2 AIR EMISSIONS

2.4 Ozone precursor emissions in the healthcare sector (ENV-7)

2.4.1 Documentation sheet

Description	**Primary indicator**: A. Annual emissions of ozone precursors in human health activities (Q86), in grammes (g) of NMVOC eq per capita **Secondary indicator:** B. Annual emissions of ozone precursors in human health activities (Q86), in tons (t) of NMVOC equivalent C. Annual emissions of ozone precursors in human health activities (Q86), as a share of total emissions of ozone precursors (all NACE activities)
Rationale	Ozone in the lower layer of the atmosphere (troposphere) can generate smog, which is harmful to health, especially for people with respiratory disorders. Nitrogen oxides (NOx), non-methane volatile organic compounds (NMVOC), carbon monoxide (CO), and methane (CH_4) are the most important ozone precursors. These substances are called tropospheric ozone precursors, and their ozone formation potential is calculated using an index. This index is called the TOFP (Tropospheric Ozone Formation Potential) index.[1]
Calculation	Done by the Federal Planning Bureau for Eurostat based on regional and national emissions inventories, an activity model and emission factors (activity data * emission factor) using NACE classification [2] **Primary indicator (A):** • Numerator: Annual emissions of ozone precursors in human health activities (Q86), in grammes (g) of NMVOC eq • Denominator: Population of the corresponding year (calculated as mean of population at beginning and end of year) **Indicator B:** • Numerator: Annual emissions of ozone precursors in human health activities (Q86), in tonnes (t) of NMVOC eq • Denominator: / **Indicator C:** • Numerator: Annual emissions of ozone precursors in human health activities (Q86), in tonnes (t) of NMVOC eq • Denominator: Annual emissions of ozone precursors in total (all NACE activities), in tonnes (t) of NMVOC eq
Data source	Federal Planning Bureau (June 2025 for regional data); Eurostat: Air emissions accounts by NACE Rev. 2 activity (Last update of data: 28/11/2025 23:00) [3].
Technical definitions	TOFP index = 1,22 * NO_x + NMVOC + 0,11 * CO + 0,014 * CH_4 • Nitrogen oxydes (NO_x) • Non-Methane Volatile Organic Components (NMVOC) • Carbon monoxide (CO) • Methane (CH_4)

