Last update: 07/11/2022

METADATA – AIR QUALITY

Description	Poor air quality is caused by polluting substances present in the ambient air. One example is particulate matter, referring to all the fine microscopic particles suspended in the air. Particulate matter is often categorized as having a diameter smaller than 10 micrometres (PM_{10}) and having a diameter smaller than 2.5 micrometres ($PM_{2.5}$). Another example is nitrogen dioxide (NO_2), a harmful gas emitted alongside nitrogen oxide in combustion processes. Ozone (O_3) is another hazardous gas, formed in the atmosphere by chemical reactions under the influence of sunlight. The indicators considered here are: a) Chronic population exposure to PM_{10} b) Chronic population exposure to $PM_{2.5}$ c) Chronic population exposure to NO_2 d) Chronic population exposure to O_3
Rationale	Poor air quality constitutes the single biggest environmental health risk, responsible for millions of premature deaths and healthy life years lost worldwide. Exposure to air pollution has been associated with respiratory disease, cardiovascular disorders and lung cancer. It disproportionally affects vulnerable groups, including young children, the elderly and people with lung diseases and asthma [1]. To improve air quality and public health, the WHO publishes the Air Quality Guidelines (AQGs), which are a set of recommended limit values for specific air pollutants. The AQGs were last updated with recent scientific evidence in 2021, and contain recommendations for daily concentrations as well as long-term averages [1]. As air pollution levels in Belgium often exceed the AQGs, the need to develop indicators to monitor population exposure to relevant pollutants is evident.
Primary Data source	Indicators of exposure rely on both air quality and population data. Air quality assessment is based on pollutant data provided by IRCEL-CELINE, in the form of high-resolution maps depicting yearly average concentration for the years 2017 to 2020. The pollution maps are the result of high-resolution models, calibrated against actual measurements but still subject to a degree of uncertainty. The data used for assessing PM_{10}, $PM_{2.5}$ and NO_2 consists of output from ATMO-Street, which is the interpolation-dispersion model RIO-IFDM (used for O_3) expanded with a street canyon module [2]. The exact ATMO-Street and RIO-IFDM output used in the calculations is: • the yearly average concentration for PM_{10}, $PM_{2.5}$ and NO_2, and mean daily 8-hour maximum concentration averaged over the months April to September for O_3. • the result for the domains Flemish Region + Brussels Capital Region and Walloon region separately. These maps differ slightly from the results for Belgium as a whole that are publicly available. • from version 62 for the years 2017-19, and v. 63 for the year 2020. The results from both versions are comparable. The population data used is provided by Statbel, consisting of the population on the level of statistical sector, the smallest administrative unit in Belgium, in the year 2020. Both the number of inhabitants of each statistical sector [3], as well as the geographic vector file representing the sectors [4], are publicly available. Since the population is static, any changes in exposure are uniquely caused by changes in air quality and not demographic evolutions.

Indicator source	In assessing population exposure, every inhabitant is assumed to be exposed to the average concentration level of the statistical sector where they reside. This indicator is calculated based on the data described above, and multiple average sector concentrations can be aggregated into larger areas using a population-weighted average, as described below.
Periodicity	Both the IRCEL-CELINE air quality maps and the Statbel population data receive annual updates.
Calculation, technical definitions and limitations	National or regional exposure to air pollution is approached using the population-weighted average (PWA) concentration. The population-weighted concentration is in this case calculated based on the mean concentration of each sector, where the population of the corresponding sector – as a fraction of the total population – serves as the weight. The PWA concentration C_{PWA} of an area (e.g., one of the regions) consisting of N statistical sectors is calculated as: $$C_{PWA} = \frac{1}{P_{tot}} \sum_{i=1}^{N} P_i \times C_i$$ with P_i and C_i the population and average concentration of sector i, and P_{tot} the total population of the area. Apart from the PWA concentration, the fraction of the population exposed to pollutant values above the AQG can be calculated as an indicator for exposure.
International comparability	To ensure comparability of the PWA concentrations from Belgium to the other EU-14 countries, the values used in the international comparison are based on a European dataset provided by the European Environment Agency [5]. These values are publicly available and receive annual updates.

[1] WHO Global Air Quality Guidelines. World Health Organisation, 2021. https://www.who.int/news-room/questions-and-answers/item/who-global-air-quality-guidelines

[2] ATMO-Street. IRCEL-CELINE, n.d. https://www.irceline.be/en/documentation/models/atmo-street?set_language=en

[3] Structure of the Population. Statbel, 2022. https://statbel.fgov.be/en/themes/population/structure-population

[4] Secteurs statistiques - Statistische sectoren. Statbel, n.d. https://statbel.fgov.be/fr/propos-de-statbel/methodologie/classifications/secteurs-statistiques

[5] Air Quality Health Risk Assessments (NUTS3). European Environment Agency, n.d. https://www.eea.europa.eu/data-and-maps/data/air-quality-health-risk-assessments-nuts3/air-quality-health-risk-assessments-nuts3