1 July 2014

**Methodology**

**Methodology for CSI004 indicator calculation**

Initially, AirBase stations are spatially joined with Urban Audit core cities in a Geographical Information System (GIS) in order to select those stations which fall within the boundaries of the cities that take part in the Urban Audit. The selected AirBase stations include station types classified as 'urban traffic', 'sub-urban traffic', 'urban background' and 'sub-urban background'. According to a study for the European Commission (Entec, 2006), in Europe, as an average, 5 % of the city population lives closer than 100 m to major roads and therefore is potentially exposed to concentrations measured at traffic stations. The remaining 95 % of the city population is assumed to be exposed to urban and suburban background concentrations. These percentages vary from country to country and are shown in the table below. Stations classified as 'industrial' are influenced by other local emissions and such environments are generally not representative for residential areas. The industrial stations are therefore not selected for the indicator calculations.

|  |  |  |
| --- | --- | --- |
| **Country (*j*)** | **Percentage of population living close to major roads (*Ptj*)** | **Percentage of population exposed to background concentrations (*Pbj*)** |
|  |  |  |
| Austria | **6.4** | **93.6** |
| Belgium | **7.4** | **92.6** |
| Bulgaria | **3.6** | **96.4** |
| Croatia | **4.1** | **95.9** |
| Cyprus | **5.0** | **95.0** |
| Czech Republic | **4.5** | **95.5** |
| Denmark | **6.6** | **93.4** |
| Estonia | **2.8** | **97.2** |
| Finland | **3.8** | **96.2** |
| France | **4.2** | **95.8** |
| Germany | **6.2** | **93.8** |
| Greece | **4.0** | **96.0** |
| Hungary | **4.7** | **95.3** |
| Ireland | **4.9** | **95.1** |
| Italy | **4.9** | **95.1** |
| Latvia | **3.8** | **96.2** |
| Lithuania | **2.3** | **97.7** |
| Luxembourg | **9.1** | **90.9** |
| Malta | **5.0** | **95.0** |
| Netherlands | **6.4** | **93.6** |
| Poland | **3.4** | **96.6** |
| Portugal | **3.8** | **96.2** |
| Romania | **2.4** | **97.6** |
| Slovakia | **5.7** | **94.3** |
| Slovenia | **4.9** | **95.1** |
| Spain | **5.3** | **94.7** |
| Sweden | **2.2** | **97.8** |
| United Kingdom | **5.8** | **94.2** |
|  |  |  |
| Iceland | **0.7** | **99.3** |
| Liechtenstein | **2.5** | **97.5** |
| Norway | **1.9** | **98.1** |
| Switzerland | **5.0** | **95.0** |
| Turkey | **5.0** | **95.0** |

For PM10, PM2.5, O3 and NO2, only stations with a data coverage of at least 75 % per calendar year are used. That is, in the case of daily values, having more than 274 valid daily values per calendar year (or 275 days if leap year). And in the case of hourly values, having more than 6576 valid hourly values per calendar year (or 6594 hours if leap year). For BaP the minimum data coverage accepted is 14 %.

For each city *i* in country *j*, and every pollutant, the total number of traffic stations (*nit*) and the total number of background stations (*nib*) is obtained. *Ptj* % of the total population (*Popi*) is proportionally assigned to each of the traffic stations and *Pb*j % of *Popi* is proportionally assigned to each of the bakground stations. So, every traffic station has an allocated population equal to ((Ptj / 100) \* *Popi* / *nit*) and every urban or suburban background station has an allocated population equal to ((Pbj /100) \**Popi* / *nib*).

Based on the selection of AirBase stations air quality statistics are extracted from the database via Structured Query Language (SQL) server queries in order to update the pollutant specific indicators specified below.

The geo-political domain for calculating this indicator can be that of EEA member countries, EU Member States or individual states.

**Particulate matter (PM10)**

For each selected station that fulfils the data coverage criteria the percentile 90.4 (P90.4) of the daily mean concentration series will be calculated from the hourly values (if available) or daily values. When P90.4 is below or equal to 50 microgram/m3, it indicates that the daily limit value (DLV) would have not been exceeded more than 35 days.

Depending on the value of P90.4, each station (and its allocated population) is then classified uniquely in one of the two exceedance classes (P90.4 >50 meaning above the DLV and P90.4≤50 meaning below the DLV).

The percentage of urban population allocated to both exceedance classes is calculated by dividing the population corresponding to the stations assigned to each individual exceedance class by the sum of the population assigned to each station.

**Nitrogen dioxide (NO2)**

The annual mean concentration is calculated for each of the selected stations that fulfil the data coverage criteria.

Depending on the annual mean concentration, each station (and its allocated population) is then classified uniquely in one of the 2 classes of concentration (below or equal to the limit value (LV, 40 microgram/m3), or above the LV).

The percentage of urban population allocated to these two concentration classes is calculated by dividing the population corresponding to the stations assigned to each concentration class by the sum of the population assigned to each station.

**Ozone (O3)**

For each selected station fulfilling the data coverage criteria, the percentile 93.2 of the daily maximum 8-hourly mean concentration series is calculated from the hourly values. When P93.2 is below or equal to 120 microgram/m3, it indicates that the target value (TV) would have not been exceeded more than 25 days.

Depending on the value of P93.2, each station (and its allocated population) is then classified uniquely in one of the two exceedance classes (P93.2>120 meaning above the TV and P93.2≤120 meaning below the TV).

The percentage of urban population allocated to the two exceedance classes is calculated by dividing the population corresponding to the stations assigned to each individual exceedance class by the sum of the population assigned to each station.

**Particulate matter (PM2.5)**

The annual mean concentration is calculated for each of the selected stations fulfilling the data coverage criteria.

Depending on the mean concentration, each station (and its allocated population) is then classified uniquely in one of the 2 classes of concentration (below or equal to the target value (TV, 25 microgram/m3), or above the TV).

The percentage of urban population allocated to these two concentration classes is calculated by dividing the population corresponding to the stations assigned to each concentration class by the sum of the population assigned to each station.

**Benzo(a)pyrene (BaP)**

The annual mean concentration is calculated for each of the selected stations fulfilling the data coverage criteria.

Depending on the mean concentration, each station (and its allocated population) is then classified uniquely in one of the 2 classes of concentration (below or equal to the target value (TV, 1.0 nanogram/m3), or above the TV).

The percentage of urban population allocated to these two concentration classes is calculated by dividing the population corresponding to the stations assigned to each concentration class by the sum of the population assigned to each station.