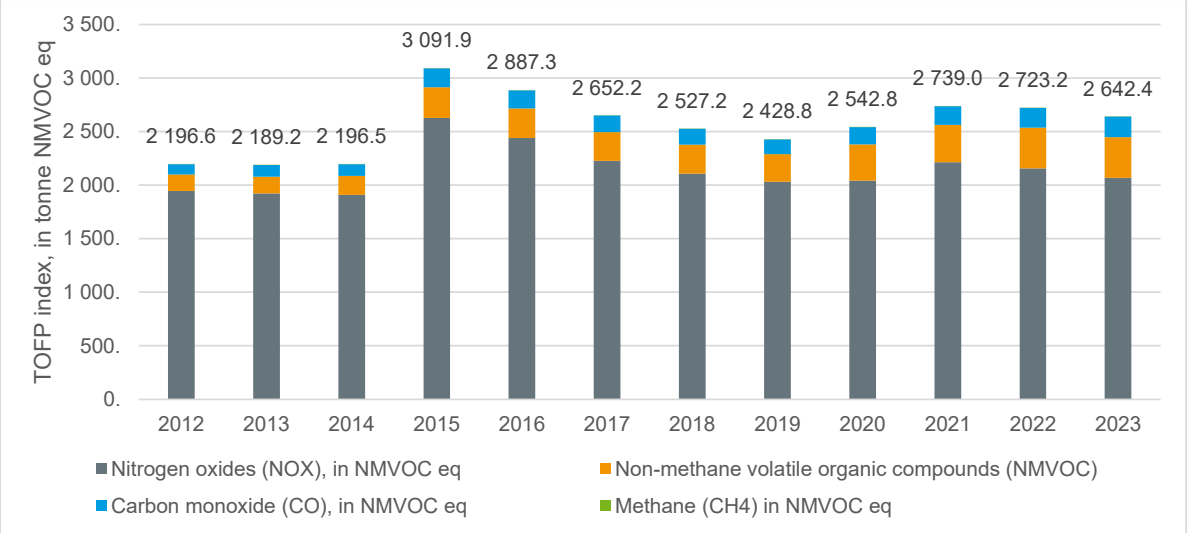
	The healthcare sector was identified via the statistical classification of economic activities in the European Community (NACE Rev. 2): Human health activities (Q86) (excluding residential care). More details on the methodology: https://ec.europa.eu/eurostat/web/environment/methodology [4]
International comparability	NACE (Statistical Classification of Economic Activities in the European Community, https://ec.europa.eu/eurostat/web/nace/overview) classification allows European comparison. However, comparability between country is not guaranteed due to differences in the allocation of road transport emissions (also impacting acidifying gas emissions) to NACE activities across countries (see also ENV-4 for more details).
Limitations	The data come from a model based on activity, not measurements. Residential care activities and social work activities without accommodation (Q87–Q88) were aggregated, making it impossible to isolate data for Q87 alone. Consequently, only human health activities (Q86) are considered as a proxy for the health care system, while residential care activities were excluded. Differences with other EU countries and jumps observed in data (in 2015 and 2021) can partly be explained by methodological factors: • Since 2021, Wallonia has applied a new and more accurate method to estimate energy consumption, based on data directly obtained from distribution network operators (as already implemented in Brussels and Flanders before 2021). Nevertheless, previous years were not retroactively modified, which can partly explain a jump in data in 2021 in Wallonia. However, the methodological change in Wallonia only affects the allocation key used to disaggregate regional emissions inventories, which represent a small share of ozone precursors compared with those originating from road transport. It should also be noted that the 2022 data for Wallonia are based on projections, as the data were not yet complete at the time of receipt (June 2025 for regional data). • Emissions from road transport data (total quantities emitted), impacting emissions of ozone precursors, are based on national/regional emissions inventories and the COPERT 5 model and allocation keys among NACE sectors vary between countries. In Belgium the allocation key is based on excise duties for Eurostat 2025 data, whereas previous estimates (e.g. 2024 data) relied on vehicle registrations. Excise duties are considered more reliable; however, this new approach appears to have an important impact for Q86 emissions: emissions of ozone precursors in human health activities in Eurostat version released in 2024 are slowly decreasing across the years while an abrupt increase is observed in 2015 in Eurostat version released in 2025. • Excise duties are calculated on a five-year basis (2010, 2015, 2020) using an “structural survey” of the National Bank of Belgium while intermediate years are based on less detailed surveys and extrapolations. As 2014 is based on an extrapolation of 2010 data, a jump in excise data is observed in 2015, which can partly explain the 2015 jump in emissions of ozone precursors.
Dimension	Environmental sustainability
Supervisor	Carl Devos
Reviewers	Jehan Charlier

