
MT	Malta	-629	192
NL	Netherlands	-666	608
NO	Norway	262	118
PL	Poland	331	288
PT	Portugal	132	224
RO	Romania	987	239
RS	Serbia	658	287
SE	Sweden	280	119
SI	Slovenia	1 121	537
SK	Slovakia	1 077	321
TR	Turkey	11	167

Missing emitter countries: Liechtenstein and Kosovo

Table A3.18 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2021 for the O_3 precursors NO_X and NMVOC (€2021/t)

Iso code	Country	O_3 precursor	
		NO_X	VOC
AL	Albania	1 028	245
AT	Austria	741	498
BA	Bosnia and Herzegovina	1 454	255
BE	Belgium	-628	665
BG	Bulgaria	1 133	265
CH	Switzerland	788	723
CY	Cyprus	393	130
CZ	Czechia	638	422
DE	Germany	-55	542
DK	Denmark	57	232
EE	Estonia	105	92
ES	Spain	366	294
FI	Finland	160	76
FR	France	610	369
GB	United Kingdom	-406	346
GR	Greece	2	338
HR	Croatia	1 465	345
HU	Hungary	1 047	340
IE	Ireland	453	223
IS	Iceland	274	72
IT	Italy	369	684
LT	Lithuania	296	129
LU	Luxembourg	534	531
LV	Latvia	164	114
MD	Moldova	572	126
ME	Montenegro	1 161	236
MK	North Macedonia	650	259
MT	Malta	-652	197
NL	Netherlands	-686	632
NO	Norway	274	123
PL	Poland	353	306
PT	Portugal	125	228
RO	Romania	1 078	259
RS	Serbia	711	309
SE	Sweden	299	125
SI	Slovenia	1 153	548
SK	Slovakia	1 157	343
TR	Turkey	14	174

Missing emitter countries: Liechtenstein and Kosovo

Table A3.19 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2012 for the NO_2 precursor NO_X (€2021/t)

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
AT	Austria	4 946	14 788
BE	Belgium	8 438	22 847
BG	Bulgaria	4 398	13 735
CH	Switzerland	8 273	21 291
CY	Cyprus	2 297	916
CZ	Czechia	3 856	10 170
DE	Germany	7 942	23 202
DK	Denmark	3 321	8 547
EE	Estonia	2 520	3 701
ES	Spain	5 385	14 213
FI	Finland	2 869	7 573
FR	France	5 434	14 872
GB	United Kingdom	7 683	20 545
GR	Greece	6 887	19 640
HR	Croatia	4 335	12 686
HU	Hungary	6 303	17 580
IE	Ireland	2 374	4 067
IT	Italy	7 472	22 091
LT	Lithuania	3 475	8 962
LU	Luxembourg	1 987	3 601
LV	Latvia	4 824	12 277
ME	Montenegro	2 897	3 888
MT	Malta	3 835	1 981
NL	Netherlands	10 662	27 263
NO	Norway	5 227	13 370
PL	Poland	3 620	9 396
PT	Portugal	4 775	13 528
RO	Romania	5 865	16 762
SE	Sweden	3 291	8 920
SI	Slovenia	4 305	10 298
SK	Slovakia	4 548	11 351

Missing emitter countries: Iceland, Liechtenstein, Albania, Bosnia and Herzegovina, North Macedonia and Serbia and Kosovo

Table A3.20 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2013 for the NO_2 precursor NO_X (€2021/t)

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
AT	Austria	4 965	14 935

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
BE	Belgium	8 498	23 441
BG	Bulgaria	4 341	13 205
CH	Switzerland	8 382	21 903
CY	Cyprus	2 320	932
CZ	Czechia	3 872	10 291
DE	Germany	8 013	23 958
DK	Denmark	3 339	8 900
EE	Estonia	2 491	4 099
ES	Spain	5 349	13 904
FI	Finland	2 872	7 388
FR	France	5 463	14 854
GB	United Kingdom	7 782	20 921
GR	Greece	6 803	19 306
HR	Croatia	4 302	12 732
HU	Hungary	6 254	17 581
IE	Ireland	2 393	4 371
IT	Italy	7 474	21 916
LT	Lithuania	3 454	9 034
LU	Luxembourg	2 011	3 668
LV	Latvia	4 752	12 792
ME	Montenegro	2 898	3 964
MT	Malta	3 859	2 004
NL	Netherlands	10 723	27 456
NO	Norway	5 296	13 223
PL	Poland	3 624	9 565
PT	Portugal	4 747	13 264
RO	Romania	5 787	16 616
SE	Sweden	3 322	9 334
SI	Slovenia	4 313	10 684
SK	Slovakia	4 544	11 325

Missing emitter countries: Iceland, Liechtenstein, Albania, Bosnia and Herzegovina, North Macedonia and Serbia and Kosovo

Table A3.21 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2014 for the NO_2 precursor NO_X (€2021/t)

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
AT	Austria	5 025	15 279
BE	Belgium	8 569	23 405
BG	Bulgaria	4 438	13 679
CH	Switzerland	8 530	21 164

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
CY	Cyprus	2 367	973
CZ	Czechia	3 889	10 475
DE	Germany	8 077	23 862
DK	Denmark	3 380	8 638
EE	Estonia	2 528	3 801
ES	Spain	5 412	14 248
FI	Finland	2 926	7 512
FR	France	5 518	14 899
GB	United Kingdom	7 927	21 205
GR	Greece	6 900	20 114
HR	Croatia	4 351	13 224
HU	Hungary	6 323	18 016
IE	Ireland	2 432	4 723
IT	Italy	7 573	22 292
LT	Lithuania	3 432	8 993
LU	Luxembourg	2 048	3 680
LV	Latvia	4 757	13 855
ME	Montenegro	2 941	4 134
MT	Malta	3 926	2 067
NL	Netherlands	10 853	28 091
NO	Norway	5 389	12 630
PL	Poland	3 633	9 545
PT	Portugal	4 762	13 846
RO	Romania	5 884	17 266
SE	Sweden	3 383	9 223
SI	Slovenia	4 341	10 569
SK	Slovakia	4 588	11 411

Missing emitter countries: Iceland, Liechtenstein, Albania, Bosnia and Herzegovina, North Macedonia and Serbia and Kosovo

Table A3.22 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2015 for the NO_2 precursor NO_X (€2021/t)

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
AT	Austria	5 195	16 234
BE	Belgium	8 837	24 686
BG	Bulgaria	4 491	14 507
CH	Switzerland	8 840	23 304
CY	Cyprus	2 433	1 019
CZ	Czechia	3 996	11 207
DE	Germany	8 326	25 639

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
DK	Denmark	3 457	9 547
EE	Estonia	2 542	3 888
ES	Spain	5 549	15 601
FI	Finland	2 964	7 412
FR	France	5 694	16 022
GB	United Kingdom	8 194	22 686
GR	Greece	7 073	21 148
HR	Croatia	4 457	13 765
HU	Hungary	6 478	19 237
IE	Ireland	2 498	4 990
IT	Italy	7 795	24 294
LT	Lithuania	3 492	9 819
LU	Luxembourg	2 120	3 939
LV	Latvia	4 780	14 621
ME	Montenegro	2 996	4 293
MT	Malta	4 065	2 196
NL	Netherlands	11 178	30 196
NO	Norway	5 529	13 497
PL	Poland	3 729	10 115
PT	Portugal	4 841	14 495
RO	Romania	6 009	18 056
SE	Sweden	3 484	9 812
SI	Slovenia	4 457	11 693
SK	Slovakia	4 716	11 983

Missing emitter countries: Iceland, Liechtenstein, Albania, Bosnia and Herzegovina, North Macedonia and Serbia and Kosovo

Table A3.23 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2016 for the NO_2 precursor NO_X (€2021/t)

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
AT	Austria	5 287	16 211
BE	Belgium	9 007	24 749
BG	Bulgaria	4 539	14 499
CH	Switzerland	8 991	23 033
CY	Cyprus	2 515	1 071
CZ	Czechia	4 048	11 312
DE	Germany	8 472	25 759
DK	Denmark	3 536	9 328
EE	Estonia	2 593	4 380
ES	Spain	5 623	15 465

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
FI	Finland	3 049	7 989
FR	France	5 803	16 382
GB	United Kingdom	8 399	23 105
GR	Greece	7 116	21 136
HR	Croatia	4 456	13 606
HU	Hungary	6 526	19 138
IE	Ireland	2 574	5 110
IT	Italy	7 861	23 892
LT	Lithuania	3 514	10 217
LU	Luxembourg	2 179	3 989
LV	Latvia	4 837	14 497
ME	Montenegro	3 044	4 297
MT	Malta	4 230	2 242
NL	Netherlands	11 449	30 614
NO	Norway	5 684	13 224
PL	Poland	3 775	10 139
PT	Portugal	4 936	15 166
RO	Romania	6 042	18 194
SE	Sweden	3 579	9 749
SI	Slovenia	4 522	11 796
SK	Slovakia	4 760	11 894

Missing emitter countries: Iceland, Liechtenstein, Albania, Bosnia and Herzegovina, North Macedonia and Serbia and Kosovo

Table A3.24 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2017 for the NO_2 precursor NO_X (€2021/t)

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
AT	Austria	5 435	16 717
BE	Belgium	9 240	26 085
BG	Bulgaria	4 612	15 427
CH	Switzerland	9 283	24 262
CY	Cyprus	2 585	1 118
CZ	Czechia	4 151	11 751
DE	Germany	8 675	26 971
DK	Denmark	3 615	9 851
EE	Estonia	2 644	5 322
ES	Spain	5 768	16 264
FI	Finland	3 112	8 339
FR	France	5 951	17 224
GB	United Kingdom	8 626	23 971

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
GR	Greece	7 305	22 113
HR	Croatia	4 552	14 181
HU	Hungary	6 688	20 089
IE	Ireland	2 637	5 103
IT	Italy	8 095	25 605
LT	Lithuania	3 517	10 499
LU	Luxembourg	2 263	4 187
LV	Latvia	4 900	15 789
ME	Montenegro	3 099	4 477
MT	Malta	4 381	2 375
NL	Netherlands	11 719	31 817
NO	Norway	5 834	13 264
PL	Poland	3 876	10 790
PT	Portugal	5 005	15 522
RO	Romania	6 043	17 825
SE	Sweden	3 686	10 013
SI	Slovenia	4 652	12 571
SK	Slovakia	4 883	12 315

Missing emitter countries: Iceland, Liechtenstein, Albania, Bosnia and Herzegovina, North Macedonia and Serbia and Kosovo

Table A3.25 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2018 for the NO_2 precursor NO_X (€2021/t)

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
AT	Austria	5 540	17 404
BE	Belgium	9 425	26 534
BG	Bulgaria	4 648	15 504
CH	Switzerland	9 465	24 576
CY	Cyprus	2 655	1 154
CZ	Czechia	4 224	11 841
DE	Germany	8 807	26 800
DK	Denmark	3 705	10 426
EE	Estonia	2 689	5 007
ES	Spain	5 874	16 830
FI	Finland	3 163	8 481
FR	France	6 054	17 382
GB	United Kingdom	8 842	24 717
GR	Greece	7 301	22 171
HR	Croatia	4 577	14 432
HU	Hungary	6 766	20 486

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
IE	Ireland	2 707	5 066
IT	Italy	8 138	25 430
LT	Lithuania	3 531	10 679
LU	Luxembourg	2 319	4 218
LV	Latvia	4 919	15 583
ME	Montenegro	3 129	4 655
MT	Malta	4 591	2 436
NL	Netherlands	11 962	32 610
NO	Norway	5 962	13 815
PL	Poland	3 958	11 190
PT	Portugal	5 101	16 049
RO	Romania	6 098	18 504
SE	Sweden	3 778	10 397
SI	Slovenia	4 711	13 153
SK	Slovakia	4 972	12 835

Missing emitter countries: Iceland, Liechtenstein, Albania, Bosnia and Herzegovina, North Macedonia and Serbia and Kosovo

Table A3.26 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2020 for the NO_2 precursor NO_X (€2021/t)

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
AT	Austria	5 487	18 134
BE	Belgium	9 434	29 121
BG	Bulgaria	4 654	17 518
CH	Switzerland	9 465	26 967
CY	Cyprus	2 666	1 261
CZ	Czechia	4 180	12 928
DE	Germany	8 664	28 052
DK	Denmark	3 611	10 468
EE	Estonia	2 633	5 342
ES	Spain	5 941	18 602
FI	Finland	3 084	8 186
FR	France	6 004	18 557
GB	United Kingdom	8 896	26 155
GR	Greece	7 167	22 728
HR	Croatia	4 479	14 587
HU	Hungary	6 698	20 810
IE	Ireland	2 686	5 303
IT	Italy	8 072	27 839
LT	Lithuania	3 452	11 592

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
LU	Luxembourg	2 331	4 477
LV	Latvia	4 672	15 797
ME	Montenegro	3 138	4 956
MT	Malta	4 706	2 583
NL	Netherlands	11 845	34 616
NO	Norway	5 850	12 998
PL	Poland	3 943	12 323
PT	Portugal	5 032	17 060
RO	Romania	6 070	20 065
SE	Sweden	3 767	10 943
SI	Slovenia	4 711	13 257
SK	Slovakia	4 924	14 027

Missing emitter countries: Iceland, Liechtenstein, Albania, Bosnia and Herzegovina, North Macedonia and Serbia and Kosovo

Table A3.27 - Damage to health in EEA38+UK per tonne of pollutant emissions in 2021 for the NO_2 precursor NO_X (€2021/t)

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
AT	Austria	5 652	19 048
BE	Belgium	9 518	27 122
BG	Bulgaria	4 982	20 124
CH	Switzerland	9 604	27 247
CY	Cyprus	2 774	1 317
CZ	Czechia	4 380	14 083
DE	Germany	9 010	30 294
DK	Denmark	3 742	10 919
EE	Estonia	2 792	7 199
ES	Spain	6 001	17 796
FI	Finland	3 165	8 880
FR	France	6 125	18 586
GB	United Kingdom	9 091	26 183
GR	Greece	7 472	26 017
HR	Croatia	4 622	15 945
HU	Hungary	7 087	23 552
IE	Ireland	2 812	5 724
IT	Italy	8 172	27 403
LT	Lithuania	3 648	12 657
LU	Luxembourg	2 374	4 574
LV	Latvia	5 015	18 218
ME	Montenegro	3 238	5 444

ISO code	Country name	NO_2	
		NO_X (VOLY)	NO_X (VSL)
MT	**Malta**	4 890	2 659
NL	**Netherlands**	12 172	35 254
NO	**Norway**	6 039	12 768
PL	**Poland**	4 109	13 321
PT	**Portugal**	5 165	17 100
RO	**Romania**	6 423	22 546
SE	**Sweden**	3 857	10 298
SI	**Slovenia**	4 823	15 213
SK	**Slovakia**	5 299	15 993

Missing emitter countries: Iceland, Liechtenstein, Albania, Bosnia and Herzegovina, North Macedonia and Serbia and Kosovo

Annex 4 Corrections made to E-PRTR data

Table A4.1 - Information on corrections made to the reported E-PRTR emission data

