Major factors to be considered during air sampling

- Constituent or pollutant
- Sampling rate
- Sampling time

Types of air monitoring

- Personal sampling
  - Undertaken within breathing zone of operative
    - As close to mouth and nose as practicable (within 200 mm)
    - Inlet to the sampling head shouldn't be obstructed
- Portable monitors
  - Can be moved during sampling
- Stationary sampling
  - Fixed during sampling

Air Quality Measurement

- Measurements of air quality generally fall into:
  - **Source sampling** - Emission from a source is measured
  - **Ambient Air Quality** - Measures the quality of air in a particular place.
  - **Industrial Hygiene sampling** - for testing the air quality inside of factories and places of work
- **Indoor sampling** - to study the quality of air in living spaces

Types of measurement/sampling

- Active sampling
- Passive sampling
- Electrochemical methods
- Optical analyzers

Types of Ambient monitoring Stations

Station type	Description
Pedestrian exposure station	In congested areas, surrounded by buildings with many pedestrians and average traffic flow > 10000 vehicles/day.
Downtown neighbor hood exposure stations	In central business districts but not congested areas, and less high rise buildings. The average traffic flow < 500 vehicles/day. Eg. parks, landscapes areas etc.
Residential population exposure station	In the residential or sub-urban areas but not in central business districts. Should be more than 100 m away from any street.
Mesoscale stations	At appropriate height to collect meteorological and air quality data at upper elevation; main purpose to collect the trend of data variations not human exposure.
Non-urban stations	In remote non-urban areas with no traffic and industrial activity. Mainly for background concentrations.

Location of all stations but mesoscale stations should be *0.5 m from curve and 2.5 to 3.5 m above the ground. For mesoscale stations it could be at even higher elevations.*

Active sampling

- Pumped Sampling
- Analytes all physically pulled into the sampler using an air sampling pump
- Concentrating the analytes on some sort of media (adsorbents, or filters)

Passive sampling

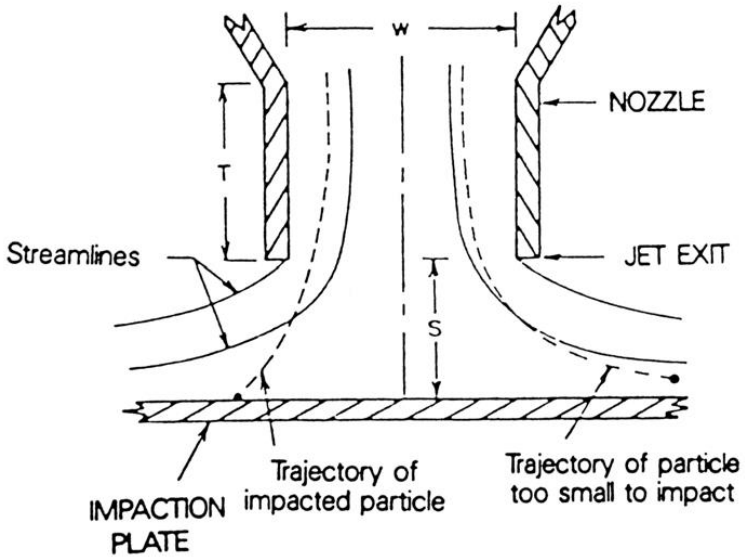
- Diffusive sampling
- Analytes enter the sampler unassisted due to molecular diffusion.
- Unlike active sampling, passive samplers don't require electricity.
- The adsorbed analytes can be desorbed off the adsorbent by solvent or thermal desorption.