2.4.2 Results

BELGIUM

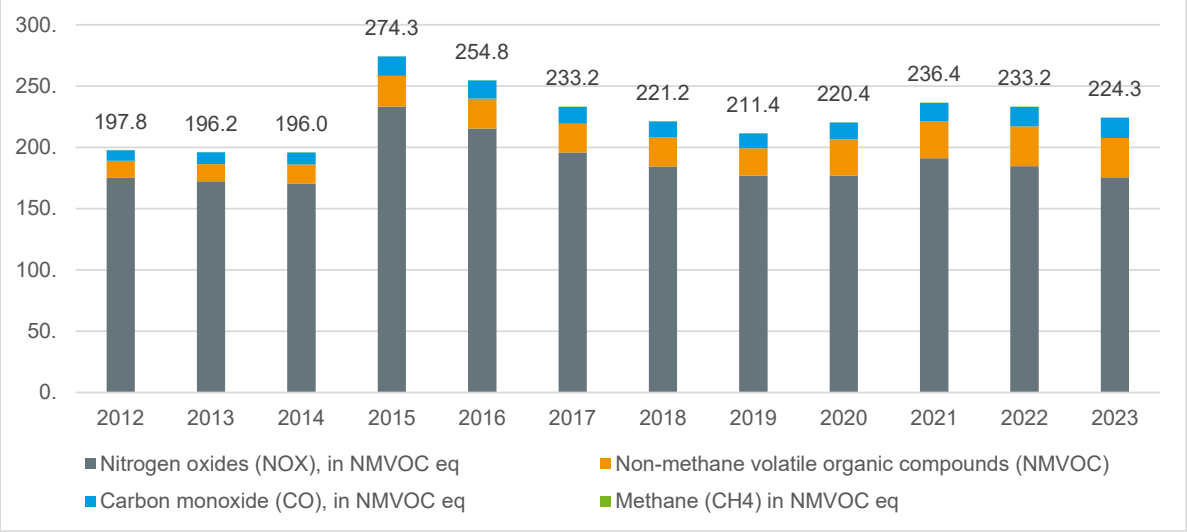
Ozone can cause damage to people with respiratory disorder. The ozone precursor emissions are measured by the Tropospheric Ozone Formation Potential (TOPF) index. Figure 1 presents the TOPF index for Belgium by type of gas from 2012 to 2023: the most significant source is NO_x emissions (78% to 89% of the TOFP index), followed by non-methane volatile organic components (NMVOC), which has an increasing contribution between 2012 and 2023. Carbon monoxide (CO) and methane (CH_4) are also included in the index, but have less influence. After the peak of 2015 (3092 tonnes of NMVOC equivalent and 274.3 g per capita), partially explained by methodological factors (see the documentation sheet), there was a slow decrease then a stabilisation over the last years.

Figure 1 - Ozone precursor emissions in Belgium (TOFP index) for human health activities, in tonne NMVOC (Q86)



Source: Eurostat (air emissions accounts), November 2025

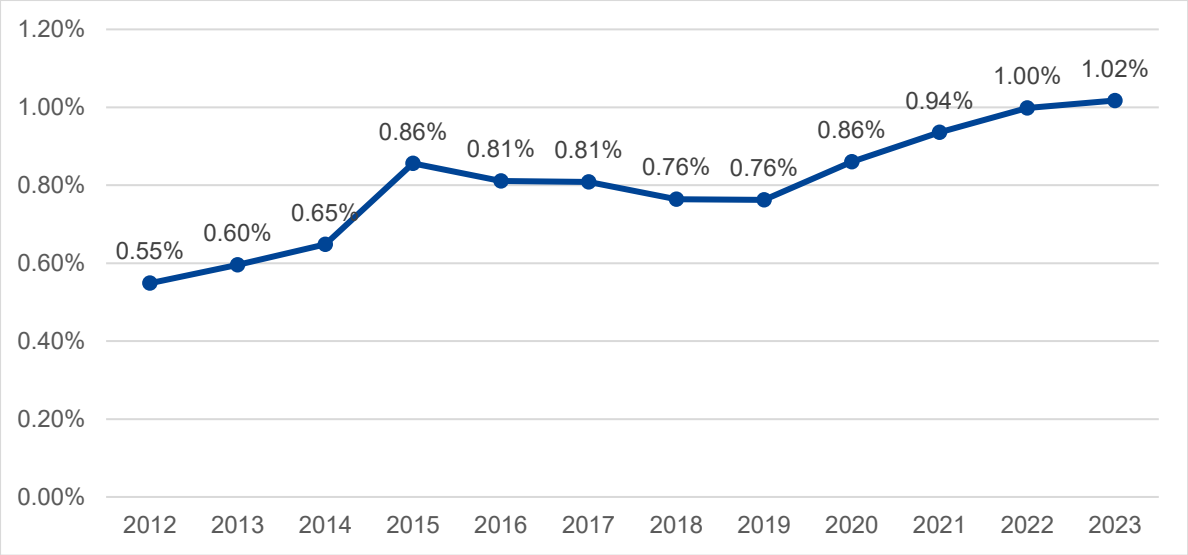
Figure 2 – Ozone precursor emissions in Belgium (TOFP index) for human health activities, in g NMVOC eq per capita (Q86)



Source: Eurostat (air emissions accounts), November 2025

The human health activities (Q86 in NACE) account for only a small proportion of the ozone precursor emissions in Belgium with only 1% of the emissions (see Figure 3) when comparing the TOPF index for all activities vs the TOPF index for human health activities. Still, an increase of 0.47 percentage point is observed over the 2012-2023 period (from 0.55% to 1.02%), mainly due to the decrease of the emissions for all activities (-35.1%) while the emissions for the human health activities increased by 20.3% over the same period.