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
CZ.MZP.S205/CZ39116919.FACILITY	Lihovar Vrdy	Vrdy	Czechia	4(a)(ii)	Chemical installations for the production on an industrial scale of basic organic chemicals: Oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters, acetates, ethers, peroxides, epoxy resins	2018	Arsenic and compounds (as As)	27600	27.6	kg	emission quantity corrected
ES.CAED/003705000.FACILITY	MAIER, S.COOP. (MAIER, S.COOP.)	Kanpantxu	Spain	2(f)	Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process	2018	Chromium and compounds (as Cr)	19700	1970	kg	emission quantity corrected
ES.CAED/003705000.FACILITY	MAIER, S.COOP. (MAIER, S.COOP.)	Kanpantxu	Spain	2(f)	Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process	2019	Chromium and compounds (as Cr)	15900	1590	kg	emission quantity corrected
ES.CAED/004655000.FACILITY	FAGOR EDERLAN, S.COOP. (FAGOR EDERLAN INYECCIÓN MOTOR - ESKORIATZA)	Eskoriatza	Spain	2(e)(ii)	Installation for the smelting, including the alloying, of non-ferrous metals, including recovered products (refining, foundry casting, etc.)	2020	PCDD + PCDF (dioxins + furans) (as Teq)	2	0.002	kg	emission quantity corrected
PL.MŚ/000000349.FACILITY	PGE Górnictwo i Energetyka Konwencjonalna S.A. - Oddział Elektrownia Bełchatów	Rogowiec	Poland	1(c)	Thermal power stations and other combustion installations	2021	Arsenic and compounds (as As)	2700	27	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
PT.CAED/PT.APA05765302.CI	Dow Portugal - Produtos Químicos, Sociedade Unipessoal, Lda (CI)	Estarreja	Portugal	4(a)(viii)	Chemical installations for the production on an industrial scale of basic organic chemicals: Basic plastic materials (polymers, synthetic fibres and cellulose-based fibres)	2020	PCDD + PCDF (dioxins + furans) (as Teq)	0.826	0.00826	kg	emission quantity corrected
PT.CAED/PT.APA05765302.CI	Dow Portugal - Produtos Químicos, Sociedade Unipessoal, Lda (CI)	Estarreja	Portugal	4(a)(viii)	Chemical installations for the production on an industrial scale of basic organic chemicals: Basic plastic materials (polymers, synthetic fibres and cellulose-based fibres)	2021	PCDD + PCDF (dioxins + furans) (as Teq)	0.534	0.00534	kg	emission quantity corrected
PT.CAED/PT.APA05766622.CI	SUGAL-Alimentos, SA (CI)	Azambuja	Portugal	8(b)(ii)	Treatment and processing intended for the production of food and beverage products from vegetable raw materials	2020	PCDD + PCDF (dioxins + furans) (as Teq)	1.03	0.00103	kg	emission quantity corrected
PT.CAED/PT.APA05775042.CI	Pinopine (CI)	Aveiro	Portugal	4(a)(viii)	Chemical installations for the production on an industrial scale of basic organic chemicals: Basic plastic materials (polymers, synthetic fibres and cellulose-based fibres)	2020	PCDD + PCDF (dioxins + furans) (as Teq)	1.35	0.00135	kg	emission quantity corrected
PT.CAED/PT.APA05775922.CI	António Carlos Pereira Marques Mé-Mé (CI)	Vendas Novas	Portugal	7(a)(i)	Installations for the intensive rearing of poultry with 40,000 places for poultry	2020	PCDD + PCDF (dioxins + furans) (as Teq)	7.14	0.00714	kg	emission quantity corrected
PT.CAED/PT.APA05775922.CI	António Carlos Pereira Marques Mé-Mé (CI)	Vendas Novas	Portugal	7(a)(i)	Installations for the intensive rearing of poultry with 40,000 places for poultry	2021	PCDD + PCDF (dioxins + furans) (as Teq)	6.78	0.00678	kg	emission quantity corrected
AT.CAED/900839051387 3.FACILITY	Trans Austria Gasleitung GmbH	Weitendorf	Austria	1(c)	Thermal power stations and other combustion installations	2020	Methane	592000	159000	kg	emission quantity corrected
AT.CAED/900839097570 1.FACILITY	voestalpine Stahl Donawitz GesmbH	Donawitz	Austria	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2017	Lead and compounds (as Pb)	279	1298.650307	kg	emission quantity corrected
AT.CAED/900839097570 1.FACILITY	voestalpine Stahl Donawitz GesmbH	Donawitz	Austria	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2018	Lead and compounds (as Pb)	262	1825.743865	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
AT.CAED/900839097570 1.FACILITY	voestalpine Stahl Donawitz GesmbH	Donawitz	Austria	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2016	Lead and compounds (as Pb)	256	1463.880368	kg	emission quantity corrected
AT.CAED/900839159753 7.FACILITY	Lafarge Zementwerke GmbH	Mannersdorf am Leithagebirge	Austria	3(c)	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces. Note to reporters, use Level 3 activity e.g. 3(c)(i), in preference to 3(c). Level 2 activity class (i.e. 3(c)) only to be used where Level 3 is not available.	2015	Ammonia	44400	10700	kg	emission quantity corrected
BE.WA/029010000.FACILITY	CBR sa - Site d'Antoing	Antoing	Belgium	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2021	Mercury and compounds (as Hg)	59.3	10.1	kg	emission quantity corrected
BE.BRU/100010016.FACILITY	STEP NORD (Aquiris)	Bruxelles	Belgium	5(f)	Urban waste-water treatment plants	2021	Nitrous oxide	938000	15209.39086	kg	emission quantity corrected
BE.BRU/100010016.FACILITY	STEP NORD (Aquiris)	Bruxelles	Belgium	5(f)	Urban waste-water treatment plants	2014	Nitrous oxide	50000	14100	kg	emission quantity corrected
BE.WA/026010000.FACILITY	CBR sa - Site de Lixhe	Lixhe	Belgium	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2016	Mercury and compounds (as Hg)	269	106.0732362	kg	emission quantity corrected
BE.WA/028010000.FACILITY	HOLCIM Belgique - Usine d'OBOURG	Obourg	Belgium	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2021	Nitrous oxide	80800	22400	kg	emission quantity corrected
BE.WA/029010000.FACILITY	CBR sa - Site d'Antoing	Antoing	Belgium	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2014	Mercury and compounds (as Hg)	29.7	10.1	kg	emission quantity corrected
BE.WA/039010000.FACILITY	KNAUF INSULATION	Visé	Belgium	3(e)	Installations for the manufacture of glass, including glass fibre	2013	Ammonia	326000	53600	kg	emission quantity corrected
BE.WA/146010000.FACILITY	APERAM STAINLESS BELGIUM	Châtelet	Belgium	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2020	Mercury and compounds (as Hg)	47.2	15.8	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
BE.WA/146010000.FACILITY	APERAM STAINLESS BELGIUM	Châtelet	Belgium	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2021	Mercury and compounds (as Hg)	106	15.8	kg	emission quantity corrected
BE.WA/146010000.FACILITY	APERAM STAINLESS BELGIUM	Châtelet	Belgium	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2016	Nickel and compounds (as Ni)	126	55.8	kg	emission quantity corrected
BE.WA/146010000.FACILITY	APERAM STAINLESS BELGIUM	Châtelet	Belgium	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2014	Mercury and compounds (as Hg)	53.6	23.7	kg	emission quantity corrected
BE.WA/146010000.FACILITY	APERAM STAINLESS BELGIUM	Châtelet	Belgium	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2014	Nickel and compounds (as Ni)	173	75.5	kg	emission quantity corrected
BE.WA/189010000.FACILITY	BIOWANZE	Wanze	Belgium	4(a)(ii)	Chemical installations for the production on an industrial scale of basic organic chemicals: Oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters, acetates, ethers, peroxides, epoxy resins	2016	Cadmium and compounds (as Cd)	887	88.7	kg	emission quantity corrected
BG.CAED/003000039.FACILITY	Poultry Farm Yaica I pticy Zora	Дончево	Bulgaria	7(a)(i)	Installations for the intensive rearing of poultry with 40,000 places for poultry	2018	Ammonia	14780.6	246900.5	kg	emission quantity corrected
BG.CAED/003000059.FACILITY	Landfill of the Aksakovo municipality 3	Въглен	Bulgaria	5(d)	Landfills (excluding landfills of inert waste and landfills, which were definitely closed before 16.7.2001 or for which the after-care phase required by the competent authorities according to Article 13 of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste has expired)	2017	Methane	6860000	2390000	kg	emission quantity corrected
BG.CAED/003000059.FACILITY	Landfill of the Aksakovo municipality 3	Въглен	Bulgaria	5(d)	Landfills (excluding landfills of inert waste and landfills, which were definitely closed before 16.7.2001 or for which the after-care phase required by the competent authorities according to Article 13 of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste has expired)	2020	Ammonia	39398	171441	kg	emission quantity corrected
BG.CAED/003000059.FACILITY	Landfill of the Aksakovo municipality 3	Въглен	Bulgaria	5(d)	Landfills (excluding landfills of inert waste and landfills, which were definitely closed before 16.7.2001 or for which the after-care phase required by the competent authorities according to Article 13 of Council Directive	2021	Methane	4928949	1132702	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
					1999/31/EC of 26 April 1999 on the landfill of waste has expired)						
BG.CAED/003000067.FACILITY	Pig farm Aiax-1 EOOD	Козлодуйци	Bulgaria	7(a)(ii)	Installations for the intensive rearing of pigs with 2,000 places for production pigs (over 30 kg)	2020	Ammonia	1318640	602420	kg	emission quantity corrected
BG.CAED/003000067.FACILITY	Pig farm Aiax-1 EOOD	Козлодуйци	Bulgaria	7(a)(ii)	Installations for the intensive rearing of pigs with 2,000 places for production pigs (over 30 kg)	2021	Ammonia	1410120	602420	kg	emission quantity corrected
BG.CAED/009000031.FACILITY	VP Brands interneshanal company for the production of organic chemicals	Пловдив	Bulgaria	4(a)(ii)	Chemical installations for the production on an industrial scale of basic organic chemicals: Oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters, acetates, ethers, peroxides, epoxy resins	2021	Nitrogen oxides	426750	206907	kg	emission quantity corrected
BG.CAED/010000013.FACILITY	Landfill of the Ruse Municipality	Русе	Bulgaria	5(d)	Landfills (excluding landfills of inert waste and landfills, which were definitely closed before 16.7.2001 or for which the after-care phase required by the competent authorities according to Article 13 of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste has expired)	2020	Ammonia	95100	203000	kg	emission quantity corrected
BG.CAED/017000003.FACILITY	Stomana Industry company for production of ferrous metals	Перник	Bulgaria	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2019	Chromium and compounds (as Cr)	734	276	kg	emission quantity corrected
BG.CAED/017000006.FACILITY	Bobov dol power station	Големо село	Bulgaria	1(c)	Thermal power stations and other combustion installations	2017	Particulate matter	700000	82200	kg	emission quantity corrected
CZ.MZP.B645/CZ0025096E.FACILITY	Provozovna IRZ skládka odpadu	Těmice	Czechia	5(d)	Landfills (excluding landfills of inert waste and landfills, which were definitely closed before 16.7.2001 or for which the after-care phase required by the competent authorities according to Article 13 of Council Directive	2016	Methane	1030000	195000	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
					1999/31/EC of 26 April 1999 on the landfill of waste has expired)						
CZ.MZP.B645/CZ77251264.FACILITY	VETROPACK MORAVIA GLASS akciová společnost	Kyjov	Czechia	3(e)	Installations for the manufacture of glass, including glass fibre	2013	Lead and compounds (as Pb)	1200	238	kg	emission quantity corrected
CZ.MZP.E531/CZ27995052.FACILITY	CEMEX Czech Republic, s.r.o.	Prachovice	Czechia	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2016	Carbon dioxide excluding biomass	532000	532000000	kg	emission quantity corrected
CZ.MZP.E532/CZ90841608.FACILITY	Elektrárna Chvaletice	Chvaletice	Czechia	1(c)	Thermal power stations and other combustion installations	2017	Arsenic and compounds (as As)	1000	100	kg	emission quantity corrected
CZ.MZP.M713/CZ63275497.FACILITY	MEGAWASTE-EKOTERM, s.r.o.	Prostějov	Czechia	5(a)	Installations for the recovery or disposal of hazardous waste	2020	PCDD + PCDF (dioxins + furans) (as Teq)	0.000577	0.000002	kg	emission quantity corrected
CZ.MZP.S206/CZ33698019.FACILITY	Elektrárna Mělník	Horní Počaply	Czechia	1(c)	Thermal power stations and other combustion installations	2020	Mercury and compounds (as Hg)	204.90464	46.96463	kg	emission quantity corrected
CZ.MZP.S206/CZ33698019.FACILITY	Elektrárna Mělník	Horní Počaply	Czechia	1(c)	Thermal power stations and other combustion installations	2020	PCDD + PCDF (dioxins + furans) (as Teq)	0.00039	0.00013	kg	emission quantity corrected
DK.CAED/000096764.FACILITY	I/S Vestforbrænding, Glostrup	Glostrup	Denmark	5(b)	Installations for the incineration of non-hazardous waste in the scope of Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste	2018	Arsenic and compounds (as As)	0.3	3.159089706	kg	emission quantity corrected
DK.CAED/000096764.FACILITY	I/S Vestforbrænding, Glostrup	Glostrup	Denmark	5(b)	Installations for the incineration of non-hazardous waste in the scope of Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste	2018	Chromium and compounds (as Cr)	2	8.072736887	kg	emission quantity corrected
DK.CAED/000098610.FACILITY	Nordic Sugar A/S Nykøbing	Nykøbing F	Denmark	8(b)(ii)	Treatment and processing intended for the production of food and beverage products from vegetable raw materials	2020	Sulphur oxides	321836	124721	kg	emission quantity corrected
DK.CAED/000098610.FACILITY	Nordic Sugar A/S Nykøbing	Nykøbing F	Denmark	8(b)(ii)	Treatment and processing intended for the production of food and beverage products from vegetable raw materials	2016	Particulate matter	346000	34600	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
DK.CAED/00 0105754.FA CILITY	Renosyd i/s	Skanderborg	Denmar k	5(b)	Installations for the incineration of non-hazardous waste in the scope of Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste	2021	Particulate matter	393	147	kg	emission quantity corrected
DK.CAED/00 0105775.FA CILITY	Sønderborg Kraftvarme A/S	Sønderborg	Denmar k	5(b)	Installations for the incineration of non-hazardous waste in the scope of Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste	2021	Sulphur oxides	4224	1429	kg	emission quantity corrected
DK.CAED/00 0105787.FA CILITY	Svendborg Kraftvarme A/S	Svendborg	Denmar k	5(b)	Installations for the incineration of non-hazardous waste in the scope of Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste	2019	Lead and compounds (as Pb)	1.1	26.1	kg	emission quantity corrected
DK.CAED/00 0105787.FA CILITY	Svendborg Kraftvarme A/S	Svendborg	Denmar k	5(b)	Installations for the incineration of non-hazardous waste in the scope of Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste	2020	Cadmium and compounds (as Cd)	3.925	0.07	kg	emission quantity corrected
DK.CAED/00 0106181.FA CILITY	Avedøreværke t	Hvidovre	Denmar k	1(c)	Thermal power stations and other combustion installations	2021	Particulate matter	74950	21000	kg	emission quantity corrected
DK.CAED/00 0106201.FA CILITY	H.C. Ørsted Værket	København SV	Denmar k	1(c)	Thermal power stations and other combustion installations	2021	Nitrous oxide	1087549	1743	kg	emission quantity corrected
EE.KAUR.TT R/40.FACILIT Y	TALLINNA JÄÄTMETE TAASKASUTUS KESKUS AS, Tallinna prügila	Rebala küla, Jõelähtme vald	Estonia	5(d)	Landfills (excluding landfills of inert waste and landfills, which were definitely closed before 16.7.2001 or for which the after-care phase required by the competent authorities according to Article 13 of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste has expired)	2019	Methane	290000	114000	kg	emission quantity corrected
EE.KAUR.TT R/74.FACILIT Y	Enefit Power AS, Balti Elektrijaam Enefit Power AS, Balti Elektrijaam	Narva linn	Estonia	1(c)	Thermal power stations and other combustion installations	2015	Carbon dioxide excluding biomass	89400000	19400000 00	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
	Enefit Power AS, Balti elektrijaam										
EE.KAUR.TTR/75.FACILITY	Enefit Power AS, Eesti elektrijaam	Auvere küla, Narva-Jõesuu linn	Estonia	1(c)	Thermal power stations and other combustion installations	2012	Sulphur oxides	2230000	19800000	kg	emission quantity corrected
EL.CAED/100001.FACILITY	PPC S.A. LIGNITIKI MEGALOPOLIS (SES UNIT III)	Megalopoli	Greece	1(c)	Thermal power stations and other combustion installations	2020	Sulphur oxides	344000	1805000	kg	emission quantity corrected
EL.CAED/100053.FACILITY	HELLENIC PETROLEUM S.A. - INDUSTRIAL DIVISION OF ASPROPYRGOS	Aspropyrgos	Greece	1(a)	Mineral oil and gas refineries	2019	Cadmium and compounds (as Cd)	31	186.5	kg	emission quantity corrected
EL.CAED/100075.FACILITY	TITAN CEMENT S.A. - DREPANO PLANT	Rion	Greece	3(c)	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces. Note to reporters, use Level 3 activity e.g. 3(c)(i), in preference to 3(c). Level 2 activity class (i.e. 3(c)) only to be used where Level 3 is not available.	2018	Benzene	9280	1410	kg	emission quantity corrected
EL.CAED/100078.FACILITY	HERACLES G.C.Co, MILAKI PLANT	Aliveri	Greece	3(c)	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces. Note to reporters, use Level 3 activity e.g. 3(c)(i), in preference to 3(c). Level 2 activity class (i.e. 3(c)) only to be used where Level 3 is not available.	2017	Polycyclic aromatic hydrocarbons	319	108	kg	emission quantity corrected
EL.CAED/100078.FACILITY	HERACLES G.C.Co, MILAKI PLANT	Aliveri	Greece	3(c)	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces. Note to reporters, use Level 3 activity e.g. 3(c)(i), in preference to 3(c). Level 2 activity class (i.e. 3(c)) only to be used where Level 3 is not available.	2021	Polycyclic aromatic hydrocarbons	245	86.7	kg	emission quantity corrected
EL.CAED/100080.FACILITY	HERACLES G.C.Co, VOLOS PLANT	Portaria	Greece	3(c)	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces. Note to reporters, use Level 3 activity e.g. 3(c)(i), in preference to 3(c). Level 2 activity class (i.e. 3(c)) only to be used where Level 3 is not available.	2013	Nitrous oxide	92700	33700	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
EL.CAED/100110.FACILITY	SIDENOR STEEL INDUSTRY S.A.	Thessaloniki	Greece	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2015	PCDD + PCDF (dioxins + furans) (as Teq)	0.0006	0.00024	kg	emission quantity corrected
EL.CAED/100128.FACILITY	J. MAVROULIS - G. PRIOVOLOS	Thiva	Greece	5(a)	Installations for the recovery or disposal of hazardous waste	2014	PCDD + PCDF (dioxins + furans) (as Teq)	0.00837	0.000543	kg	emission quantity corrected
ES.CAED/000169000.FACILITY	HYCO (LA POBLA DE MAFUMENT)	Pobla de Mafumet, La	Spain	4(b)(i)	Chemical installations for the production on an industrial scale of basic inorganic chemicals: Gases, such as ammonia, chlorine or hydrogen chloride, fluorine or hydrogen fluoride, carbon oxides, sulphur compounds, nitrogen oxides, hydrogen, sulphur dioxide, carbonyl chloride	2018	Nitrogen oxides	419000	142000	kg	emission quantity corrected
ES.CAED/000169000.FACILITY	HYCO (LA POBLA DE MAFUMENT)	Pobla de Mafumet, La	Spain	4(b)(i)	Chemical installations for the production on an industrial scale of basic inorganic chemicals: Gases, such as ammonia, chlorine or hydrogen chloride, fluorine or hydrogen fluoride, carbon oxides, sulphur compounds, nitrogen oxides, hydrogen, sulphur dioxide, carbonyl chloride	2021	Nitrogen oxides	325000	127000	kg	emission quantity corrected
ES.CAED/000584000.FACILITY	TAU PORCELANICO, S.L.	Castellón de la Plana / Castelló de la Plana	Spain	3(g)	Installations for the manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain	2017	Nitrogen oxides	645000	106000	kg	emission quantity corrected
ES.CAED/000899000.FACILITY	EXIDE TECHNOLOGIES RECYCLING	Sant Julià del Llor i Bonmatí	Spain	5(a)	Installations for the recovery or disposal of hazardous waste	2019	PCDD + PCDF (dioxins + furans) (as Teq)	0.4	0.0004	kg	emission quantity corrected
ES.CAED/001916000.FACILITY	FÁBRICA DE CEMENTOS DE LA ROBLA	La Robla	Spain	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2013	Polycyclic aromatic hydrocarbons	156	59	kg	emission quantity corrected
ES.CAED/001932000.FACILITY	SAINT-GOBAIN ISOVER IBÉRICA, S.L.	Azuqueca de Henares	Spain	3(e)	Installations for the manufacture of glass, including glass fibre	2019	Ammonia	186000	52100	kg	emission quantity corrected
ES.CAED/002325000.FACILITY	SIDERÚRGICA SEVILLANA, S.A.	Alcalá de Guadaíra	Spain	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2018	Nickel and compounds (as Ni)	537	97.2	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
ES.CAED/002463000.FACILITY	VERALLIA SPAIN	Montblanc	Spain	3(e)	Installations for the manufacture of glass, including glass fibre	2014	Nitrous oxide	73800	10300	kg	emission quantity corrected
ES.CAED/002585000.FACILITY	CEMEX ESPAÑA OPERACIONES, S.L.U. - PLANTA DE MORATA	Morata de Jalon	Spain	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2016	Mercury and compounds (as Hg)	79.9	29.3	kg	emission quantity corrected
ES.CAED/003100000.FACILITY	COMPAÑIA ESPAÑOLA DE LAMINACION (CELSA 1-4)	Castellbisbal	Spain	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2013	Cadmium and compounds (as Cd)	542	54.2	kg	emission quantity corrected
ES.CAED/003355000.FACILITY	ALCALAGRES, S.A.	Camarma de Esteruelas	Spain	3(g)	Installations for the manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain	2019	Cadmium and compounds (as Cd)	298	29.8	kg	emission quantity corrected
ES.CAED/003355000.FACILITY	ALCALAGRES, S.A.	Camarma de Esteruelas	Spain	3(g)	Installations for the manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain	2020	Cadmium and compounds (as Cd)	160	16	kg	emission quantity corrected
ES.CAED/003453000.FACILITY	ELCOGAS S.A. - CENTRAL TÉRMICA GICC	Puertollano	Spain	1(c)	Thermal power stations and other combustion installations	2013	Nitrous oxide	593000	53600	kg	emission quantity corrected
ES.CAED/003463000.FACILITY	GRUPO FERROATLÁNTICA, SAU	Sabon	Spain	4(b)(v)	Chemical installations for the production on an industrial scale of basic inorganic chemicals: Non-metals, metal oxides or other inorganic compounds such as calcium carbide, silicon, silicon carbide	2013	Nitrogen oxides	843000	300000	kg	emission quantity corrected
ES.CAED/003531000.FACILITY	CENTRAL TÉRMICA LOS BARRIOS	Barrios, Los	Spain	1(c)	Thermal power stations and other combustion installations	2012	Cadmium and compounds (as Cd)	1090	10.9	kg	emission quantity corrected
ES.CAED/003701000.FACILITY	PETROLEOS DEL NORTE, PETRONOR, S.A. (PETRONOR)	Muskiz	Spain	1(a)	Mineral oil and gas refineries	2020	Nitrous oxide	1570000	157000	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
ES.CAED/003724000.FACILITY	ACERÍA COMPACTA DE BIZKAIA, S.A. (ACERÍA COMPACTA DE BIZKAIA)	Sestao	Spain	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2015	PCDD + PCDF (dioxins + furans) (as Teq)	0.000882	0.000199	kg	emission quantity corrected
ES.CAED/003738000.FACILITY	ARCELOR PACKAGING INTERNATIONAL ESPAÑA, S.L. (FABRICA DE ETXEBARRI)	Etxebarri	Spain	2(f)	Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process	2015	Nitrous oxide	211000	58500	kg	emission quantity corrected
ES.CAED/004264000.FACILITY	DOLOMITAS DEL NORTE,S.A	Bueras	Spain	3(c)(iii)	Installations for the production of cement clinker or lime in other furnaces	2019	Sulphur oxides	283000	691500	kg	emission quantity corrected
ES.CAED/004657000.FACILITY	FAGOR EDERLAN, S.COOP. (FAGOR EDERLAN INYECCIÓN TRANSMISIÓN - ARETXABALETA)	Arrasate / Mondragon	Spain	2(e)(ii)	Installation for the smelting, including the alloying, of non-ferrous metals, including recovered products (refining, foundry casting, etc.)	2021	PCDD + PCDF (dioxins + furans) (as Teq)	0.595	0.000595	kg	emission quantity corrected
ES.CAED/005486000.FACILITY	FRINSA DEL NOROESTE S.A.	Xaras	Spain	8(b)(i)	Treatment and processing intended for the production of food and beverage products from animal raw materials (other than milk)	2016	Nitrogen oxides	134000	1340000	kg	emission quantity corrected
ES.CAED/006403000.FACILITY	SAPA EXTRUSION SPAIN	Santa Oliva	Spain	2(f)	Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process	2021	Nitrogen oxides	1260000	578000	kg	emission quantity corrected
ES.CAED/006508000.FACILITY	ESTACIÓN DEPURADORA DE AGUAS RESIDUALES MURCIA ESTE	Llano de Brujas	Spain	5(f)	Urban waste-water treatment plants	2021	Nitrous oxide	227000	56000	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
ES.CAED/006617000.FACILITY	FINANCIERA MADERERA, S.A.	San Cibrao das Viñas	Spain	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2019	Particulate matter	222000	54500	kg	emission quantity corrected
ES.CAED/006618000.FACILITY	FINANCIERA MADERERA, S.A.	Padron	Spain	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2019	Nitrogen oxides	1700000	869000	kg	emission quantity corrected
ES.CAED/007354000.FACILITY	NAVARRO SIC, S.A.	Cañizares	Spain	4(b)(v)	Chemical installations for the production on an industrial scale of basic inorganic chemicals: Non-metals, metal oxides or other inorganic compounds such as calcium carbide, silicon, silicon carbide	2016	Nitrogen oxides	385000	124000	kg	emission quantity corrected
FR.CAED/10757.FACILITY	FERROGLOBE MANGANÈSE FRANCE SAS	Grande Synthe	France	2(e)(i)	Installation for the production of non-ferrous crude metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes	2013	Lead and compounds (as Pb)	1150	440	kg	emission quantity corrected
FR.CAED/10858.FACILITY	VENATOR PIGMENTS FRANCE	Comines	France	4(a)(x)	Chemical installations for the production on an industrial scale of basic organic chemicals: Dyes and pigments	2016	Sulphur oxides	524000	192000	kg	emission quantity corrected
FR.CAED/11610.FACILITY	CIMENTS CALCIA SAS	Airvault	France	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2021	Benzene	15000	6170	kg	emission quantity corrected
FR.CAED/1194.FACILITY	PAPREC AGRO	St Christophe de Double	France	5(c)	Installations for the disposal of non-hazardous waste	2020	Ammonia	38700	12400	kg	emission quantity corrected
FR.CAED/12539.FACILITY	CALCIA (CIMENTS) (USINE)	Villiers au Bouin	France	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2018	Nitrous oxide	14100	112500	kg	emission quantity corrected
FR.CAED/14625.FACILITY	ORVIA - COUVOIR DE LA MESANGERE (SAS)	Beaupreau	France	7(a)(i)	Installations for the intensive rearing of poultry with 40,000 places for poultry	2017	Ammonia	205000	41100	kg	emission quantity corrected
FR.CAED/1888.FACILITY	INDUSTEEL FRANCE	Le Breuil	France	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2014	Chromium and compounds (as Cr)	977	204	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
FR.CAED/1888.FACILITY	INDUSTEEL FRANCE	Le Breuil	France	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2014	Nickel and compounds (as Ni)	1050	81.3	kg	emission quantity corrected
FR.CAED/1904.FACILITY	VERALLIA FRANCE	Chalon sur Saone	France	3(e)	Installations for the manufacture of glass, including glass fibre	2013	Arsenic and compounds (as As)	131	30.5	kg	emission quantity corrected
FR.CAED/1919.FACILITY	APERAM ALLOYS IMPHY	Imphy	France	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2015	Nickel and compounds (as Ni)	1650	378	kg	emission quantity corrected
FR.CAED/274.FACILITY	MERSEN (EX CARBONE LORRAINE)	Amiens	France	9(d)	Installations for the production of carbon (hard-burnt coal) or electro-graphite by means of incineration or graphitisation	2021	Polycyclic aromatic hydrocarbons	17600	1760	kg	emission quantity corrected
FR.CAED/3507.FACILITY	CIMENTS CALCIA	Couvrot	France	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2020	Nitrous oxide	99600	23100	kg	emission quantity corrected
FR.CAED/3835.FACILITY	ERAMET	Sandouville	France	2(f)	Installations for surface treatment of metals and plastic materials using an electrolytic or chemical process	2019	Nickel and compounds (as Ni)	3780	1650	kg	emission quantity corrected
FR.CAED/4025.FACILITY	LINEX PANNEAUX S.A.S	Allouville Bellefosse	France	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2017	Nitrous oxide	58800	20400	kg	emission quantity corrected
