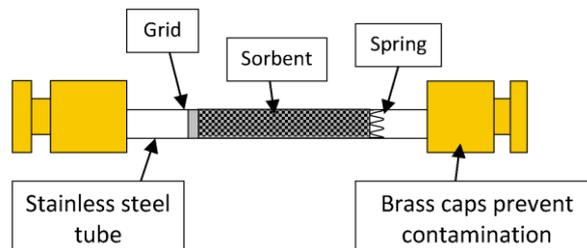




## How do sorbent tubes work for VOC monitoring?

Sorbent tubes are stainless steel tubes used for organic compounds (compounds that contain carbon). Tubes are 9 cm tall and 0.5 cm wide (excluding caps).



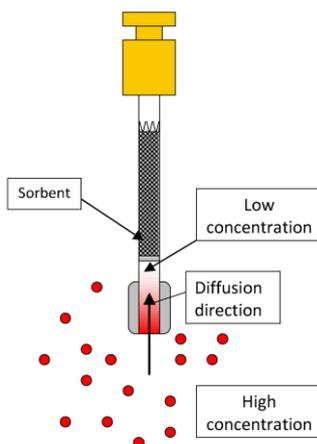
There are two methods of sampling with a sorbent tube – active sampling or passive sampling.

### Passive sampling

Passive sampling is designed for long-term monitoring so that a sufficient concentration of compounds is absorbed on to the tubes to be detected during analysis – a sample is collected over 1-4 weeks. Passive exposure can also be used for measuring personal exposure to compounds, for example in the workplace. In this case the sample is collected over 8 hours to represent a working day.

#### Benefits of passive monitoring:

- No power supply required
- Inexpensive
- Can be used over a wide area
- Long-term monitoring



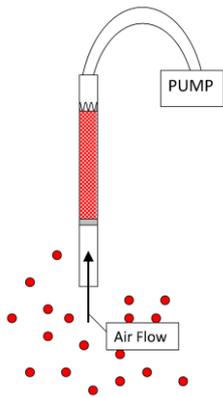
Passive sampling works by a process called molecular diffusion. During molecular diffusion, compounds will move from an area of high concentration to an area of low concentration.

The compounds in the air are at a higher concentration than those in the tube, so the compounds diffuse into the tube and collect on the absorbent inside.

Because the compounds are absorbed, the low concentration at the sorbent surface is maintained, and therefore diffusion continues. The rate that the compounds move into the tube is called the uptake rate. This is a known rate and is used in the calculations during analysis.

### Active sampling

The tube is used for short-term monitoring – a sample is collected over a few hours. Active monitoring can also be used for personal exposure monitoring in the workplace.



During active sampling, a calibrated pump is attached to the tube to draw air through the tube at a constant rate (this is usually set to 50 ml per minute).

As the air passes through the tube, the compounds collect on the absorbent inside. The pump flow rate and sampling time are used to calculate the volume of air passing through the tube so the concentration of compounds in the air can be calculated.

#### Benefits of active sampling:

- Faster sample collection so results are received sooner
- Controlled sample volume
- Effective sampling of low concentrations
- Very volatile compounds are retained

### Analysis

Once the sampling period is over, the tubes are sealed and returned to the laboratory for analysis.

The sample is removed from the tube by a process called thermal desorption. During thermal desorption the sample is heated to allow it to be extracted from the absorbent.

The sample is transferred to a GCMS (for example) where the lab determines the concentration of compounds on the tube. This is then used in a calculation with the pump flow rate or uptake rate to calculate the average concentration of compounds that were present in the air over the monitoring period.

The results are reported in parts per billion (ppb) for passive sampling or micrograms per metre cubed ( $\mu\text{g m}^{-3}$ ) for pumped sampling. Reports are emailed to the customer within 10 working days of receipt of the samples.

#### Technical tips:

- Unlike some Palmes diffusion tubes for inorganic compounds, a sorbent tube can usually be used to measure a range of compounds at the same time. Several tubes may be required to meet specific requirements.
- Some compounds stop being absorbed by the tube during pumped sampling if a certain volume is reached – this is called the breakthrough volume. Contact our Technical Department for advice on maximum pumping times.