Figure 3 – Proportion of human health activities in the ozone precursor emissions

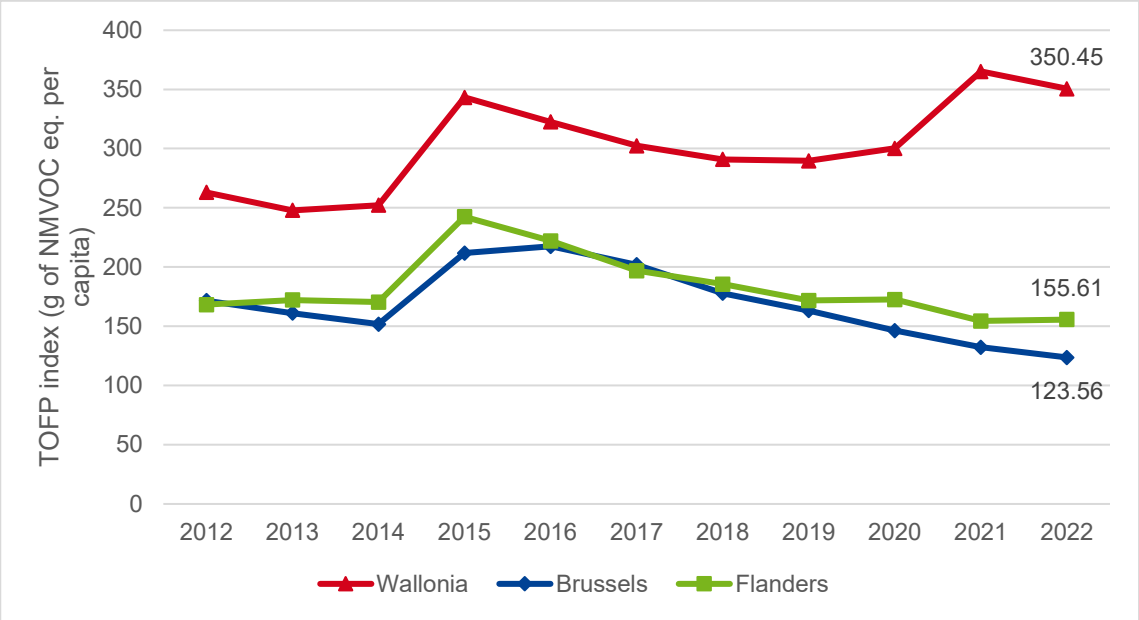


Source: Eurostat (air emissions accounts), November 2025

REGIONAL COMPARISON

When looking at the regional data, Wallonia has the highest TOFP index (350 g/capita) with more than twice the value of Brussels (124 g/capita) and of Flanders (156 g/capita); all regions had a peak around 2015-2016, then a decreasing trend; Wallonia has an extra peak in 2021 (Figure 4). Although the sharp increase observed in Wallonia in 2021 and 2022 can be partially attributed to methodological factors similar to the increase observed across all regions in 2015 (see the limitations described in the documentation sheet), Wallonia consistently remains well above the other two regions throughout the period. Methods are the same between regions from 2021 onwards. More in-depth analysis is therefore needed to determine what are the underlying causes of these differences.