FR.CAED/4316.FACILITY	CF2P SAS (EX IKEA INDUSTRY FRANCE)	Lure	France	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2014	Lead and compounds (as Pb)	1990	278	kg	emission quantity corrected
FR.CAED/5318.FACILITY	OI FRANCE SAS	Veauche	France	3(e)	Installations for the manufacture of glass, including glass fibre	2018	Arsenic and compounds (as As)	121	36.5	kg	emission quantity corrected
FR.CAED/5360.FACILITY	STEP ST-FONS GRAND LYON	St Fons	France	5(b)	Installations for the incineration of non-hazardous waste in the scope of Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste	2020	Nitrous oxide	98100	24300	kg	emission quantity corrected
FR.CAED/6581.FACILITY	LAFARGEHOLCIM CIMENTS	St Pierre La Cour	France	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2021	Ammonia	51400	15200	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
	(USINE CIMENTERIE)										
FR.CAED/725.FACILITY	O-I FRANCE SAS	Vayres	France	3(e)	Installations for the manufacture of glass, including glass fibre	2017	Arsenic and compounds (as As)	67.3	28.9	kg	emission quantity corrected
FR.CAED/7640.FACILITY	ASCOMETAL FOS-SUR-MER	Fos-sur-Mer	France	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2017	Chromium and compounds (as Cr)	348	125	kg	emission quantity corrected
FR.CAED/7633.FACILITY	BASELL POLYOLÉFINES FRANCE SAS	Berre L'Etang	France	1(c)	Thermal power stations and other combustion installations	2015	Benzene	25000	6800	kg	emission quantity corrected
FR.CAED/7656.FACILITY	ARCELORMITTAL MÉDITERRANÉE	Fos-sur-Mer	France	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2016	Cadmium and compounds (as Cd)	969	454	kg	emission quantity corrected
FR.CAED/7656.FACILITY	ARCELORMITTAL MÉDITERRANÉE	Fos-sur-Mer	France	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2014	Arsenic and compounds (as As)	112	36.7	kg	emission quantity corrected
FR.CAED/7656.FACILITY	ARCELORMITTAL MÉDITERRANÉE	Fos-sur-Mer	France	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2014	Nickel and compounds (as Ni)	3280	987	kg	emission quantity corrected
FR.CAED/8115.FACILITY	KERAGLASS	Bagneaux sur Loing	France	3(e)	Installations for the manufacture of glass, including glass fibre	2018	Arsenic and compounds (as As)	294	200	kg	emission quantity corrected
FR.CAED/8257.FACILITY	ITON SEINE	Bonnieres sur Seine	France	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2014	Mercury and compounds (as Hg)	95	15	kg	emission quantity corrected
FR.CAED/8313.FACILITY	ALPA ACIERIES LAMINOIRS PARIS	Gargenville	France	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2014	Mercury and compounds (as Hg)	64.1	34	kg	emission quantity corrected
FR.CAED/840.FACILITY	CELSA FRANCE SAS	Boucau	France	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2013	PCDD + PCDF (dioxins + furans) (as Teq)	0.00086	0.00019	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
FR.CAED/9481.FACILITY	ALSACHIMIE	Chalampe	France	4(a)(ii)	Chemical installations for the production on an industrial scale of basic organic chemicals: Oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters, acetates, ethers, peroxides, epoxy resins	2017	Nitrous oxide	2810000	467000	kg	emission quantity corrected
HR.CAED/00000064.FACILITY	Proizvodnja gnojiva	Kutina	Croatia	4(c)	Chemical installations for the production on an industrial scale of phosphorous, nitrogen or potassium based fertilisers (simple or compound fertilisers)	2021	Sulphur oxides	517000	242000	kg	emission quantity corrected
HR.CAED/00000204.FACILITY	Knaufinsulation d.o.o. Novi Marof	Novi Marof	Croatia	3(f)	Installations for melting mineral substances, including the production of mineral fibres	2018	Cadmium and compounds (as Cd)	102	45.26927083	kg	emission quantity corrected
http://paikkatiedot.fi/so/1002031/pf/ProductionFacility/00000001592.ProductionFacility	UPM-Kymmene Oyj, Kaukaan tehtaat	Lappeenranta	Finland	6(a)	Industrial plants for the production of pulp from timber or similar fibrous materials	2021	Particulate matter	261000	65200	kg	emission quantity corrected
http://paikkatiedot.fi/so/1002031/pf/ProductionFacility/00000001913.ProductionFacility	SSAB Europe Oy (ent. RUUKKI METALS OY), Raahen terästehdas	Raahe	Finland	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2019	Sulphur oxides	1730000	762000	kg	emission quantity corrected
http://paikkatiedot.fi/so/1002031/pf/ProductionFacility/00000001913.ProductionFacility	SSAB Europe Oy (ent. RUUKKI METALS OY), Raahen terästehdas	Raahe	Finland	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2021	Sulphur oxides	1850000	857000	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
http://paikkatiedot.fi/so/1002031/pf/ProductionFacility/0000002110.ProductionFacility	Outokumpu Chrome Oy, Outokumpu Stainless Oy, Tornion tehtaat	Tornio	Finland	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2021	Arsenic and compounds (as As)	1410	60.2	kg	emission quantity corrected
http://paikkatiedot.fi/so/1002031/pf/ProductionFacility/0000003500.ProductionFacility	Borealis Polymers Oy, Petrokemian laitokset	Porvoo	Finland	4(a)(i)	Chemical installations for the production on an industrial scale of basic organic chemicals: Simple hydrocarbons (linear or cyclic, saturated or unsaturated, aliphatic or aromatic)	2021	Benzene	97000	48000	kg	emission quantity corrected
http://paikkatiedot.fi/so/1002031/pf/ProductionFacility/0000016248.ProductionFacility	Kymin Voima Oy, Energiantuotanto	Kuusankoski	Finland	1(c)	Thermal power stations and other combustion installations	2019	Nitrous oxide	7850000	78500	kg	emission quantity corrected
http://paikkatiedot.fi/so/1002031/pf/ProductionFacility/0100050963.ProductionFacility	Metsä Board Oyj, Metsä Board Kaskinen Pulp Mill	Kaskinen	Finland	6(a)	Industrial plants for the production of pulp from timber or similar fibrous materials	2017	Nitrous oxide	1680000	16800	kg	emission quantity corrected
https://data.gov.sk/set/data/so/47056307_minzp/pf:ProductionFacility/	Slovenské elektrárne, a.s. - Elektrárne Nováky, závod	Zemianske Kostoľany	Slovakia	1(c)	Thermal power stations and other combustion installations	2015	Arsenic and compounds (as As)	646	229	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
47056307.NRZ.FACILITY											
https://data.ied_registry.omgeving.vlaanderen.be/id/productionfacility/BE.VL.000000067.FACILITY	BASF ANTWERPEN	Antwerpen	Belgium	4(a)(ii)	Chemical installations for the production on an industrial scale of basic organic chemicals: Oxygen-containing hydrocarbons such as alcohols, aldehydes, ketones, carboxylic acids, esters, acetates, ethers, peroxides, epoxy resins	2017	Nitrous oxide	313000	79300	kg	emission quantity corrected
https://data.ied_registry.omgeving.vlaanderen.be/id/productionfacility/BE.VL.000000424.FACILITY	APERAM GENK	Genk	Belgium	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2018	Mercury and compounds (as Hg)	378	37.8	kg	emission quantity corrected
https://registry.gdi-de.org/id/de.hb/de.hb.pf.bube-eureg.06-04-11/2005382/5/0	ArcelorMittal Bremen GmbH	Bremen	Germany	2(c)(iii)	Installations for the processing of ferrous metals, Application of protective fused metal coats	2018	PCDD + PCDF (dioxins + furans) (as Teq)	0.00069	0.000126	kg	emission quantity corrected
https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-114000-100-9008609	Venator Uerdingen GmbH	Krefeld	Germany	4(b)(v)	Chemical installations for the production on an industrial scale of basic inorganic chemicals: Non-metals, metal oxides or other inorganic compounds such as calcium carbide, silicon, silicon carbide	2014	Sulphur oxides	164000	497000	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-566028-500-0338944	RWE Generation SE Kraftwerk Ibbenbüren	Ibbenbüren	Germany	1(c)	Thermal power stations and other combustion installations	2018	Arsenic and compounds (as As)	226	75.6	kg	emission quantity corrected
https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-566028-500-0338944	RWE Generation SE Kraftwerk Ibbenbüren	Ibbenbüren	Germany	1(c)	Thermal power stations and other combustion installations	2016	Arsenic and compounds (as As)	297	82	kg	emission quantity corrected
https://registry.gdi-de.org/id/de.nw.inspire.pf.bube-eureg/arb-2017-974016-900-0014514	thomas zement GmbH & Co. KG Werk Erwitte	Erwitte	Germany	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2017	Benzene	5480	1400	kg	emission quantity corrected
https://registry.gdi-de.org/id/de.sn.sax4inspire.pf/74017206	slr-Elsterheide GmbH	Elsterheide	Germany	2(d)	Ferrous metal foundries with a production capacity of 20 tonnes per day	2021	Benzene	3280	1110	kg	emission quantity corrected
https://registry.gdi-de.org/id/de.sn.sax4inspi	LEAG Lausitz Energie Kraftwerke AG Kraftwerk Lippendorf	Neukieritzsch	Germany	1(c)	Thermal power stations and other combustion installations	2013	Cadmium and compounds (as Cd)	614	61.4	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
re.pf/80011277											
https://registry.gdi-de.org/id/de.st.lau.pf.anlagen-ied-euregistry/100681	Knauf Insulation GmbH	Bernburg	Germany	3(e)	Installations for the manufacture of glass, including glass fibre	2015	Ammonia	261000	116000	kg	emission quantity corrected
https://registry.gdi-de.org/id/de.th/5bf25e39-19d5-4254-adac-63f1b1cec499/86013077	Stahlwerk Thüringen GmbH	Unterwellenborn	Germany	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2020	Polycyclic aromatic hydrocarbons	2340	1080	kg	emission quantity corrected
HU.OKIR/100329299.FACILITY	Duna-Dráva Cement Kft.	Beremend	Hungary	3(c)	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces. Note to reporters, use Level 3 activity e.g. 3(c)(i), in preference to 3(c). Level 2 activity class (i.e. 3(c)) only to be used where Level 3 is not available.	2021	Mercury and compounds (as Hg)	69	33	kg	emission quantity corrected
HU.OKIR/100340995.FACILITY	O-I Hungary Kft.	Orosháza	Hungary	3(e)	Installations for the manufacture of glass, including glass fibre	2016	Nitrogen oxides	398000	192000	kg	emission quantity corrected
HU.OKIR/100423302.FACILITY	Isd Dunaferr Zrt.	Dunaújváros	Hungary	2(a)	Metal ore (including sulphide ore) roasting or sintering installations	2018	PCDD + PCDF (dioxins + furans) (as Teq)	0.03	0.011	kg	emission quantity corrected
HU.OKIR/100426945.FACILITY	Falco Zrt.	Szombathely	Hungary	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2017	Nitrogen oxides	396000	122000	kg	emission quantity corrected
IE.CAED/P0030.FACILITY	Irish Cement Limited (Platin)	Meath	Ireland	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2021	Mercury and compounds (as Hg)	55.67346	14.34	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
IE.CAED/P0207.FACILITY	Intel Ireland Limited	Kildare	Ireland	9(c)	Installations for the surface treatment of substances, objects or products using organic solvents, in particular for dressing, printing, coating, degreasing, waterproofing, sizing, painting, cleaning or impregnating	2021	Nitrous oxide	249672	95716	kg	emission quantity corrected
IE.CAED/P0378.FACILITY	Mannok Cement Limited	Cavan	Ireland	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2014	Sulphur oxides	544000	192000	kg	emission quantity corrected
IE.CAED/P0607.FACILITY	SSE Generation Ireland Limited (Tarbert)	Kerry	Ireland	1(c)	Thermal power stations and other combustion installations	2021	Nickel and compounds (as Ni)	1250.05	507.13	kg	emission quantity corrected
IE.CAED/P0607.FACILITY	SSE Generation Ireland Limited (Tarbert)	Kerry	Ireland	1(c)	Thermal power stations and other combustion installations	2021	Nitrogen oxides	963099	382788	kg	emission quantity corrected
IE.CAED/P0607.FACILITY	SSE Generation Ireland Limited (Tarbert)	Kerry	Ireland	1(c)	Thermal power stations and other combustion installations	2021	Sulphur oxides	2626930	997129	kg	emission quantity corrected
IT.CAED/000531002.FACILITY	Centrale Torrevaldaliga Nord	Civitavecchia	Italy	1(c)	Thermal power stations and other combustion installations	2018	Cadmium and compounds (as Cd)	105.6	29.4	kg	emission quantity corrected
IT.CAED/330102006.FACILITY	FANTONI SPA - Divisione Pannelli e Colla	Osoppo	Italy	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2020	Mercury and compounds (as Hg)	224.62	45.17	kg	emission quantity corrected
IT.CAED/330502002.FACILITY	ACCIAIERIE BERTOLI SAFAU SPA	Pozzuolo del Friuli	Italy	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2021	Nickel and compounds (as Ni)	180.25	88.32	kg	emission quantity corrected
IT.CAED/341452003.FACILITY	Stabilimento di Trieste	Trieste	Italy	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2019	PCDD + PCDF (dioxins + furans) (as Teq)	0.000487	0.000135	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
IT.CAED/361 002004.FACI LITY	AFV ACCIAIERIE BELTRAME SPA - STABILIMENT O DI VICENZA	Vicenza	Italy	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2017	Mercury and compounds (as Hg)	265	54.5	kg	emission quantity corrected
IT.CAED/400 262008.FACI LITY	Impianto RSU Tre Monti (ex Akron)	Imola	Italy	5(c)	Installations for the disposal of non-hazardous waste	2015	Methane	4390000	2010000	kg	emission quantity corrected
IT.CAED/430 372004.FACI LITY	Azienda Agricola Busi Lorenzo	Lesignano de' Bagni	Italy	7(a)	Installations for the intensive rearing of poultry or pigs. Note to reporters, use Level 3 activity e.g. 7(a)(ii), in preference to 7(a). Level 2 activity class (i.e. 7(a)) only to be used where Level 3 is not available.	2020	Ammonia	67600	676000	kg	emission quantity corrected
IT.CAED/430 162003.FACI LITY	SOCIETA' AGRICOLA GALLI EUGENIO S.R.L.	Polesine Zibello	Italy	7(a)	Installations for the intensive rearing of poultry or pigs. Note to reporters, use Level 3 activity e.g. 7(a)(ii), in preference to 7(a). Level 2 activity class (i.e. 7(a)) only to be used where Level 3 is not available.	2017	Methane	100000	728000	kg	emission quantity corrected
IT.CAED/430 562004.FACI LITY	SOCIETA' AGRICOLA SUINICOLA PARMENSE SOCIETA' SEMPLICE	Torrile	Italy	7(a)	Installations for the intensive rearing of poultry or pigs. Note to reporters, use Level 3 activity e.g. 7(a)(ii), in preference to 7(a). Level 2 activity class (i.e. 7(a)) only to be used where Level 3 is not available.	2020	Ammonia	23100	231000	kg	emission quantity corrected
IT.CAED/721 001002.FACI LITY	Centrale Termoelettrica ""Federico II""	Brindisi	Italy	1(c)	Thermal power stations and other combustion installations	2013	Nickel and compounds (as Ni)	1530	153	kg	emission quantity corrected
IT.CAED/721 001002.FACI LITY	Centrale Termoelettrica ""Federico II""	Brindisi	Italy	1(c)	Thermal power stations and other combustion installations	2013	Cadmium and compounds (as Cd)	63.8	27.1	kg	emission quantity corrected
IT.CAED/721 001005.FACI LITY	ENIPOWER S.P.A. - Stabilimento di Brindisi	Brindisi	Italy	1(c)	Thermal power stations and other combustion installations	2020	Nitrous oxide	12676000	12676	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
IT.CAED/741231003.FACILITY	CENTRALE TERMOELETTRICA DI TARANTO	Taranto	Italy	1(c)	Thermal power stations and other combustion installations	2021	Arsenic and compounds (as As)	129.083	58.887	kg	emission quantity corrected
IT.CAED/741231004.FACILITY	STABILIMENTO DI TARANTO	Taranto	Italy	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2020	Benzene	1326.9455	9622.85	kg	emission quantity corrected
IT.CAED/741231004.FACILITY	STABILIMENTO DI TARANTO	Taranto	Italy	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2012	Chromium and compounds (as Cr)	7840	784	kg	emission quantity corrected
IT.CAED/930121001.FACILITY	RAFFINERIA DI GELA SPA	Gela	Italy	1(a)	Mineral oil and gas refineries	2018	PCDD + PCDF (dioxins + furans) (as Teq)	0.003514	0.00061	kg	emission quantity corrected
IT.CAED/960101001.FACILITY	ERG Power Impianti Nord	Priolo Gargallo	Italy	1(c)	Thermal power stations and other combustion installations	2016	Nickel and compounds (as Ni)	175	53.8	kg	emission quantity corrected
IT.CAED/960101002.FACILITY	ISAB S.r.l.-IGCC	Priolo Gargallo	Italy	1(c)	Thermal power stations and other combustion installations	2013	Nickel and compounds (as Ni)	527	154	kg	emission quantity corrected
IT.CAED/960111001.FACILITY	Sonatrach Raffineria Italiana-Raffineria di Augusta	Augusta	Italy	1(a)	Mineral oil and gas refineries	2013	Cadmium and compounds (as Cd)	208	21	kg	emission quantity corrected
IT.CAED/980441001.FACILITY	CENTRALE TERMOELETTRICA DI SAN FILIPPO DEL MELA	San Filippo del Mela	Italy	1(c)	Thermal power stations and other combustion installations	2015	Nickel and compounds (as Ni)	780	255	kg	emission quantity corrected
LU.CAED/000002000.FACILITY	ArcelorMittal Belval & Differdange S.A.	Esch-sur-Alzette	Luxembourg	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2019	Benzene	29900	12400	kg	emission quantity corrected
LU.CAED/000006000.FACILITY	Guardian Luxguard II S.à r.l.	Dudelange	Luxembourg	3(e)	Installations for the manufacture of glass, including glass fibre	2016	Nitrogen oxides	154000	1117000	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
LV.LVGMC.PRTR/310853.Facility	AS “Balticovo”, Iecavas pagasts	Iecavas pagasts, Bauskas novads	Latvia	7(a)(i)	Installations for the intensive rearing of poultry with 40,000 places for poultry	2014	Ammonia	346000	30200	kg	emission quantity corrected
MT.ERA/000000017.FACILITY	Marsa Power Station	Marsa	Malta	1(c)	Thermal power stations and other combustion installations	2012	Nickel and compounds (as Ni)	2310	231	kg	emission quantity corrected
LV.LVGMC.PRTR/056901.Facility	SIA ""SCHWENK Latvija"", Brocēnu cementa rūpnīca	Brocēni	Latvia	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2012	Mercury and compounds (as Hg)	56	16	kg	emission quantity corrected
NL.RIVM/00000148.FACILITY	ENCI BV (Maastricht)	Maastricht	Netherlands	3(c)	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces. Note to reporters, use Level 3 activity e.g. 3(c)(i), in preference to 3(c). Level 2 activity class (i.e. 3(c)) only to be used where Level 3 is not available.	2013	Mercury and compounds (as Hg)	55.9	10.6	kg	emission quantity corrected
NL.RIVM/00044009.FACILITY	BV Afvalverbranding Zuid Nederland (AZN)	Moerdijk	Netherlands	5(b)	Installations for the incineration of non-hazardous waste in the scope of Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste	2021	Nitrous oxide	42200	10200	kg	emission quantity corrected
NL.RIVM/00064004.FACILITY	AVR Afvalverwerking BV (Duiven)	Duiven	Netherlands	5(c)	Installations for the disposal of non-hazardous waste	2014	Mercury and compounds (as Hg)	39.2	10.9	kg	emission quantity corrected
NL.RIVM/00064335.FACILITY	DJP - De Hoop BV	Eerbeek	Netherlands	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2021	Nitrogen oxides	126000000	126000	kg	emission quantity corrected
PL.MŚ/000000058.FACILITY	ArcelorMittal Poland S.A. Oddział Dąbrowa Górnicza	Dąbrowa Górnicza	Poland	2(a)	Metal ore (including sulphide ore) roasting or sintering installations	2021	PCDD + PCDF (dioxins + furans) (as Teq)	0.00821	0.000641	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
PL.MŚ/000000123.FACILITY	TAURON Wytwarzanie S.A Elektrownia Łagisza	Będzin	Poland	1(c)	Thermal power stations and other combustion installations	2019	Cadmium and compounds (as Cd)	2940	29.4	kg	emission quantity corrected
PL.MŚ/000000136.FACILITY	Celsa ""Huta Ostrowiec"" Sp.o.o.	Ostrowiec Świętokrzyski	Poland	5(g)	Independently operated industrial waste-water treatment plants which serve one or more activities covered in annex 1 of Regulation 166/2006	2016	Cadmium and compounds (as Cd)	330	33	kg	emission quantity corrected
PL.MŚ/000000136.FACILITY	Celsa ""Huta Ostrowiec"" Sp.o.o.	Ostrowiec Świętokrzyski	Poland	5(g)	Independently operated industrial waste-water treatment plants which serve one or more activities covered in annex 1 of Regulation 166/2006	2015	Cadmium and compounds (as Cd)	208	20.8	kg	emission quantity corrected
PL.MŚ/000000190.FACILITY	CEMEX Polska Sp. z o.o. - Zakład Cementownia Rudniki	Rudniki	Poland	3(c)	Installations for the production of cement clinker in rotary kilns, lime in rotary kilns, cement or lime in other furnaces. Note to reporters, use Level 3 activity e.g. 3(c)(i), in preference to 3(c). Level 2 activity class (i.e. 3(c)) only to be used where Level 3 is not available.	2017	Mercury and compounds (as Hg)	239	23.9	kg	emission quantity corrected
PL.MŚ/000000314.FACILITY	KRONOSPAN SZCZECINEK Sp. z o.o.	Szczecinek	Poland	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2016	Ammonia	322000	204000	kg	emission quantity corrected
PL.MŚ/000000331.FACILITY	KRONOSPAN POLSKA Sp. z o.o.	Szczecinek	Poland	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2018	Ammonia	317000	57600	kg	emission quantity corrected
PL.MŚ/000000356.FACILITY	PGE Górnictwo i Energetyka Konwencjonalna S.A. - Oddział Elektrociepłownia Lublin Wrotków	Lublin	Poland	1(c)	Thermal power stations and other combustion installations	2021	PCDD + PCDF (dioxins + furans) (as Teq)	0.00444	0.00142	kg	emission quantity corrected
PL.MŚ/000000468.FACILITY	ENEA Elektrownia Połaniec Spółka Akcyjna	Połaniec	Poland	1(c)	Thermal power stations and other combustion installations	2013	Nickel and compounds (as Ni)	2540	254	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
PL.MŚ/0000 00504.FACIL ITY	Gospodarstwo Rolne Piotr Skrentny	Kiełpin	Poland	7(a)	Installations for the intensive rearing of poultry or pigs. Note to reporters, use Level 3 activity e.g. 7(a)(ii), in preference to 7(a). Level 2 activity class (i.e. 7(a)) only to be used where Level 3 is not available.	2021	Nitrous oxide	29500	13600	kg	emission quantity corrected
PL.MŚ/0000 00586.FACIL ITY	Grupa Azoty Zakłady Azotowe ""Puławy"" S.A.	Puławy	Poland	4(c)	Chemical installations for the production on an industrial scale of phosphorous, nitrogen or potassium based fertilisers (simple or compound fertilisers)	2019	Mercury and compounds (as Hg)	40.6	11.6	kg	emission quantity corrected
PL.MŚ/0000 00586.FACIL ITY	Grupa Azoty Zakłady Azotowe ""Puławy"" S.A.	Puławy	Poland	4(c)	Chemical installations for the production on an industrial scale of phosphorous, nitrogen or potassium based fertilisers (simple or compound fertilisers)	2021	Nickel and compounds (as Ni)	1380	327	kg	emission quantity corrected
PL.MŚ/0000 00586.FACIL ITY	Grupa Azoty Zakłady Azotowe ""Puławy"" S.A.	Puławy	Poland	4(c)	Chemical installations for the production on an industrial scale of phosphorous, nitrogen or potassium based fertilisers (simple or compound fertilisers)	2016	Chromium and compounds (as Cr)	867	149	kg	emission quantity corrected
PL.MŚ/0000 00586.FACIL ITY	Grupa Azoty Zakłady Azotowe ""Puławy"" S.A.	Puławy	Poland	4(c)	Chemical installations for the production on an industrial scale of phosphorous, nitrogen or potassium based fertilisers (simple or compound fertilisers)	2012	Polycyclic aromatic hydrocarbons	24000	11800	kg	emission quantity corrected
PL.MŚ/0000 00605.FACIL ITY	Instytut Metali Nieżelaznych w Gliwicach Oddział w Legnicy	Legnica	Poland	2(e)	Installations for the production and/or smelting of non-ferrous metals. Note to reporters, use Level 3 activity e.g. 2(e)(i), in preference to 2(e). Level 2 activity class (i.e. 2(e)) only to be used where Level 3 is not available.	2021	Cadmium and compounds (as Cd)	106	20	kg	emission quantity corrected
PL.MŚ/0000 00693.FACIL ITY	Elektrownia Pątnów I	Konin	Poland	1(c)	Thermal power stations and other combustion installations	2019	Chromium and compounds (as Cr)	428	2275	kg	emission quantity corrected
PL.MŚ/0000 01614.FACIL ITY	SKB Drive Tech S.A.	Radomsko	Poland	2(d)	Ferrous metal foundries with a production capacity of 20 tonnes per day	2018	Polycyclic aromatic hydrocarbons	1500	550	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
PL.MŚ/000001740.FACILITY	TAMEH POLSKA sp. z o. o. - Zakład Wytwarzania Kraków (Elektrociepłownia)	Kraków	Poland	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2017	Mercury and compounds (as Hg)	795	244	kg	emission quantity corrected
PL.MŚ/000003637.FACILITY	SW-SOLAR CZARNA WODA SPÓŁKA Z OGRANICZONĄ ODPOWIEDZIALNOŚCIĄ	Czarnków	Poland	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2018	PCDD + PCDF (dioxins + furans) (as Teq)	0.000966	0.0001	kg	emission quantity corrected
PT.CAED/PT.APA05762422.CI	Unidade de Portimão (CI)	Portimão	Portugal	5(d)	Landfills (excluding landfills of inert waste and landfills, which were definitely closed before 16.7.2001 or for which the after-care phase required by the competent authorities according to Article 13 of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste has expired)	2021	Methane	16900000	4430000	kg	emission quantity corrected
PT.CAED/PT.APA05764962.CI	Centro de Produção de Loulé (CI)	Loulé	Portugal	3(c)(i)	Installations for the production of cement clinker in rotary kilns	2018	Cadmium and compounds (as Cd)	56.3	14.4	kg	emission quantity corrected
PT.CAED/PT.APA05766002.CI	BA GLASS PORTUGAL, SA - Unidade Fabril da Marinha Grande (CI)	Marinha Grande	Portugal	3(e)	Installations for the manufacture of glass, including glass fibre	2017	Cadmium and compounds (as Cd)	73.8	10.5	kg	emission quantity corrected
PT.CAED/PT.APA05766022.CI	BA GLASS PORTUGAL, S.A. Unidade Fabril da Venda Nova (CI)	Amadora	Portugal	3(e)	Installations for the manufacture of glass, including glass fibre	2013	Nitrogen oxides	759000	352000	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
PT.CAED/PT.APA05770882.CI	SN Seixal - Siderurgia Nacional SA (CI)	Seixal	Portugal	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2014	Cadmium and compounds (as Cd)	37.5	351	kg	emission quantity corrected
PT.CAED/PT.APA05771862.CI	Sonae Arauco Portugal, S.A. Mangualde (CI)	Mangualde	Portugal	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2019	Cadmium and compounds (as Cd)	17.9	213.5	kg	emission quantity corrected
PT.CAED/PT.APA05771862.CI	Sonae Arauco Portugal, S.A. Mangualde (CI)	Mangualde	Portugal	6(b)	Industrial plants for the production of paper and board and other primary wood products (such as chipboard, fibreboard and plywood)	2019	Particulate matter	226000	69400	kg	emission quantity corrected
PT.CAED/PT.APA05772082.CI	Unidade da Resitejo (Aterro, Triagem e TM) (CI)	Carregueira	Portugal	5(d)	Landfills (excluding landfills of inert waste and landfills, which were definitely closed before 16.7.2001 or for which the after-care phase required by the competent authorities according to Article 13 of Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste has expired)	2017	Methane	308000	3080000	kg	emission quantity corrected
PT.CAED/PT.APA05773702.CI	Preceram - Norte, Cerâmicas, SA (CI)	Aguada de Baixo	Portugal	3(g)	Installations for the manufacture of ceramic products by firing, in particular roofing tiles, bricks, refractory bricks, tiles, stoneware or porcelain	2015	Nickel and compounds (as Ni)	168	64.1	kg	emission quantity corrected
PT.CAED/PT.APA05775502.CI	SGL Composites, S.A. (CI)	Lavradio	Portugal	4(a)(viii)	Chemical installations for the production on an industrial scale of basic organic chemicals: Basic plastic materials (polymers, synthetic fibres and cellulose-based fibres)	2019	Particulate matter	433000	128000	kg	emission quantity corrected
PT.CAED/PT.APA05778782.CI	Sakthi Portugal SP21, SA (CI)	Águeda	Portugal	2(d)	Ferrous metal foundries with a production capacity of 20 tonnes per day	2020	Cadmium and compounds (as Cd)	104	15	kg	emission quantity corrected
PT.EEA/38299.FACILITY	Metalúrgica Recor, S.A.	Santa Maria da Feira	Portugal	2(d)	Ferrous metal foundries with a production capacity of 20 tonnes per day	2016	PCDD + PCDF (dioxins + furans) (as Teq)	0.113	0.000113	kg	emission quantity corrected
SE.CAED/10014118.Facility	Igelsta värmeverk	Södertälje	Sweden	1(c)	Thermal power stations and other combustion installations	2021	PCDD + PCDF (dioxins + furans) (as Teq)	0.0009	0.0002	kg	emission quantity corrected

