EXPOSURE TO AMBIENT AIR POLLUTION

Indicator Phrasing

English: number or % of people exposed outdoors to [specify the pollutant] levels above [specify: national / WHO] guidelines

French: nombre ou % de personnes exposées à l'extérieur à des niveaux de [précisez le polluant] supérieurs aux directives [précisez: nationales / de l'OMS]

Spanish: número o % de personas expuestas al aire libre a niveles de [especificar el contaminante] superiores a las directrices [especificar: nacionales / de la OMS

Portuguese: número ou % de pessoas expostas ao ar livre a [especificar o poluente] em níveis acima das diretrizes [especificar: nacional / OMS]

Czech: počet nebo % lidí vystavených venku vyšším hodnotám [upřesněte znečišťující látku], než doporučují [upřesněte: národní / WHO] standardy

What is its purpose?

The indicator measures the proportion (or number) of people exposed to above-threshold levels of dangerous air pollutants in the outdoor areas, including particulate matter (PM2.5, PM10), ozone (O3), nitrogen dioxide (NO2) and sulphur dioxide (SO2). In the context of lower-income countries, these are mostly emitted from traffic (combustion engines), burning solid fuels and industrial activities. They account for significant sources of morbidity and mortality.

How to Collect and Analyse the Required Data

The indicator's value can be determined either by:

- **Using existing data** regularly collected by the public authorities (or any other competent actor). This approach is likely to be less expensive and time-consuming; however, it is possible to use existing data only if they cover the area where your project aims to decrease ambient air pollution (which often is not the case).

- **Conducting your own measurements** is likely to require more money, expertise and time; however, it allows you to collect data in the areas where your project is working on decreasing air pollution. If your team has limited experience with monitoring air quality, contract a relevant specialist / company, to support you with the data collection and analysis process (alternatively, you can sub-contract the entire measurement process).

If you decide to gain (a part or all of) the required data by conducting your own measurement, use the following steps:

1) **Specify the pollutant, including its thresholds**

Define the exact pollutant that you intend to measure and the relevant threshold. The **thresholds** for the main air pollutants are usually set by the national authorities; alternatively, you can use WHO recommendations (see below).

2) **Decide on the monitoring technology**

The choice of sensors depends on which pollutant you want to measure and which sensor you are able to use (considering their availability, price, ease-of-use). See an overview of sensors in this article though also check more recent products, as the market for low-cost air quality monitors is evolving rapidly. If your team has limited experience with using sensors, contract a relevant specialist, such as an expert from a company / state authority or a freelance consultant, to support you with the data collection and analysis process.

3) **Define the installation and data collection process**

In collaboration with a specialist (if required), define the installation and data collection process, including:

- **How many sensors will you use**: The more sensors you use, the more locations you can monitor but it will also cost you more money.

- **Where the sensors will be placed**: Even monitors located some 5 – 10 metres apart can provide very different data as pollution levels vary depending on the location. In the urban contexts, the most common monitoring places are junctions, along the roads (within 1 metre and 1 – 5 metres), near other major sources of pollution (which are close to people's homes) and in background sites that are not dominated by one single nearby pollution source (see more details in the guide below). In the rural areas, you can collect data along the main roads and near people's houses (at least 15 metres from any source of pollution).

- **When the data will be collected**: Pollution levels vary by season – data from a baseline study from a cold and rainy period will not be comparable with data from an endline study conducted during the peak of a hot and dry season. Similarly, pollution levels might differ by day – for example, traffic pollution levels on Monday might be different from traffic pollution levels on Tuesday. Similarly, traffic pollution levels will be different during peak and off-peak hours.

- **How long the sensors will be deployed**, such as 24 or 48 hours.

- **Which quality assurance measures will be followed and by whom**: There are many factors that can negatively influence the reliability of your air quality data, such as choice of sensors (precision, reliability, weather resistance, etc.), their location, installation, the timing of data collection, etc. Consult with relevant specialists about these and ensure that appropriate quality assurance measures are followed.

4) **Collect the required data** using the monitoring process defined under point 3.

5) To **calculate the indicator's value**:

- list the areas with ambient air pollution exceeding relevant thresholds

- use existing data (e.g. from local authorities) to determine the number of people living in areas

where ambient air pollution exceeded relevant thresholds

- (if you need to report in percentages) divide the result by the total number of people living in all the monitored areas. Multiply the result by 100 to convert it to a percentage.

Disaggregate by

Disaggregate the data by gender, location and other relevant criteria.

Important Comments

1) Before starting, **assess the most common sources of air pollution** in the areas where you plan to conduct measurements. For example, the occasional burning of waste or seasonal burning can greatly affect your results. You should avoid these 'accidental' sources of air pollution; otherwise they will skew the data.

2) As you can see from the guidance above, pollution levels differ based on which season you collect the data in, at which location (even a few metres difference counts), on which day, at which time of a day, etc. If you want your baseline and endline data to be comparable, **you must ensure that the endline data is collected in exactly the same way as the baseline was** – during the same season, at the same location, on the same day of a week, at the same time of a day, etc. Ensure that the **methodology used during the baseline survey is recorded in detail**, including GPS points and photos of where the sensors were installed, so that it can be replicated later.

3) **Pollutants which are most commonly measured in the outdoor areas** include:

- **Particulate matter (PM)** includes extremely small particles and liquid droplets with a diameter of less than 10 microns (PM10), including fine particles smaller than 2.5 microns (PM2.5). PM2.5 pose the greatest risk to people's health, as they can penetrate people's lungs and get into their bloodstream. They are emitted from cooking, fires, cars and industries (e.g. building, manufacturing of construction materials, etc.).

- **Carbon monoxide (CO)** is a colourless, odourless, tasteless and highly toxic gas produced from incomplete oxidation of carbon in combustion when burning fossil fuels. Exposure to high levels of CO can lead to poisoning and death. It is of concern primarily indoors; however, outdoor emissions can also be high. Main sources of outdoor CO include motor vehicle exhaust and machinery burning fossil fuels.

- **Nitrogen dioxide (NO2)** is a gaseous air pollutant produced by road traffic and other combustion of fossil fuels. It increases symptoms of bronchitis and asthma and leads to respiratory infections.

- **Sulphur dioxide (SO2)** is produced from the burning of coal and oil and the smelting of mineral ores that contain sulphur. It affects the respiratory system and increases the risk of infections.

- **Ground-level ozone (O3)** is a colourless and highly irritating gas that is produced when nitrogen oxides and volatile organic compounds react in sunlight and stagnant air. Its main source is emissions from the combustion of fossil fuels.

4) While the sensors used for measuring PM2.5 and CO are relatively affordable, those measuring NO2 and O3 are still expensive (you might consider this when deciding which pollutants to measure).

Access Additional Guidance

- WHO (2005) WHO Air quality guidelines for PM, ozone, nitrogen dioxide and sulfur dioxide

- Gold Standard (2017) Methodology to Estimate and Verify Averted Mortality and Disability

- EC (0) Measuring air pollution with low-cost sensors

- EC (2019) Review of sensors for air quality

- Clean Air Asia (2016) Ambient Air Quality Standards and Monitoring

- Greater London Authority (2018) Guide for Monitoring Air Quality