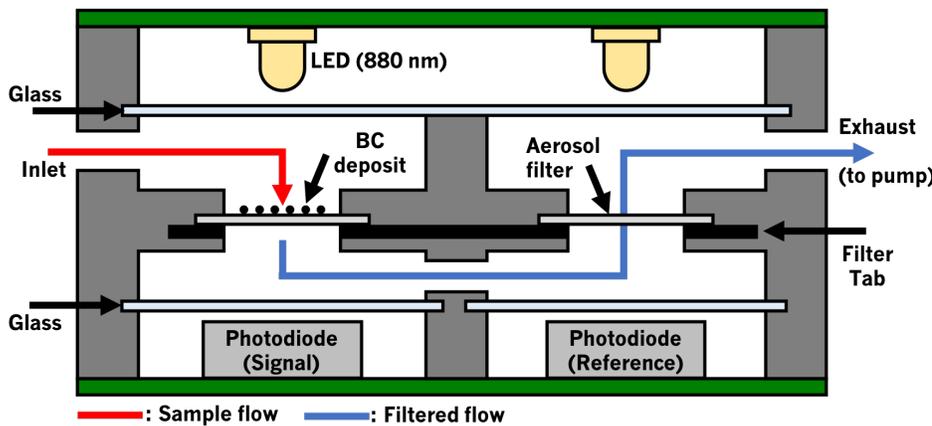


## Principle of Operation: Black Carbon Aerosol

Black carbon (BC) is the light-absorbing portion of particulate matter pollution emitted during the incomplete combustion of fossil fuels or biomass. Common BC sources include diesel vehicles and wood fires. These combustion emissions are harmful to both human health and the environment.

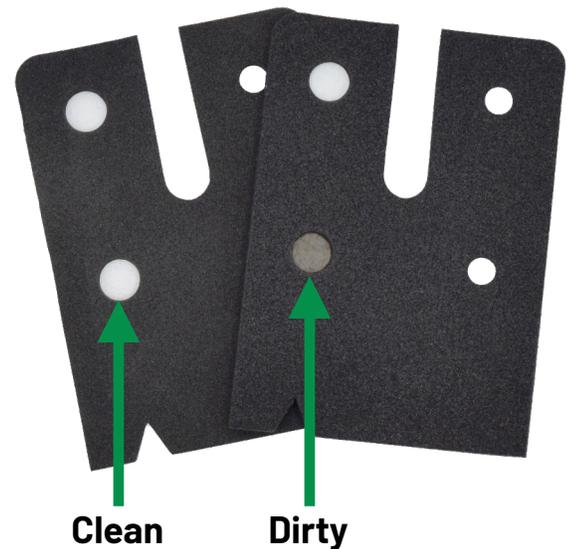


Schematic of aerosol absorption photometer

The ObservAir® measures BC using an **aerosol absorption photometer (AAP)** developed at DSTech. Two fibrous filter spots (3mm in diameter) are mounted to a foam tab that seals in the AAP. Photodiodes monitor the intensity of 880 nm light transmitted from LEDs through the two filters.

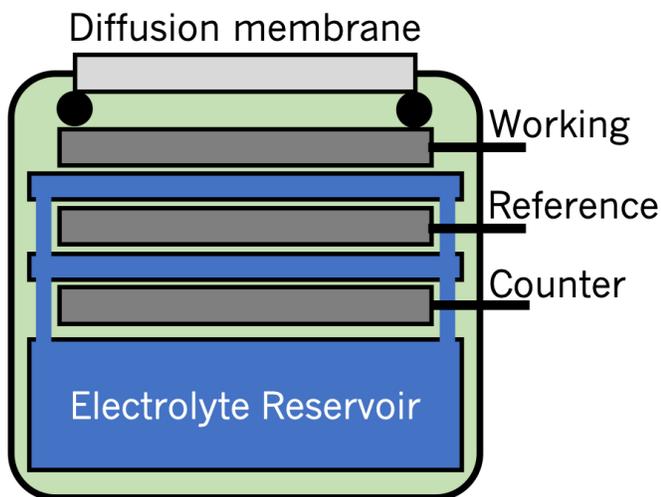
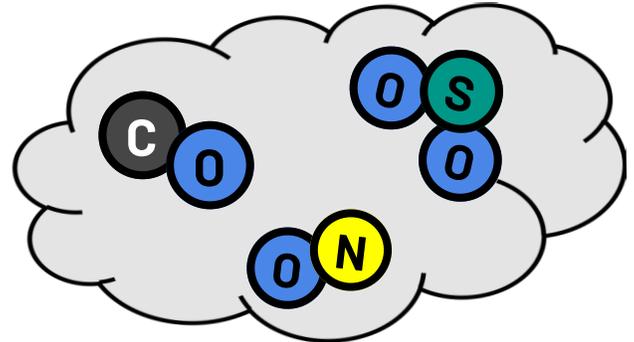
As polluted air is drawn through the AAP, light absorbing BC accumulates on the first 'signal' filter and the transmitted light intensity dims predictably over time. Filtered air (devoid of PM) then passes through the second 'reference' filter, so it is unaffected by BC concentrations. By comparing the reference light intensity to the signal, it is possible to isolate the light attenuation resulting from BC absorption alone, while eliminating other factors. Using the light attenuation data, BC concentrations are calculated in real time. The tab is replaced when too much BC has collected on the filter, as the light intensity signal degrades.

**Only bottom 'signal' filter is soiled. Reference filter above stays clean.**



## Principle of Operation: Gaseous Pollutants

Air pollution sources typically emit a variety of toxic gases. For example, diesel vehicles emit carbon monoxide and nitric oxides. Elevated atmospheric concentrations of these toxic gases are harmful to human health and the environment. For example, nitric oxide pollution forms acid rain in the atmosphere.



Schematic of electrochemical cell

The ObservAir® uses interchangeable electrochemical cells to monitor toxic gases. Cells contain three electrodes in contact with an electrolyte. Gas diffuses through a membrane and oxidizes or reduces the working electrode, thereby generating a small electrical current that is proportional to the targeted gas concentration. The reference electrode does not contact gases and generates a baseline signal. By comparing the working and reference currents, gas concentrations are logged in real time.

The ObservAir® can monitor up to two of the six gaseous pollutants listed below. A brief introduction is provided for each. All six are toxic to human health and the environment.

- **Carbon monoxide (CO):** Colorless product of fossil fuel or biomass combustion.
- **Nitric oxide (NO):** Colorless gas formed when oxygen and nitrogen react at high temperatures, such as lightning strikes and internal combustion engines.
- **Nitric oxide (NO<sub>2</sub>):** Reddish-brown gas formed at high temperature. Associated with smog and acid rain. Degrades in sunlight to form ozone and NO.
- **Hydrogen sulfide (H<sub>2</sub>S):** Colorless gas released during fossil fuel extraction, and formed naturally during anaerobic decay of biomass. Smells like rotten eggs.
- **Sulfur dioxide (SO<sub>2</sub>):** Colorless, pungent gas mainly emitted by fossil fuel combustion (notably coal power plants), but also by volcanic eruptions and chemical processing.
- **Ozone (O<sub>3</sub>):** Light blue gas with distinctive smell. Ground-level ozone is a secondary pollutant, formed when NO<sub>2</sub> and other gases chemically react in the atmosphere.