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
SE.CAED/10017446.Facility	Stora Enso Paper AB	Nymölla	Sweden	6(a)	Industrial plants for the production of pulp from timber or similar fibrous materials	2015	Nitrous oxide	10000	60000	kg	emission quantity corrected
SE.CAED/10021812.Facility	Outokumpu Stainless AB, Avesta	Avesta	Sweden	2(b)	Installations for the production of pig iron or steel (primary or secondary melting) including continuous casting	2013	Chromium and compounds (as Cr)	1000	163	kg	emission quantity corrected
SE.CAED/10024476.Facility	LKAB - Malmbergsgruvan	Malmberget	Sweden	2(a)	Metal ore (including sulphide ore) roasting or sintering installations	2020	Particulate matter	519000	104000	kg	emission quantity corrected
SE.CAED/10024885.Facility	LKAB - Kirunagruvan	Kiruna	Sweden	2(a)	Metal ore (including sulphide ore) roasting or sintering installations	2018	Ammonia	229000	22900	kg	emission quantity corrected
SI.ARSO/000000153.FACILITY	Premogovnik Velenje	Velenje	Slovenia	3(a)	Underground mining and related operations	2016	Methane	1350000	8820000	kg	emission quantity corrected
PL.MŚ/000000598.FACILITY	Jastrzębska Spółka Węglowa Spółka Akcyjna Kopalnia Węgla Kamiennego ""Pniówek""	Pawłowice	Poland	7(b)	Intensive aquaculture	2017	PCDD + PCDF (dioxins + furans) (as Teq)	11.4	0.11	kg	emission quantity corrected
IT.CAED/250302024.FACILITY	AZ. AGR. RONCALI ALBERTO	Pompiano	Italy	7(a)	Installations for the intensive rearing of poultry or pigs. Note to reporters, use Level 3 activity e.g. 7(a)(ii), in preference to 7(a). Level 2 activity class (i.e. 7(a)) only to be used where Level 3 is not available.	2012	Ammonia	12200	12200	kg	facility added
IT.CAED/250302024.FACILITY	AZ. AGR. RONCALI ALBERTO	Pompiano	Italy	7(a)	Installations for the intensive rearing of poultry or pigs. Note to reporters, use Level 3 activity e.g. 7(a)(ii), in preference to 7(a). Level 2 activity class (i.e. 7(a)) only to be used where Level 3 is not available.	2013	Ammonia	12200	12200	kg	facility added
IT.CAED/250302024.FACILITY	AZ. AGR. RONCALI ALBERTO	Pompiano	Italy	7(a)	Installations for the intensive rearing of poultry or pigs. Note to reporters, use Level 3 activity e.g. 7(a)(ii), in preference to 7(a). Level 2 activity class (i.e. 7(a)) only to be used where Level 3 is not available.	2016	Ammonia	10200	10200	kg	facility added