Particulate Matter Sampling

- Gravimetric based
- Light scattering based

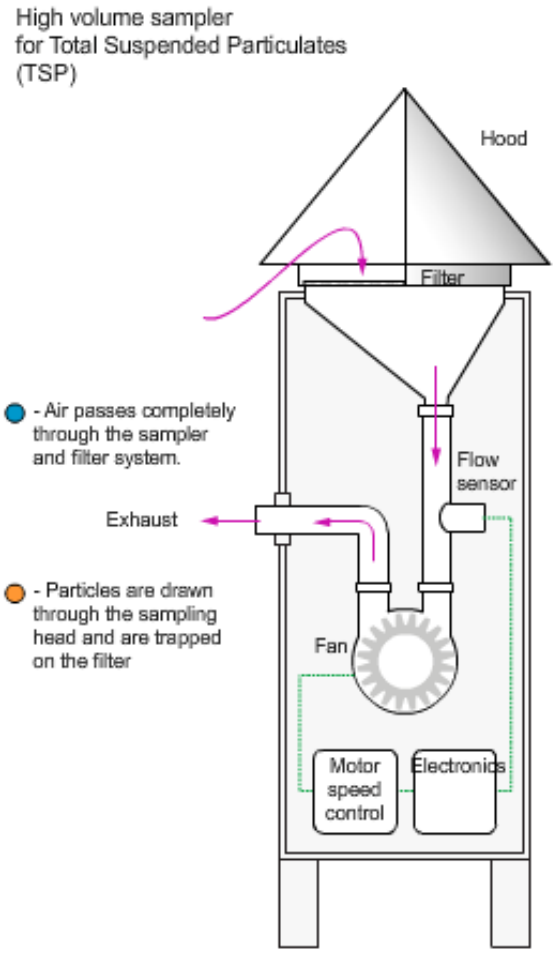
Working principles of gravimetric PM samplers

- Samplers work on the principle of Inertia
- Sub classified into
  - Impactors



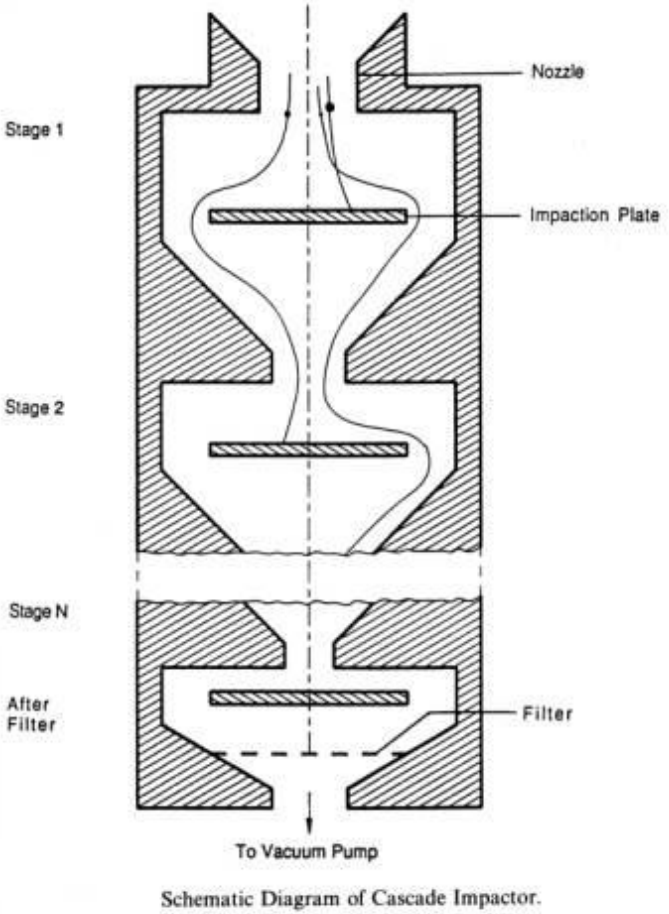
- Jet of aerosol impinge on flat plate.
- Particles larger than cut size slips across the streamline and impacts the plate
- Smaller particles follow the streamline