Figure 4 – TOPF index for human health activities (Q86) by region

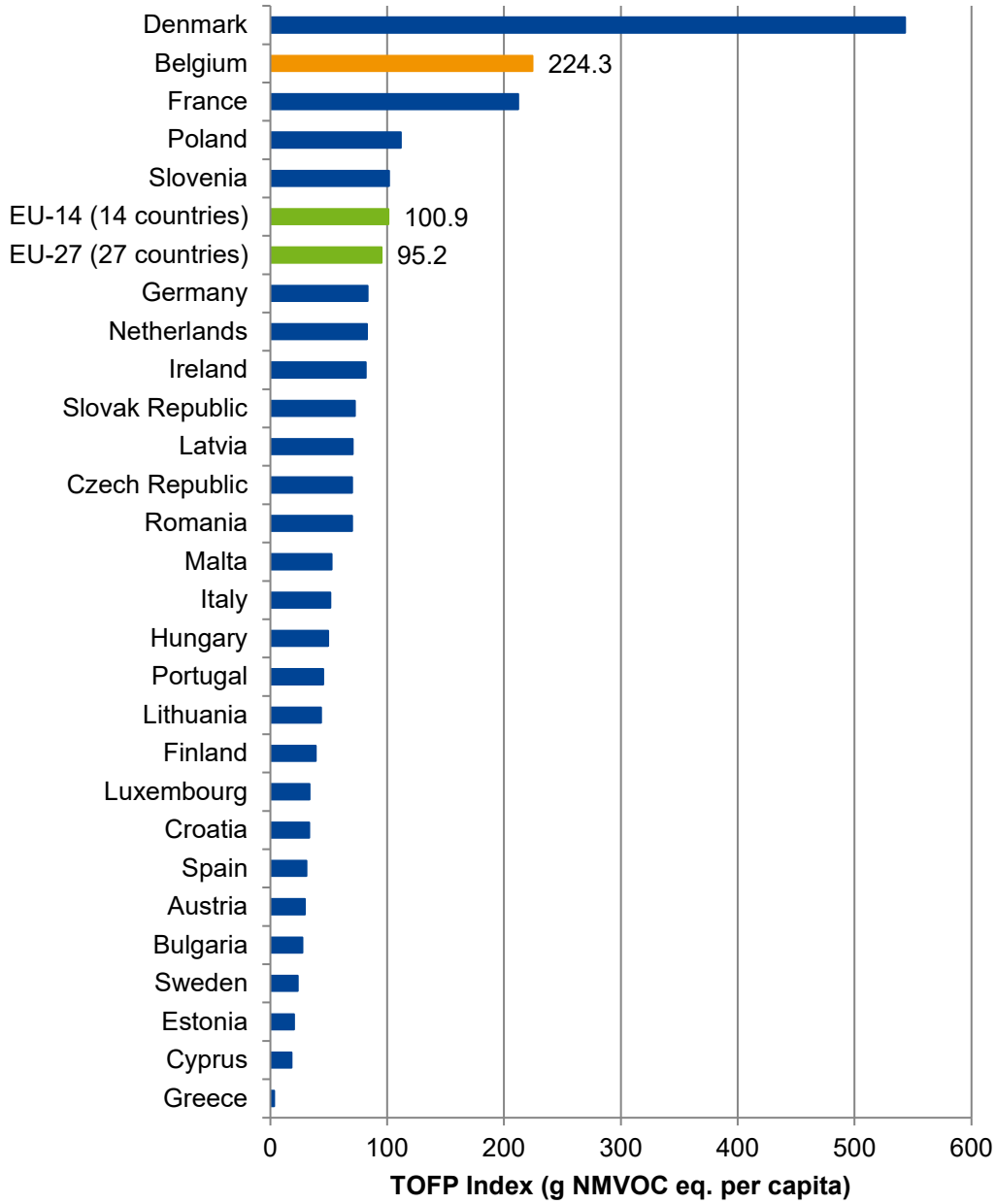


Source: Federal Planning Bureau (June 2025); 2022 data in Wallonia are based on projections.