Facility Inspire ID	Facility Name	City	Country	Activity Code	Activity Name	Year	Pollutant	Reported emissions	Revised emissions	Unit	Comment
IT.CAED/250302024.FACILITY	AZ. AGR. RONCALI ALBERTO	Pompiano	Italy	7(a)	Installations for the intensive rearing of poultry or pigs. Note to reporters, use Level 3 activity e.g. 7(a)(ii), in preference to 7(a). Level 2 activity class (i.e. 7(a)) only to be used where Level 3 is not available.	2017	Ammonia	10400	10400	kg	facility added
IT.CAED/250302024.FACILITY	AZ. AGR. RONCALI ALBERTO	Pompiano	Italy	7(a)	Installations for the intensive rearing of poultry or pigs. Note to reporters, use Level 3 activity e.g. 7(a)(ii), in preference to 7(a). Level 2 activity class (i.e. 7(a)) only to be used where Level 3 is not available.	2018	Ammonia	10100	10100	kg	facility added
IT.CAED/250302024.FACILITY	AZ. AGR. RONCALI ALBERTO	Pompiano	Italy	7(a)	Installations for the intensive rearing of poultry or pigs. Note to reporters, use Level 3 activity e.g. 7(a)(ii), in preference to 7(a). Level 2 activity class (i.e. 7(a)) only to be used where Level 3 is not available.	2020	Ammonia	13640	13640	kg	facility added
BG.CAED/012000015.FACILITY	Stam Treiding AD	София	Bulgaria	2(e)(i)	Installation for the production of non-ferrous crude metals from ore, concentrates or secondary raw materials by metallurgical, chemical or electrolytic processes	2018	PCDD + PCDF (dioxins + furans) (as Teq)	1000.92	1000.92	kg	facility removed
FR.CAED/6927.FACILITY	CONSEIL DEPART CENTRE VALOR ENERG	Pontmain	France	5(b)	Installations for the incineration of non-hazardous waste in the scope of Directive 2000/76/EC of the European Parliament and of the Council of 4 December 2000 on the incineration of waste	2021	PCDD + PCDF (dioxins + furans) (as Teq)	16.299999	16.299999	kg	facility removed