High Volume Sampler

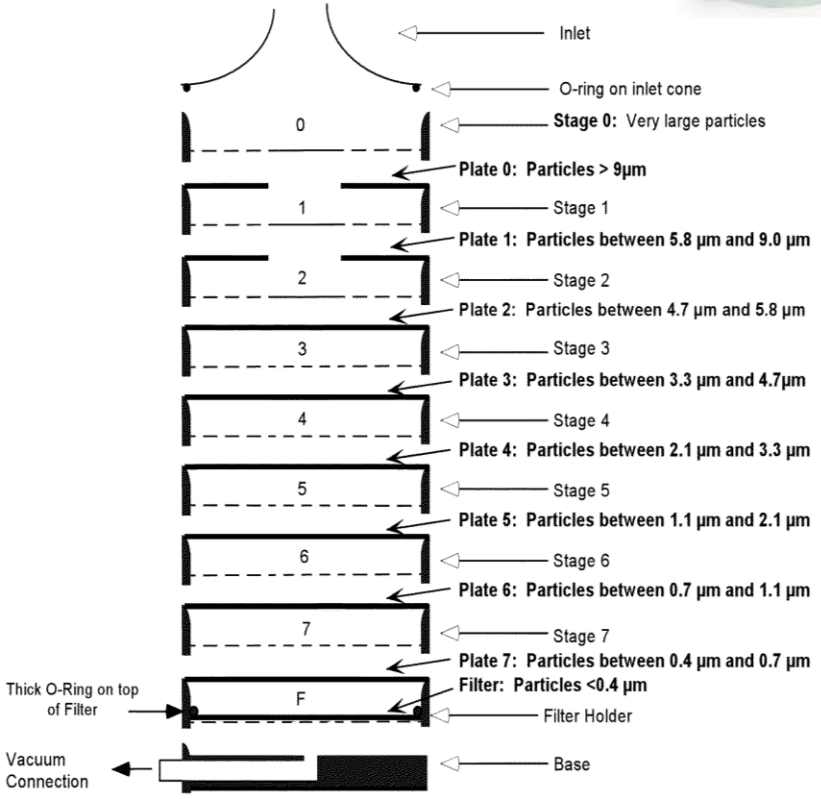


https://www.qld.gov.au/environment/pollution/monitoring/air-pollution/samplers

Cascade Impactor

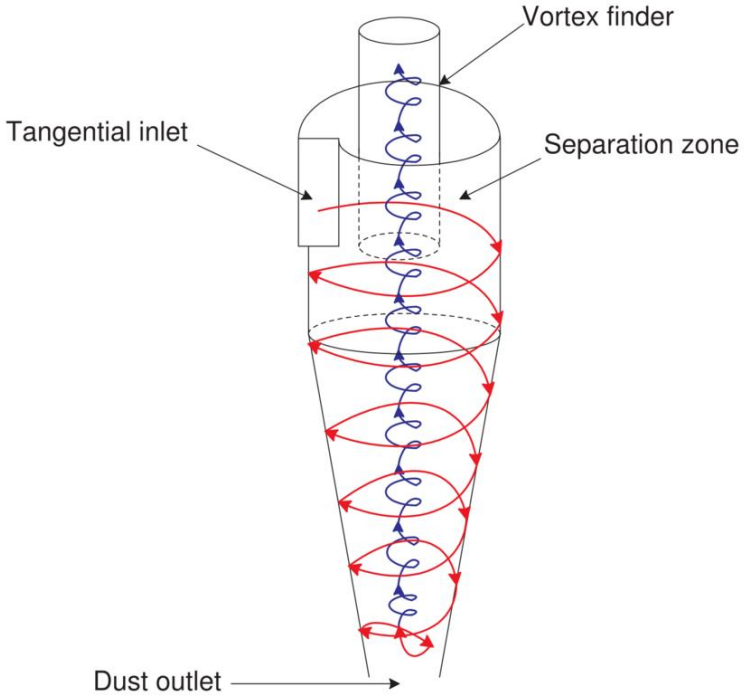


Schematic Diagram of Cascade Impactor.