INTERNATIONAL COMPARISON

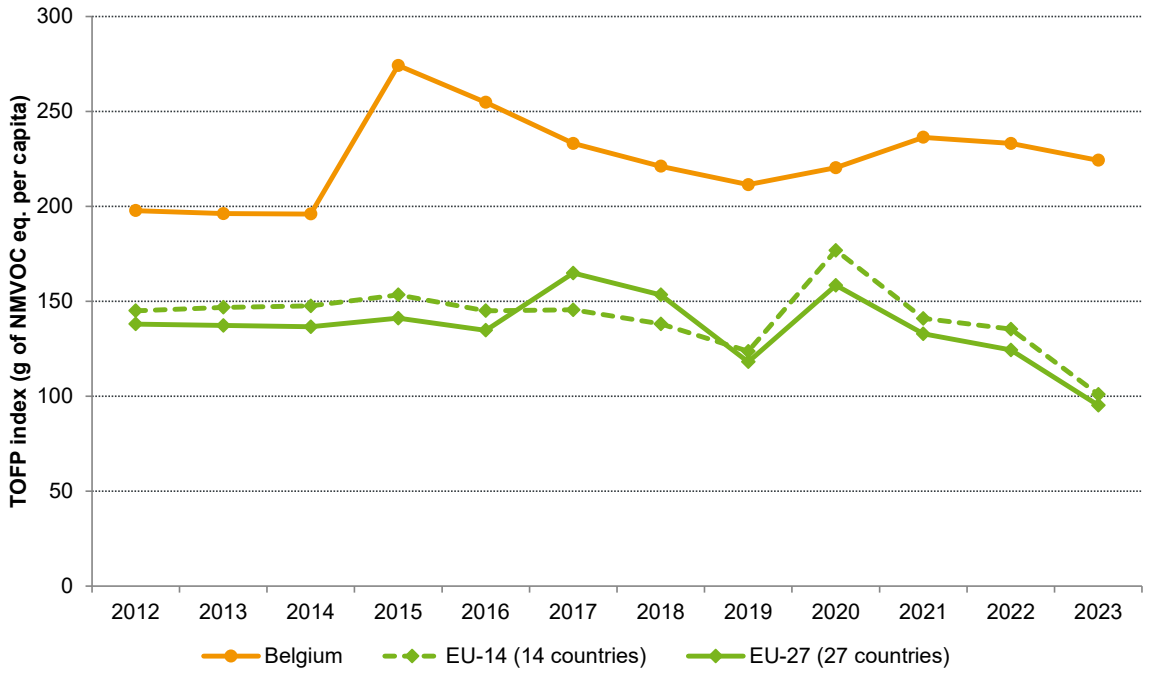
The TOPF index of Belgium is the second highest among European countries in 2023, with 224 g per capita of non-methane volatile organic components (EU-14: 101 g per capita, EU-27: 95 g per capita), as shown in Figure 5. Over the 2012-2023 period, the trend is upward for Belgium (+13.4%) with a peak in 2015, and downward for EU-14 (-30.4%) and EU-27 (-31.0%) (see Figure 6). However, as explained in the documentation sheet, international comparison per NACE sector should be used with caution.

Figure 5 - European comparison for TOFP index (2023)



Source: Eurostat (air emissions accounts), November 2025

Figure 6 – European comparison for TOPF index (2012-2023)



Source: Eurostat (air emissions accounts), November 2025

KEY POINTS

- Ozone in the lower layer of the atmosphere (troposphere) can generate smog, which is harmful to health, especially for people with respiratory disorders. Ozone precursors, measured using the TOFP index, include non-methane volatile organic compounds (NMVOC), nitrogen oxides (NO_x), carbon monoxide (CO), and methane (CH_4), with NO_x as the most significant source of emissions from the healthcare system (78% in 2023),
- Even if human health activities (Q86 in NACE) account for only a small proportion of ozone precursor emissions in Belgium, representing only 1% of total emissions from all NACE activities in 2023, this share has almost doubled since 2012 (0.55% in 2012).
- Regional differences can also be highlighted. Wallonia's emissions per capita are twice as high as those of Flanders or Brussels in 2022 (350.5 compared to 155.6 and 123.6 g of NMVOC eq per capita in Wallonia, Flanders and Brussels, respectively). More in-depth analysis is required to determine the underlying cause of these differences.
- Belgium's per capita emissions in 2023 (224.3 g of NMVOC per capita) are more than twice as high as those of the EU-14 and EU-27 averages (100.9 and 95.2 g of NMVOC per capita). Moreover, they increased by 13.4% between 2012 and 2023, whereas both EU averages declined markedly over the same period (EU-14: −30.4%; EU-27: −31.0%). However, methodological factors may explain these differences (see the documentation sheet). International comparisons must therefore be used with caution.

REFERENCES

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