Annex 5 E-PRTR to GNFR mapping

The modelling used to calculate sectoral exposure adjustment factors and the sector-specific PM_{10}:$PM_{2.5}$ ratios classifies human activities using the Gridding Nomenclature for Reporting (GNFR). The ETC-HE undertook a mapping exercise based on the reporting codes table developed by the Task Force on Emission Inventories and Projections (TFEIP) (CEIP, 2019). This document is a mapping table linking categories of different reporting formats (NACE, SNAP, NFR14, NFR09, CRF, E-PRTR, GAINS/RAINS). According to the README section of such table, it was created by a team of Finnish and Estonian emission experts that are part of the TFEIP. The ETC-HE and EEA made some minor corrections to this mapping.

Table A5.1 - Correspondence between E-PRTR activity codes and the GNFR nomenclature as used in the externality calculation

Main Activity Code - E-PRTR	Other Activity Code - E-PRTR	GNFR code
1(a)	1(c)	BDE
1(a)	1(d)	BDE
1(a)	4(a)	BDE
1(a)	4(a)(i)	BDE
1(a)	4(a)(viii)	BDE
1(a)	5(d)	BDE
1(a)	-	BDE
1(b)	-	B
1(c)	1(a)	ABC
1(c)	1(b)	ABC
1(c)	1(c)	ABC
1(c)	1(e)	ABC
1(c)	1(f)	ABC
1(c)	3(b)	ABC
1(c)	3(c)	ABC
1(c)	3(c)(i)	ABC
1(c)	3(c)(ii)	ABC
1(c)	3(c)(iii)	ABC
1(c)	4(a)	ABC
1(c)	4(a)(ii)	ABC
1(c)	4(b)	ABC
1(c)	4(b)(i)	ABC
1(c)	4(b)(iv)	ABC
1(c)	4(b)(v)	ABC
1(c)	5(a)	ABC
1(c)	5(b)	ABC
1(c)	5(c)	ABC
1(c)	5(d)	ABC

Main Activity Code - E-PRTR	Other Activity Code - E-PRTR	GNFR code
1(c)	5(g)	ABC
1(c)	6(a)	ABC
1(c)	6(b)	ABC
1(c)	7(a)	ABC
1(c)	8(b)	ABC
1(c)	8(b)(ii)	ABC
1(c)	-	ABC
1(d)	1(c)	BD
1(d)	-	BD
1(e)	1(c)	B
1(e)	3(b)	B
1(e)	-	B
1(f)	1(e)	BD
1(f)	1(f)	BD
1(f)	-	BD
2(a)	2(b)	B
2(a)	2(c)	B
2(a)	2(e)(i)	B
2(a)	4(b)	B
2(a)	-	B
2(b)	1(c)	B
2(b)	1(d)	B
2(b)	1(e)	B
2(b)	2(a)	B
2(b)	2(b)	B
2(b)	2(c)	B
2(b)	2(c)(i)	B
2(b)	2(c)(iii)	B
2(b)	2(d)	B
2(b)	2(f)	B
2(b)	3(b)	B
2(b)	3(c)	B
2(b)	3(c)(ii)	B
2(b)	5(a)	B
2(b)	5(c)	B
2(b)	5(d)	B
2(b)	9(c)	B
2(b)	-	B
2(c)	1(c)	B
2(c)	2(b)	B
2(c)	-	B
2(c)(i)	2(b)	B

Main Activity Code - E-PRTR	Other Activity Code - E-PRTR	GNFR code
2(c)(i)	2(f)	B
2(c)(i)	5(d)	B
2(c)(i)	9(c)	B
2(c)(i)	-	B
2(c)(iii)	2(b)	B
2(c)(iii)	2(f)	B
2(c)(iii)	9(c)	B
2(c)(iii)	-	B
2(d)	4(a)(i)	B
2(d)	-	B
2(e)	2(a)	B
2(e)	2(f)	B
2(e)	4(b)	B
2(e)	5(a)	B
2(e)	5(c)	B
2(e)	5(d)	B
2(e)	-	B
2(e)(i)	1(c)	B
2(e)(i)	2(a)	B
2(e)(i)	2(d)	B
2(e)(i)	2(e)(ii)	B
2(e)(i)	4(a)(vii)	B
2(e)(i)	4(b)(i)	B
2(e)(i)	4(b)(ii)	B
2(e)(i)	4(b)(iv)	B
2(e)(i)	4(b)(v)	B
2(e)(i)	5(a)	B
2(e)(i)	5(c)	B
2(e)(i)	5(d)	B
2(e)(i)	9(d)	B
2(e)(i)	-	B
2(e)(ii)	3(c)(i)	B
2(e)(ii)	-	B
2(f)	1(c)	BE
2(f)	2(b)	BE
2(f)	2(c)	BE
2(f)	2(e)	BE
2(f)	2(f)	BE
2(f)	4(a)(viii)	BE
2(f)	5(a)	BE
2(f)	5(d)	BE
2(f)	5(g)	BE

Main Activity Code - E-PRTR	Other Activity Code - E-PRTR	GNFR code
2(f)	9(c)	BE
2(f)	-	BE
3(a)	1(a)	BD
3(a)	1(c)	BD
3(a)	3(a)	BD
3(a)	3(b)	BD
3(a)	5(a)	BD
3(a)	-	BD
3(b)	3(c)	BD
3(b)	3(e)	BD
3(b)	3(g)	BD
3(b)	-	BD
3(c)	1(c)	B
3(c)	3(b)	B
3(c)	3(g)	B
3(c)	4(b)(iv)	B
3(c)	5(a)	B
3(c)	5(b)	B
3(c)	5(c)	B
3(c)	-	B
3(c)(i)	1(e)	B
3(c)(i)	3(b)	B
3(c)(i)	5(a)	B
3(c)(i)	5(b)	B
3(c)(i)	5(c)	B
3(c)(i)	5(d)	B
3(c)(i)	-	B
3(c)(ii)	3(b)	B
3(c)(ii)	-	B
3(c)(iii)	3(b)	B
3(c)(iii)	4(b)(v)	B
3(c)(iii)	5(b)	B
3(c)(iii)	5(c)	B
3(c)(iii)	-	B
3(e)	1(c)	BE
3(e)	3(f)	BE
3(e)	4(b)(i)	BE
3(e)	5(d)	BE
3(e)	9(c)	BE
3(e)	-	BE
3(f)	4(b)	BE
3(f)	-	BE

Main Activity Code - E-PRTR	Other Activity Code - E-PRTR	GNFR code
3(g)	1(c)	B
3(g)	3(a)	B
3(g)	3(c)	B
3(g)	3(f)	B
3(g)	5(a)	B
3(g)	5(b)	B
3(g)	-	B
4(a)	1(c)	BEJ
4(a)	2(f)	BEJ
4(a)	4(a)(viii)	BEJ
4(a)	4(b)	BEJ
4(a)	5(a)	BEJ
4(a)	6(a)	BEJ
4(a)	6(b)	BEJ
4(a)	-	BEJ
4(a)(i)	1(a)	B
4(a)(i)	1(c)	B
4(a)(i)	4(a)(ii)	B
4(a)(i)	4(a)(viii)	B
4(a)(i)	4(b)(i)	B
4(a)(i)	-	B
4(a)(ii)	1(c)	B
4(a)(ii)	4(a)	B
4(a)(ii)	4(a)(i)	B
4(a)(ii)	4(a)(ii)	B
4(a)(ii)	4(a)(iii)	B
4(a)(ii)	4(a)(iv)	B
4(a)(ii)	4(a)(vi)	B
4(a)(ii)	4(a)(viii)	B
4(a)(ii)	4(a)(xi)	B
4(a)(ii)	4(b)(i)	B
4(a)(ii)	4(b)(ii)	B
4(a)(ii)	4(b)(iv)	B
4(a)(ii)	4(b)(v)	B
4(a)(ii)	4(c)	B
4(a)(ii)	4(d)	B
4(a)(ii)	8(b)(ii)	B
4(a)(ii)	-	B
4(a)(iii)	-	B
4(a)(iv)	1(c)	B
4(a)(iv)	4(a)(ii)	B
4(a)(iv)	4(a)(vi)	B

Main Activity Code - E-PRTR	Other Activity Code - E-PRTR	GNFR code
4(a)(iv)	4(a)(viii)	B
4(a)(iv)	4(a)(xi)	B
4(a)(iv)	4(b)(i)	B
4(a)(iv)	4(b)(ii)	B
4(a)(iv)	4(b)(iii)	B
4(a)(iv)	4(b)(iv)	B
4(a)(iv)	4(c)	B
4(a)(iv)	5(a)	B
4(a)(iv)	-	B
4(a)(ix)	1(c)	BE
4(a)(ix)	4(a)(vi)	BE
4(a)(ix)	-	BE
4(a)(v)	-	E
4(a)(vi)	1(c)	B
4(a)(vi)	4(a)(viii)	B
4(a)(vi)	4(b)(i)	B
4(a)(vi)	4(b)(ii)	B
4(a)(vi)	4(b)(iii)	B
4(a)(vi)	4(b)(iv)	B
4(a)(vi)	-	B
4(a)(vii)	-	B
4(a)(viii)	1(a)	BE
4(a)(viii)	1(c)	BE
4(a)(viii)	4(a)	BE
4(a)(viii)	4(a)(i)	BE
4(a)(viii)	4(a)(iv)	BE
4(a)(viii)	4(a)(ix)	BE
4(a)(viii)	4(a)(v)	BE
4(a)(viii)	4(a)(vi)	BE
4(a)(viii)	4(b)(i)	BE
4(a)(viii)	4(b)(iii)	BE
4(a)(viii)	4(d)	BE
4(a)(viii)	5(a)	BE
4(a)(viii)	5(d)	BE
4(a)(viii)	-	BE
4(a)(x)	-	BE
4(a)(xi)	4(a)	BE
4(a)(xi)	-	BE
4(b)	1(c)	BJ
4(b)	4(a)	BJ
4(b)	4(b)	BJ
4(b)	4(c)	BJ

Main Activity Code - E-PRTR	Other Activity Code - E-PRTR	GNFR code
4(b)	5(d)	BJ
4(b)	-	BJ
4(b)(i)	1(c)	B
4(b)(i)	4(a)(viii)	B
4(b)(i)	4(b)(iii)	B
4(b)(i)	4(b)(v)	B
4(b)(i)	4(c)	B
4(b)(i)	-	B
4(b)(ii)	1(c)	B
4(b)(ii)	4(a)(ii)	B
4(b)(ii)	4(b)(ii)	B
4(b)(ii)	4(b)(iii)	B
4(b)(ii)	4(c)	B
4(b)(ii)	5(a)	B
4(b)(ii)	5(d)	B
4(b)(ii)	-	B
4(b)(iii)	3(c)(iii)	B
4(b)(iii)	4(a)(ii)	B
4(b)(iii)	4(a)(vi)	B
4(b)(iii)	4(a)(viii)	B
4(b)(iii)	4(b)(i)	B
4(b)(iii)	4(b)(ii)	B
4(b)(iii)	5(a)	B
4(b)(iii)	5(d)	B
4(b)(iii)	5(g)	B
4(b)(iii)	-	B
4(b)(iv)	1(c)	B
4(b)(iv)	4(a)(ii)	B
4(b)(iv)	4(b)(ii)	B
4(b)(iv)	4(c)	B
4(b)(iv)	4(e)	B
4(b)(iv)	5(a)	B
4(b)(iv)	5(d)	B
4(b)(iv)	8(b)(ii)	B
4(b)(iv)	-	B
4(b)(v)	1(c)	B
4(b)(v)	2(e)(ii)	B
4(b)(v)	4(b)	B
4(b)(v)	4(b)(ii)	B
4(b)(v)	4(d)	B
4(b)(v)	5(d)	B
4(b)(v)	-	B

Main Activity Code - E-PRTR	Other Activity Code - E-PRTR	GNFR code
4(c)	1(c)	B
4(c)	4(a)	B
4(c)	4(a)(iv)	B
4(c)	4(b)	B
4(c)	4(b)(i)	B
4(c)	4(b)(ii)	B
4(c)	4(b)(iii)	B
4(c)	5(c)	B
4(c)	-	B
4(d)	-	B
4(e)	1(c)	BE
4(e)	2(f)	BE
4(e)	5(a)	BE
4(e)	-	BE
4(f)	-	B
5(a)	1(a)	J
5(a)	1(c)	J
5(a)	2(e)	J
5(a)	2(e)(ii)	J
5(a)	3(g)	J
5(a)	5(a)	J
5(a)	5(b)	J
5(a)	5(c)	J
5(a)	5(d)	J
5(a)	5(e)	J
5(a)	-	J
5(b)	1(c)	AJ
5(b)	2(c)	AJ
5(b)	2(d)	AJ
5(b)	5(a)	AJ
5(b)	5(b)	AJ
5(b)	5(c)	AJ
5(b)	5(d)	AJ
5(b)	5(e)	AJ
5(b)	5(f)	AJ
5(b)	-	AJ
5(c)	1(c)	J
5(c)	5(a)	J
5(c)	5(b)	J
5(c)	5(c)	J
5(c)	5(d)	J
5(c)	5(f)	J

Main Activity Code - E-PRTR	Other Activity Code - E-PRTR	GNFR code
5(c)	-	J
5(d)	1(c)	J
5(d)	2(d)	J
5(d)	2(e)	J
5(d)	4(b)	J
5(d)	5(a)	J
5(d)	5(b)	J
5(d)	5(c)	J
5(d)	5(e)	J
5(d)	5(f)	J
5(d)	-	J
5(e)	4(c)	J
5(e)	5(c)	J
5(e)	-	J
5(f)	5(b)	J
5(f)	5(c)	J
5(f)	5(d)	J
5(f)	-	J
5(g)	1(c)	J
5(g)	2(b)	J
5(g)	4(b)	J
5(g)	-	J
6(a)	1(c)	B
6(a)	3(c)	B
6(a)	4(a)	B
6(a)	5(b)	B
6(a)	5(c)	B
6(a)	5(d)	B
6(a)	6(b)	B
6(a)	-	B
6(b)	1(c)	B
6(b)	3(c)	B
6(b)	4(a)	B
6(b)	5(a)	B
6(b)	5(b)	B
6(b)	5(c)	B
6(b)	5(d)	B
6(b)	6(a)	B
6(b)	6(b)	B
6(b)	-	B
6(c)	-	E
7(a)	1(c)	K

Main Activity Code - E-PRTR	Other Activity Code - E-PRTR	GNFR code
7(a)	2(d)	K
7(a)	7(a)(ii)	K
7(a)	-	K
7(a)(i)	7(a)	K
7(a)(i)	7(a)(ii)	K
7(a)(i)	8(a)	K
7(a)(i)	-	K
7(a)(ii)	4(a)(ii)	K
7(a)(ii)	5(c)	K
7(a)(ii)	5(e)	K
7(a)(ii)	5(g)	K
7(a)(ii)	7(a)(i)	K
7(a)(ii)	7(a)(ii)	K
7(a)(ii)	7(a)(iii)	K
7(a)(ii)	8(a)	K
7(a)(ii)	-	K
7(a)(iii)	5(e)	K
7(a)(iii)	7(a)(ii)	K
7(a)(iii)	7(a)(iii)	K
7(a)(iii)	-	K
7(b)	3(c)	L
7(b)	3(e)	L
7(b)	8(b)	L
7(b)	-	L
8(a)	5(e)	B
8(a)	-	B
8(b)	1(c)	B
8(b)	3(c)	B
8(b)	4(a)	B
8(b)	5(d)	B
8(b)	8(a)	B
8(b)	-	B
8(b)(i)	1(c)	B
8(b)(i)	-	B
8(b)(ii)	1(c)	BE
8(b)(ii)	3(c)(ii)	BE
8(b)(ii)	3(c)(iii)	BE
8(b)(ii)	4(a)(ii)	BE
8(b)(ii)	5(c)	BE
8(b)(ii)	5(d)	BE
8(b)(ii)	5(e)	BE
8(b)(ii)	8(b)(ii)	BE