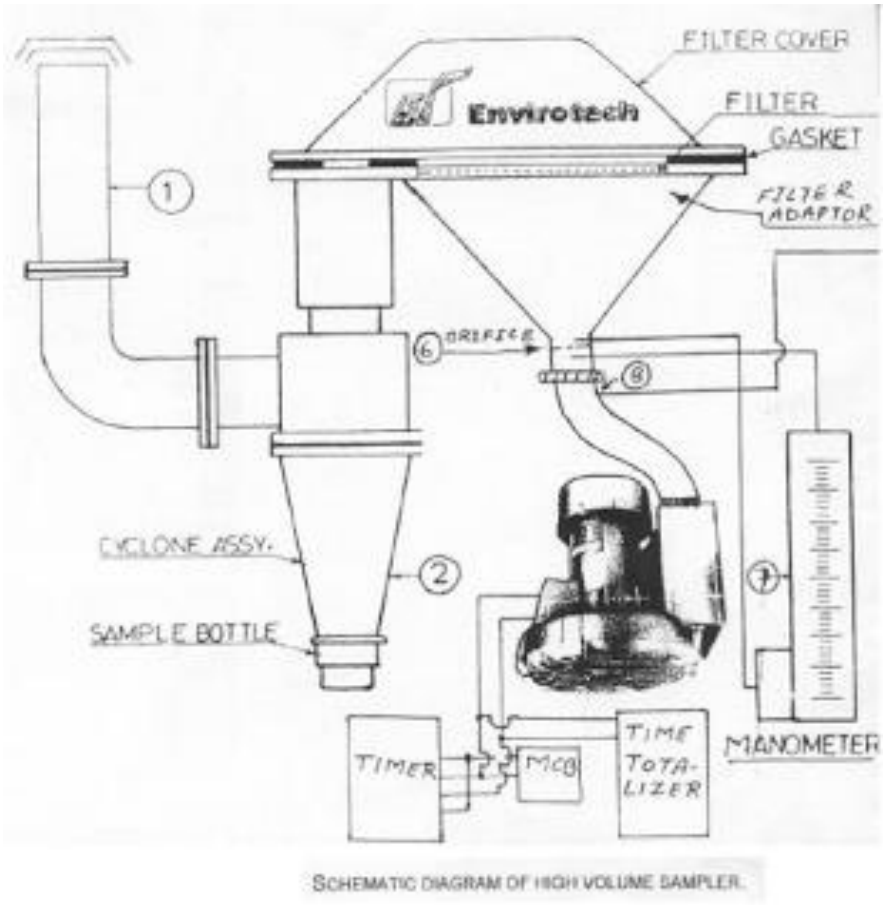


Working principles of gravimetric PM samplers

- Cyclone
  - Jet of air impinges tangentially on inner surface
  - Swirls downward in a cyclonic fashion and into a conical section
  - Air reverses direction and spirals upward to exit at the upper end
  - Particles larger than cut size deposits on inner of cylinder and later collects in grit pot.

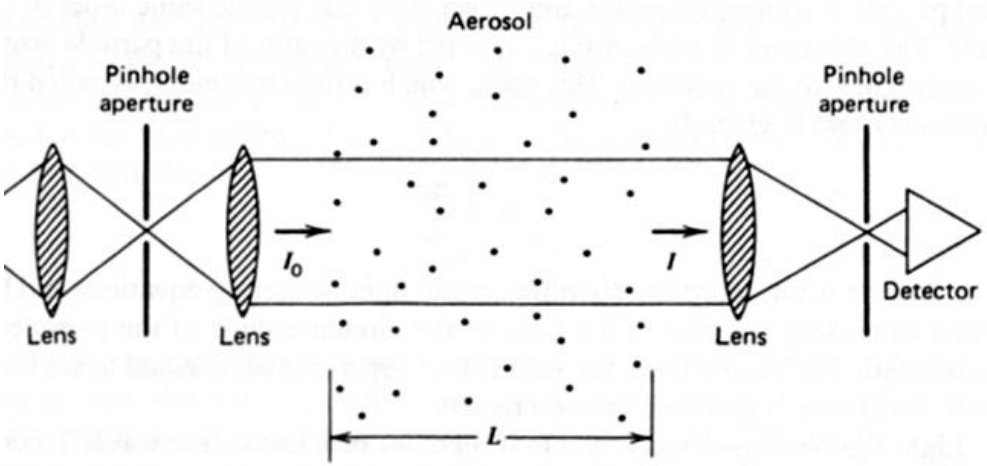


Respirable dust sampler



SCHEMATIC DIAGRAM OF HIGH VOLUME SAMPLER.