Main Activity Code - E-PRTR	Other Activity Code - E-PRTR	GNFR code
8(b)(ii)	-	BE
8(c)	-	B
9(a)	-	E
9(b)	9(c)	E
9(b)	-	E
9(c)	1(c)	BE
9(c)	2(c)(iii)	BE
9(c)	2(e)(ii)	BE
9(c)	2(f)	BE
9(c)	4(a)(viii)	BE
9(c)	5(a)	BE
9(c)	5(b)	BE
9(c)	-	BE
9(d)	2(e)(i)	B
9(d)	-	B
9(e)	2(f)	E
9(e)	9(c)	E
9(e)	-	E

Annex 6 Sectoral exposure adjustment factors and sectoral PM_{10}:$PM_{2.5}$ ratio adjustment factors

Sectoral exposure adjustment factors

Table A6.1 - Sectoral adjustment factors for the $PM_{2.5}$ precursor NO_X

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
AT	1.12	1.05	1.04	1.00	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00
BE	1.06	0.94	1.04	1.00	1.00	1.02	0.98	1.00	0.97	1.00	1.00	1.00	1.00
BG	0.93	1.06	1.01	1.00	1.00	1.00	0.95	1.26	0.95	1.00	1.00	1.00	1.00
CH	1.00	0.98	1.08	1.00	1.00	0.96	1.00	1.25	1.05	1.00	1.00	1.00	1.00
CY	0.95	0.96	1.08	1.00	1.00	1.04	1.05	0.97	1.01	1.00	1.00	1.00	1.00
CZ	1.03	1.03	1.00	1.00	1.00	0.97	1.00	1.00	0.98	1.00	1.00	1.00	1.00
DE	0.99	1.02	1.03	1.00	1.00	0.99	1.00	1.25	0.97	1.00	1.00	1.00	1.00
DK	1.08	0.98	0.99	1.00	1.00	1.04	0.87	1.21	1.00	1.00	1.00	1.00	1.00
EE	0.65	1.07	1.18	1.00	1.00	1.21	1.27	1.00	1.11	1.00	1.00	1.00	1.00
ES	0.57	1.05	1.21	1.00	1.00	1.15	1.17	1.68	0.83	1.00	1.00	1.00	1.00
FI	1.26	0.81	1.00	1.00	1.00	0.92	1.25	1.00	1.02	1.00	1.00	1.00	1.00
FR	1.14	0.94	1.19	1.00	1.00	0.98	0.77	1.75	0.92	1.00	1.00	1.00	1.00
GB	0.90	0.92	1.17	1.00	1.00	1.05	0.77	1.46	1.10	1.00	1.00	1.00	1.00
GR	0.99	1.03	1.13	1.00	1.00	1.06	0.83	1.00	1.11	1.00	1.00	1.00	1.00
HR	1.21	1.03	1.21	1.00	1.00	0.93	0.71	1.00	1.02	1.00	1.00	1.00	1.00
HU	1.09	0.99	1.06	1.00	1.00	0.98	1.17	1.00	0.91	1.00	1.00	1.00	1.00

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
IE	0.77	1.09	1.12	1.00	1.00	1.00	0.99	1.69	0.95	1.00	1.00	1.00	1.00
IS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IT	0.76	0.97	1.19	1.00	1.00	1.04	0.48	1.00	0.93	1.00	1.00	1.00	1.00
LT	1.16	0.66	1.07	1.00	1.00	1.04	0.93	2.40	0.89	1.00	1.00	1.00	1.00
LU	0.96	1.00	1.04	1.00	1.00	0.95	1.00	1.58	1.00	1.00	1.00	1.00	1.00
LV	1.38	1.20	1.02	1.00	1.00	0.84	1.46	1.00	0.95	1.00	1.00	0.77	0.77
ME	0.73	1.00	1.14	1.00	1.00	1.08	1.23	1.00	1.00	1.27	1.00	1.00	1.00
MK	0.96	1.06	1.01	1.00	1.00	0.99	1.00	1.00	0.89	1.09	1.00	1.00	1.00
MT	1.05	1.05	1.02	1.00	1.00	0.97	0.98	1.12	1.00	1.00	1.00	1.00	1.00
NL	0.98	0.90	1.03	1.00	1.00	1.05	0.96	1.24	1.02	1.00	1.00	1.00	1.00
NO	0.89	1.11	1.18	1.00	1.00	1.07	0.81	1.21	1.35	1.00	1.00	1.00	1.00
PL	1.02	1.05	1.01	1.00	1.00	0.98	1.00	1.00	0.93	1.00	1.00	1.00	1.00
PT	0.69	1.04	1.01	1.00	1.00	1.02	0.99	1.53	0.71	1.00	1.00	1.00	1.00
RO	0.65	1.18	1.29	1.00	1.00	1.23	0.61	1.00	1.15	1.00	1.00	1.00	1.00
RSXK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	1.24	0.65	1.07	1.00	1.00	0.98	1.27	1.00	1.13	1.00	1.00	1.00	1.00
SI	1.24	0.96	1.05	1.00	1.00	0.97	0.68	1.00	0.95	1.00	1.00	1.00	1.00
SK	1.11	1.05	0.96	1.00	1.00	0.97	1.00	1.00	0.93	1.00	1.00	1.00	1.00

NO_X emissions are dominated by road transport (GNFR F), located close to population. Therefore, reducing emissions over industrial sectors is generally less efficient than an equivalent reduction over all sectors. Factors are closer to one than for NO_2 exposure because it takes more time for NO_X to form particles than NO_2, leading to greater dispersion and a more homogeneous impact on exposure.

Table A6.2 - Sectoral adjustment factors for the $PM_{2.5}$ precursor PM_{10}

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
AT	1.60	1.44	0.83	1.00	1.66	0.88	1.00	1.00	0.94	1.57	1.00	1.00	0.65
BE	1.15	1.09	0.92	1.00	1.36	1.01	1.18	1.00	0.98	1.32	0.75	1.00	0.76
BG	1.00	1.17	0.99	1.00	1.00	1.18	1.00	1.00	0.73	1.79	1.00	0.62	0.62
CH	1.00	1.07	0.99	1.00	1.22	0.93	1.00	1.00	1.06	0.71	0.80	0.98	0.90
CY	0.80	0.99	1.03	1.00	1.39	1.04	1.14	1.00	1.05	1.32	0.86	0.82	0.85
CZ	0.97	1.18	0.98	1.00	1.44	1.00	1.00	1.00	0.85	1.00	1.00	0.81	0.78
DE	1.06	1.15	0.85	1.00	1.32	0.92	1.17	1.00	0.88	1.11	0.62	1.00	0.62
DK	1.71	1.47	0.88	1.00	2.11	1.47	0.94	1.00	1.13	2.10	0.53	0.61	0.57
EE	0.68	1.37	0.97	1.00	1.00	1.27	2.79	1.00	0.88	1.00	1.00	0.59	0.61
ES	0.69	1.29	0.86	1.00	2.24	1.31	1.37	1.00	0.61	2.23	0.40	0.37	0.38
FI	1.68	1.29	0.73	0.98	1.00	1.45	0.78	1.00	1.31	1.00	1.00	0.42	0.38
FR	1.00	1.22	0.77	1.00	1.00	0.96	1.03	1.00	0.76	2.01	0.49	1.00	0.50
GB	0.95	0.73	0.96	1.00	1.96	1.29	0.67	1.00	1.31	1.78	0.51	1.00	0.57
GR	0.58	1.46	0.62	1.00	2.91	1.41	1.14	1.00	0.89	1.00	0.33	0.29	0.30
HR	1.34	1.16	0.98	1.00	1.72	1.03	1.00	1.00	1.03	0.80	0.77	1.00	0.74
HU	1.00	1.29	0.96	1.00	1.00	1.18	1.00	1.00	0.97	1.52	0.72	1.00	0.66
IE	1.49	2.07	0.68	1.00	1.82	1.11	1.48	1.00	0.84	1.82	0.53	0.58	0.55
IS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IT	1.00	1.28	0.95	1.00	1.00	1.02	0.85	1.00	0.90	1.52	0.93	0.59	0.79
LT	1.28	1.16	0.84	1.00	1.49	1.16	1.00	1.00	0.55	1.27	0.57	0.49	0.52
LU	1.13	1.12	0.98	1.00	1.04	0.96	1.00	1.00	0.97	1.10	0.89	1.00	0.89
LV	2.10	1.41	0.68	1.00	1.84	0.73	1.00	1.00	0.91	1.73	1.00	0.37	0.37
ME	0.51	2.22	1.07	1.00	1.00	0.98	1.00	1.00	1.00	1.68	1.00	0.87	0.86

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
MK	0.62	1.43	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.39	1.00	0.71	0.68
MT	1.13	1.15	0.93	1.00	1.02	0.90	1.04	1.00	1.00	1.00	0.97	0.88	0.92
NL	1.06	0.96	0.84	1.00	1.24	1.05	1.08	1.00	0.96	1.10	0.73	1.00	0.72
NO	0.08	1.18	0.98	0.54	1.00	1.31	0.55	1.00	1.97	1.00	0.27	1.00	0.29
PL	1.21	1.29	0.89	1.00	1.00	0.91	1.00	1.00	0.63	1.24	0.59	1.00	0.56
PT	1.00	1.06	0.78	1.00	1.45	0.92	1.00	3.22	1.00	1.00	1.00	1.00	1.00
RO	1.04	1.44	0.94	1.00	1.00	1.31	1.00	1.00	1.21	0.71	1.00	0.75	0.74
RSXK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	1.51	0.59	0.80	1.00	1.00	1.29	1.56	1.00	1.32	2.05	0.45	0.52	0.47
SI	1.37	1.20	0.98	1.00	1.22	0.93	1.00	1.00	0.86	1.19	1.00	1.00	0.77
SK	1.16	1.58	0.95	1.00	1.17	1.02	1.00	1.00	0.85	0.98	1.00	1.00	0.74

Primary PM_{10} are mainly emitted by residential heating (GNFR C) and transport. At first glance, it may seem surprising that factors for residential heating are below 1. This is because emissions for residential heating are predominantly found in rural areas (and are spatialised mainly in rural areas in chemical transport models), and not close to populated city centres. This can explain values higher than one found for several industrial sectors. Overall, factors are less close to one than for other $PM_{2.5}$ precursors, because primary particles directly contribute to $PM_{2.5}$ formation whereas gases need to be transformed and condensate before they form particulate matter. Their spatial impact on $PM_{2.5}$ exposure is thus closer to emission sources, and less homogeneous than for gases.

Table A6.3 - Sectoral adjustment factors for the $PM_{2.5}$ precursor SO_2

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
AT	1.14	0.99	0.94	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
BE	0.85	1.01	1.04	1.00	1.00	1.00	0.83	1.00	1.00	1.00	1.00	1.00	1.00
BG	0.99	1.01	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
CH	0.93	0.95	1.06	1.00	1.00	0.97	1.00	1.70	1.00	0.60	1.00	1.00	1.00
CY	0.99	1.01	1.12	1.00	1.00	1.00	1.10	1.00	1.00	1.00	1.00	1.00	1.00
CZ	1.02	0.94	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DE	1.01	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DK	1.14	0.97	0.83	0.83	1.00	1.00	0.78	1.00	1.00	1.33	1.00	1.00	1.00
EE	0.98	1.03	1.03	1.00	1.00	1.00	1.18	1.00	1.00	1.00	1.00	1.00	1.00
ES	0.57	1.10	1.50	0.77	1.00	1.00	1.30	1.00	1.00	1.00	1.00	1.00	1.00
FI	1.18	0.86	0.95	1.00	1.00	1.00	0.81	1.00	1.00	1.00	1.00	1.00	1.00
FR	1.29	0.89	1.09	0.81	1.00	1.00	0.86	1.00	1.00	1.00	1.00	1.00	1.00
GB	1.01	0.85	1.20	1.00	1.00	1.00	0.53	1.00	1.48	1.00	1.00	1.00	1.00
GR	0.67	1.63	1.57	1.00	1.00	1.00	0.86	1.00	1.00	1.00	1.00	1.00	1.00
HR	1.17	1.00	0.72	1.59	1.00	1.00	0.79	1.00	1.00	1.00	1.00	1.00	1.00
HU	1.00	1.01	0.98	1.26	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IE	0.76	1.25	1.03	1.00	1.00	1.00	1.15	1.00	1.00	1.00	1.00	1.00	1.00
IS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IT	0.65	1.02	1.46	0.83	1.00	1.00	0.97	1.00	1.00	1.00	1.00	1.00	1.00
LT	0.90	1.08	1.28	1.00	1.00	1.00	1.00	1.00	1.11	1.00	1.00	1.00	1.00
LU	0.94	0.97	1.03	1.00	1.00	1.00	1.00	1.57	1.00	1.00	1.00	1.00	1.00
LV	1.10	1.06	0.94	1.00	1.00	1.00	1.35	1.00	0.88	1.00	1.00	1.00	1.00

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
ME	1.00	1.06	0.98	1.00	1.00	1.00	1.03	1.00	1.00	1.00	1.00	0.95	0.95
MK	0.67	1.04	0.91	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
MT	1.03	1.00	0.95	1.00	1.00	1.00	0.93	1.00	1.00	1.00	1.00	1.00	1.00
NL	1.04	1.01	0.82	1.00	1.00	1.00	0.87	1.00	1.00	1.00	1.00	1.00	1.00
NO	1.13	1.09	2.35	1.00	1.00	1.00	0.70	1.00	1.00	1.00	1.00	1.00	1.00
PL	1.06	1.00	0.92	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PT	0.87	1.04	0.87	1.00	1.00	1.00	1.05	1.00	1.00	1.00	1.00	1.00	1.00
RO	0.72	1.20	0.95	1.00	1.00	1.00	1.24	1.00	1.00	1.00	1.00	1.00	1.00
RSXK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	1.42	0.86	1.15	1.00	1.00	1.00	1.41	1.00	1.00	1.00	1.00	1.00	1.00
SI	1.16	0.97	0.92	1.00	1.00	1.00	0.62	1.00	1.00	1.00	1.00	1.00	1.00
SK	1.00	1.04	0.82	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

SO_2 is mainly emitted by sectors “Public power”, “Industry”, “Other Stationary Combustion” (i.e. the residential sector) and by “Shipping”. For other sectors, SO_2 emissions account generally for less than 1% of national SO_2 which explains the numerous factors with a value of 1.

Table A6.4 - Sectoral adjustment factors for the $PM_{2.5}$ precursor NMVOC

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
AT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
BE	1.00	3.54	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
BG	1.00	0.83	0.90	0.82	1.35	1.06	1.00	1.00	0.52	1.13	1.00	0.64	0.64
CH	1.00	0.92	0.91	1.05	1.05	0.93	1.00	1.00	0.88	0.95	1.00	1.00	1.00
CY	1.00	0.92	1.00	1.00	1.02	0.97	1.00	1.00	1.00	0.98	1.00	1.00	1.00
CZ	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DE	1.00	1.00	1.00	1.00	1.05	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
DK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
EE	0.14	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ES	1.00	0.92	0.73	0.94	1.16	1.02	1.00	1.00	1.00	1.00	1.00	0.55	0.55
FI	0.79	0.74	1.07	1.15	1.03	0.65	1.00	1.00	1.19	1.00	1.00	1.78	1.78
FR	1.00	0.40	1.00	1.00	1.04	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GB	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
GR	1.00	0.93	0.57	0.95	1.20	0.99	1.00	1.00	0.62	0.85	1.00	0.47	0.47
HR	1.00	1.17	0.78	1.13	1.15	1.00	1.00	1.00	0.96	1.16	1.00	0.66	0.66
HU	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IT	1.00	1.19	0.80	1.15	1.12	0.95	1.00	1.00	0.78	1.15	1.00	0.63	0.63
LT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
LU	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
LV	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
ME	0.78	1.28	0.92	1.32	1.15	0.92	1.00	1.00	1.32	1.12	1.00	0.88	0.88
MK	2.46	1.17	0.85	1.26	1.12	0.81	1.00	1.00	1.00	1.13	1.00	1.00	1.00
MT	1.00	1.03	1.00	1.03	1.01	0.95	1.00	1.05	1.00	1.07	1.00	1.00	1.00

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
NL	1.00	1.07	0.87	0.97	1.10	0.99	1.00	1.00	1.00	1.00	1.00	0.56	0.56
NO	0.02	1.06	1.11	1.00	1.00	0.93	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PL	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
PT	1.00	1.06	0.79	1.19	1.02	0.91	1.00	1.00	1.00	0.97	1.00	0.85	0.85
RO	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
RSXK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SI	1.00	1.02	0.92	0.87	1.14	1.00	1.00	1.00	0.74	1.14	1.00	1.00	1.00
SK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

NMVOCs are mainly emitted by sector GNFR E (solvents use), which tends to be highly spatially correlated with population. This leads to adjustment factors higher than one for this sector, and lower than one for others (in most cases). It can be noted that for many sectors, reductions in $PM_{2.5}$ concentrations due to 15% NMVOC emission reductions are very low (<0.01 µg.m^{-3}). This - according to the rules set - leads to a factor with a value of 1.

Table A6.5 - Sectoral adjustment factors for the $PM_{2.5}$ precursor NH_3

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
AT	1.00	1.00	1.00	1.00	1.00	1.06	1.00	1.00	1.00	1.72	0.93	1.00	0.97
BE	1.00	0.87	1.11	1.00	1.00	1.10	1.00	1.00	1.00	1.00	1.01	0.99	1.00
BG	1.00	1.38	1.38	1.00	1.00	1.31	1.00	1.00	1.00	2.59	0.88	0.89	0.89
CH	1.00	1.00	1.00	1.00	1.22	1.03	1.00	1.00	1.00	1.19	0.98	1.01	0.99
CY	1.00	1.00	1.00	1.00	1.00	1.07	1.00	1.00	1.00	1.00	1.00	0.97	1.00
CZ	1.00	1.00	1.14	1.00	1.00	1.09	1.00	1.00	1.00	1.00	0.97	1.00	0.99
DE	1.00	1.25	1.00	1.00	1.00	1.15	1.00	1.00	1.00	1.00	0.98	1.00	0.99
DK	1.00	1.00	1.21	1.00	1.00	1.53	1.00	1.00	1.00	1.00	0.93	1.03	0.98
EE	1.11	1.39	1.00	0.93	1.00	1.10	1.00	1.00	1.00	1.00	0.99	0.93	0.97
ES	1.00	1.94	1.61	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	0.84	0.91
FI	1.00	1.19	1.56	1.00	1.00	1.58	1.00	1.00	1.00	3.32	0.80	1.06	0.90
FR	1.00	1.37	1.27	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.88	1.03	0.97
GB	1.00	1.36	1.00	1.00	1.67	1.21	1.00	1.00	1.00	1.37	0.81	1.02	0.93
GR	1.00	3.96	3.42	1.00	1.00	2.79	1.00	1.00	1.00	1.00	0.68	0.87	0.79
HR	1.00	1.05	1.20	1.00	1.00	1.05	1.00	1.00	1.00	1.79	0.95	0.99	0.97
HU	1.00	1.00	1.21	1.00	1.00	1.17	1.00	1.00	1.00	1.79	0.96	0.97	0.97
IE	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.99	1.00
IS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IT	1.00	1.00	1.00	1.94	1.00	1.13	1.00	1.00	1.00	1.52	1.02	0.90	0.97
LT	1.79	1.22	1.17	1.00	1.00	1.00	1.00	1.00	1.00	1.45	0.94	0.98	0.96
LU	1.00	1.00	0.94	1.00	1.00	0.92	1.00	1.00	1.00	1.00	1.00	1.00	1.00
LV	1.00	2.41	1.42	1.00	1.00	1.02	1.00	1.00	1.00	2.74	0.89	0.88	0.88
ME	1.00	1.00	1.27	1.00	1.00	1.24	1.00	1.00	1.00	1.00	0.97	1.13	0.99

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
MK	1.00	1.00	1.37	1.00	1.00	1.56	1.00	1.00	1.00	1.00	1.00	0.82	0.98
MT	1.00	1.00	1.00	1.00	1.00	0.83	1.00	1.00	1.00	1.00	1.04	0.92	1.01
NL	1.00	0.77	1.00	1.00	1.19	1.10	1.00	1.00	1.00	1.00	0.98	0.98	0.98
NO	1.00	1.41	1.00	1.00	1.00	1.37	1.00	1.00	1.00	1.00	0.82	1.05	0.96
PL	1.00	1.58	1.35	1.00	1.00	1.22	1.00	1.00	1.00	1.00	0.93	0.99	0.97
PT	1.00	1.90	1.61	1.00	1.00	1.66	1.00	1.00	1.00	1.79	0.94	0.73	0.82
RO	1.00	1.00	1.10	1.00	1.00	1.00	1.00	1.00	1.00	1.59	0.94	0.97	0.96
RSXK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	1.00	0.99	1.00	1.00	1.00	1.04	1.00	1.00	1.00	1.86	1.00	0.95	0.97
SI	1.00	1.00	1.14	1.00	1.00	1.05	1.00	1.00	1.00	1.00	1.02	0.96	0.99
SK	1.00	1.00	1.07	1.00	1.00	1.03	1.00	1.00	1.00	1.15	0.97	1.00	0.99

Because NH_3 emissions are dominated by agriculture (GNFR K and L), generally located far from population, NH_3 reduction over specific industrial sectors is usually more efficient to reduce $PM_{2.5}$ exposure than the reduction over all sectors together (implying: mainly over agriculture).

Table A6.6 - Sectoral adjustment factors for the NO_2 precursor NO_X

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
AT	1.48	1.11	1.23	0.41	1.56	0.85	1.42	1.71	1.07	1.08	1.00	1.00	1.00
BE	1.10	0.88	1.16	1.44	1.20	1.01	1.03	1.84	0.92	1.17	1.00	1.00	1.00
BG	0.75	1.14	1.03	0.80	1.00	1.02	0.93	3.16	0.66	0.66	1.00	0.55	0.55
CH	1.10	0.93	1.11	0.65	1.19	0.92	0.97	2.04	1.01	0.78	1.00	0.66	0.66
CY	0.64	0.71	1.33	1.00	1.67	1.14	1.80	0.67	0.93	0.71	1.00	0.70	0.70
CZ	0.96	1.09	1.13	1.28	1.37	0.97	1.00	1.87	0.87	1.23	1.00	0.82	0.82
DE	1.03	1.07	1.06	1.12	1.18	0.91	1.14	2.04	0.89	1.41	1.00	0.64	0.64
DK	1.38	0.97	0.88	0.60	1.51	1.06	0.70	2.68	0.81	1.51	1.00	0.45	0.45
EE	0.57	0.92	1.15	0.48	1.90	0.94	2.76	5.27	0.66	1.33	1.00	0.43	0.43
ES	0.42	0.92	1.31	0.64	2.29	1.25	1.42	3.12	0.59	1.78	1.00	0.33	0.33
FI	1.55	0.63	0.95	1.00	1.65	1.00	0.67	2.98	1.01	0.20	1.00	0.34	0.34
FR	1.72	0.85	1.72	0.85	2.21	0.87	0.88	3.20	0.67	1.60	1.00	0.45	0.45
GB	0.70	0.89	1.54	0.69	1.76	1.08	0.61	2.10	1.24	1.31	1.00	0.47	0.47
GR	0.43	1.33	2.20	1.00	3.07	1.35	1.09	1.12	0.95	0.48	1.00	0.17	0.17
HR	1.21	1.24	1.25	1.93	1.60	0.87	0.87	1.91	0.89	0.38	1.00	0.35	0.35
HU	1.21	0.91	1.27	1.14	1.53	0.90	2.21	3.45	0.75	0.66	1.00	0.38	0.38
IE	0.69	1.21	1.36	1.00	1.61	0.90	1.26	3.13	0.76	1.80	1.00	0.43	0.43
IS	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
IT	0.73	0.91	1.30	0.67	1.00	0.98	1.06	1.76	0.80	1.15	1.00	0.51	0.51
LT	1.25	0.46	1.07	1.00	1.55	1.01	0.78	5.21	0.69	0.39	1.00	0.41	0.41
LU	1.03	1.07	1.06	1.00	0.84	0.90	0.71	1.52	1.00	0.65	1.00	1.00	1.00
LV	1.90	1.49	1.06	1.00	1.98	0.61	2.24	1.73	0.84	0.54	1.00	0.33	0.33
ME	0.49	2.55	1.49	1.00	1.00	1.10	1.51	3.56	1.75	2.02	1.00	0.89	0.89

Country	GNFR A	GNFR B	GNFR C	GNFR D	GNFR E	GNFR F	GNFR G	GNFR H	GNFR I	GNFR J	GNFR K	GNFR L	GNFR KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
MK	0.60	1.61	0.91	1.00	1.00	0.98	1.00	1.00	0.67	1.26	1.00	0.56	0.56
MT	1.15	1.09	0.92	1.00	0.96	0.82	1.05	1.08	1.00	0.96	1.00	0.80	0.80
NL	0.95	0.89	0.97	0.47	1.22	1.03	1.02	1.82	0.94	0.83	1.00	1.00	1.00
NO	0.32	1.17	1.17	0.49	2.18	1.13	0.66	1.40	1.73	2.48	1.00	0.43	0.43
PL	1.11	1.08	1.01	1.36	1.00	0.90	1.85	1.95	0.72	1.21	1.00	0.47	0.47
PT	0.40	1.01	0.97	0.49	1.61	0.89	1.79	4.15	0.39	0.90	1.00	0.31	0.31
RO	0.62	1.22	1.38	2.27	1.89	1.20	1.11	3.55	1.05	0.64	1.00	0.73	0.73
RSXK	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
SE	1.61	0.43	1.01	1.84	1.86	0.97	1.38	1.55	1.12	1.05	1.00	0.44	0.44
SI	1.27	0.92	1.09	1.00	1.23	0.97	0.81	1.52	0.90	1.21	1.00	0.74	0.74
SK	1.19	1.12	0.98	1.00	1.07	0.93	0.96	1.71	0.84	0.93	1.00	0.41	0.41

For industrial sectors, adjustment factors are lower than one in most cases. The main impact on NO_2 exposure is found close to NO_X emission sources. As NO_X emissions are dominated by the road sector (GNFR F) located close to population, reducing emissions over specific industrial sectors is generally less efficient than an equivalent reduction over all sectors.

Sectoral PM ratio adjustment factor

This new sectoral PM_{10}:$PM_{2.5}$ ratio adjustment factor is calculated as the country specific PM_{10}:$PM_{2.5}$ emission ratio divided by the sector and country specific PM_{10}:$PM_{2.5}$ ratio. It is independent of the previously calculated sectoral exposure adjustment factor. To calculate the sectoral PM_{10}:$PM_{2.5}$ ratio adjustment factor, the ETC-HE relied on total national emissions as used in the EMEP model[16]. These data are based on the officially reported emission

[16] https://www.ceip.at/webdab-emission-database/emissions-as-used-in-emep-models; used in EMEP/MSC-W reports, and by EMEP/MSC-E. These emission data are based on officially reported emissions to the extent possible, but some of the officially reported data have been corrected and/or gap-filled.

data by each country. They were reported for the SNAP sector nomenclature up until the year 2013, and for the GNFR sector nomenclature from 2013 onwards.

Table A6.7 - Sectoral PM ratio adjustment factors calculated by GNFR sectors for 2019 EMEP emissions

Country	A	B	C	D	E	F	G	H	I	J	K	L	KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
AT	1.56	0.47	1.77	0.59	1.59	1.31	1.87	1.87	1.30	1.13	0.42	0.09	0.13
BE	1.27	0.68	1.45	1.26	1.40	1.01	1.40	1.14	1.05	1.49	0.34	0.08	0.25
BG	1.54	0.26	1.52	0.26	1.17	1.32	1.44	1.57	1.56	1.57	0.36	0.06	0.11
CH	2.26	1.41	2.15	0.23	1.81	0.97	2.27	2.27	0.45	2.02	0.30	0.10	0.19
CY	1.36	0.70	1.55	0.43	1.76	1.42	1.98	1.98	1.96	1.96	0.42	0.40	0.41
CZ	0.95	0.70	1.28	0.23	0.96	0.93	1.18	1.31	1.23	1.24	0.27	0.12	0.15
DE	2.04	0.59	2.09	0.46	2.04	1.44	2.10	2.21	1.50	2.01	0.63	0.09	0.32
DK	1.34	0.56	1.75	0.61	1.38	1.15	1.77	1.78	1.78	1.78	0.39	0.22	0.27
EE	1.12	0.83	1.49	0.34	1.17	1.15	1.47	1.57	1.56	1.33	0.49	0.06	0.15
ES	1.16	0.75	1.40	0.70	1.32	0.99	1.29	1.44	1.40	1.32	0.22	0.14	0.17
FI	0.49	1.22	1.55	1.26	1.74	0.44	1.76	1.81	1.80	1.80	0.52	0.18	0.22
FR	1.40	0.69	1.63	1.31	1.29	1.23	1.47	1.17	1.22	1.65	0.39	0.24	0.30
GB	1.35	0.68	1.53	0.98	1.00	1.01	1.51	1.57	1.55	1.43	0.35	0.17	0.27
GR	1.06	0.37	1.61	0.25	1.40	1.25	1.65	1.65	1.64	1.55	0.38	0.54	0.50
HR	1.22	0.41	1.39	0.69	1.17	1.06	1.33	1.40	1.42	1.42	0.28	0.06	0.12
HU	0.99	0.33	1.52	0.34	1.32	1.13	1.45	1.56	1.54	1.50	0.26	0.06	0.13
IE	1.55	0.51	2.29	0.23	2.11	1.54	2.18	2.34	2.27	2.34	0.91	0.09	0.25
IS	0.46	0.78	1.78	0.40	1.06	1.09	1.70	1.86	1.72	1.77	0.50	0.08	0.34
IT	0.86	0.80	1.22	0.27	1.12	0.87	1.23	1.23	1.23	1.09	0.32	0.25	0.28
LT	1.94	0.99	1.95	0.21	1.64	1.63	2.15	2.15	2.04	2.07	0.54	0.08	0.13

Country	A	B	C	D	E	F	G	H	I	J	K	L	KL
	Public Power	Industry	Other Stationary Combustion	Fugitive	Solvents	Road Transport	Shipping	Aviation	Off road	Waste	Agriculture Livestock	Agriculture Other	Agriculture Total
LU	1.50	0.96	1.51	0.15	1.43	0.94	1.54	1.54	1.54	1.53	0.78	0.06	0.22
LV	1.27	0.53	1.44	0.15	1.48	1.11	1.40	1.48	1.44	1.48	0.40	0.10	0.13
ME	0.61	0.69	1.14	0.17	1.19	0.92	1.13	1.15	1.05	1.09	0.25	0.85	0.84
MT	2.64	0.38	2.58	0.57	1.86	2.01	2.45	2.54	2.52	0.75	0.48	0.08	0.27
NL	1.50	0.88	1.69	1.65	1.79	0.77	1.69	1.33	1.71	1.65	0.15	0.35	0.18
NO	1.28	0.70	1.26	1.34	0.87	0.67	1.30	1.36	1.33	1.35	0.41	0.46	0.43
PL	0.97	1.04	1.19	0.31	1.79	1.35	1.67	1.79	1.78	1.75	0.37	0.08	0.20
PT	1.28	0.80	1.37	0.62	1.22	1.14	1.27	1.41	1.38	1.40	0.20	1.06	0.68
RO	0.88	0.53	1.33	0.47	1.24	1.06	1.28	1.37	1.34	1.33	0.22	0.05	0.08
RSXK	0.58	0.60	1.31	0.19	1.19	0.88	1.22	1.35	1.34	1.35	0.31	0.71	0.64
SE	1.47	1.34	1.98	0.81	1.56	0.47	1.96	2.09	1.98	2.08	0.54	0.23	0.35
SI	1.08	0.56	1.21	0.22	1.10	0.86	1.20	1.24	1.24	1.24	0.39	0.11	0.30
SK	1.21	0.59	1.27	0.30	1.30	0.91	1.18	1.30	1.29	1.30	0.25	0.07	0.11

Note: For some countries and sectors, emission data are not available. In this case, average values over all countries were calculated for the sectoral PM_{10}:$PM_{2.5}$ ratio

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