Light Scattering method

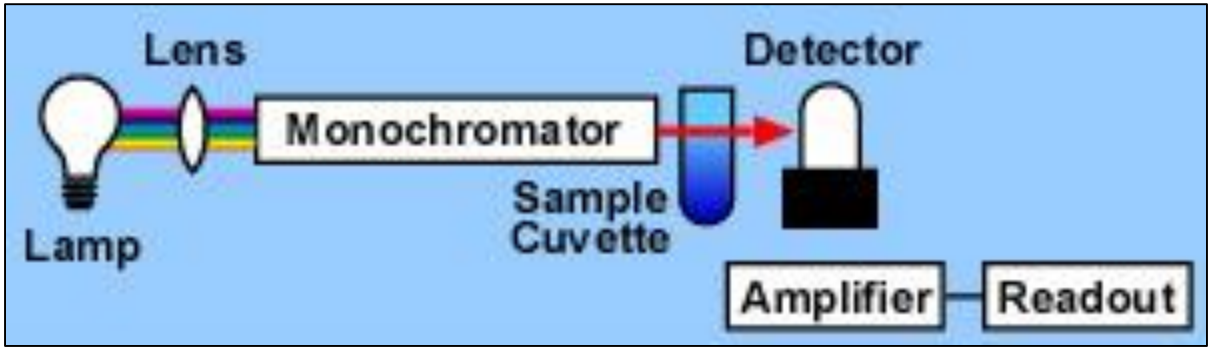


Aethalometer

Measurement of gases

Sulfur Dioxide

- UV Fluorescence
  - Air sample drawn into a scrubber chamber and then on into an irradiation chamber where it is exposed to UV light
- SO_2 absorbs in 190-230nm
- The amount of fluorescent radiation is directly proportional to the concentration of SO_2



Sulfur Dioxide

$SO_2 + UV \longrightarrow SO_2^*$

$SO_2^* \longrightarrow SO_2 + light$

Measurement of gases

Oxides of Nitrogen

- **Chemiluminescence**
  - Passing sample over a catalyst to convert NO_2 to NO
- Suitable for ambient air containing NOx (NO and NO_2) at levels less than 1 mL/m^3
- Reaction of NO with ozone in a dark enclosed chamber to produce light
- Provided the ozone is present in excess the light output is directly proportional to the concentration of NO
- $\mathbf{NO + O_3 \longrightarrow NO_2^* + O_2}$
- $\mathbf{NO_2^* \longrightarrow NO_2 + h\nu\ (light)}$

Measurement of gases

Ozone

- Either by chemiluminescence methods or direct reading UV detectors.
- Chemiluminescence method-Sample drawn into a mixing chamber mixed with a stream of Ethene - causes a chemiluminescent reaction and the subsequent emitted light at about 430nm
- Direct reading UV method - stream of gas in the sample is drawn through a flow cell where it is irradiated with UV light at 254nm

Measurement of gases

Carbon Monoxide

- Non-dispersive infra red devices
- Sample through a flow cell in the instrument where it is irradiated with infrared radiation

Impingers

Impingers are glass bubble tubes designed for the collection of airborne particles into a liquid medium.

- When using an air sampler, a known volume of air bubbles is pumped through the glass tube that contains a liquid specified in the method.
- The liquid is then analyzed to determine airborne concentrations.

Pollutant	Solution
SO_2	Tetrachloromercurate
NO_2	Arsenite
NH_3	Sulfuric acid
H_2S	Cadmium hydroxide
Cl_2	Methylorange

Glass Impinger