

# Fine Particulate Air Sampling and Analysis Service

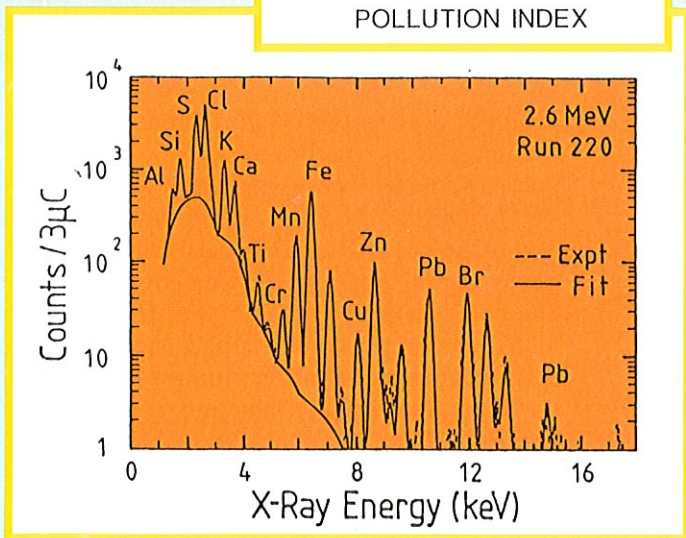
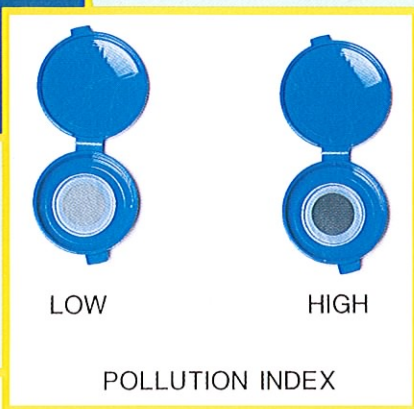
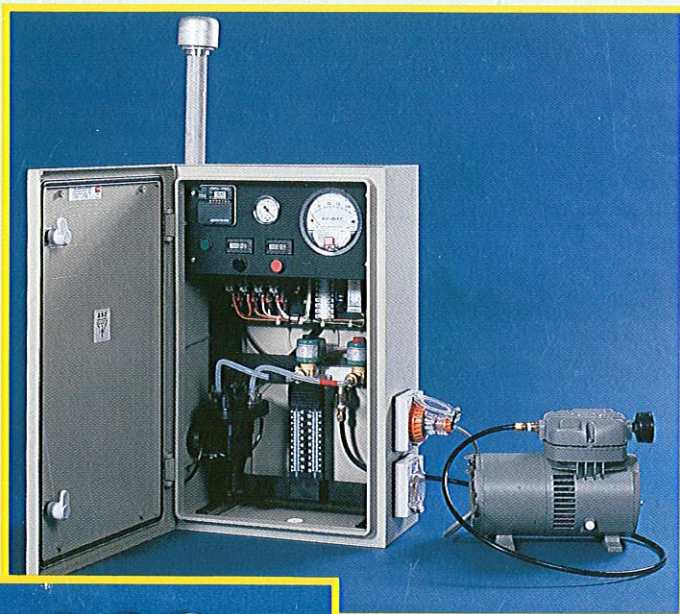


**T**he effect of fine dust particles in the atmosphere on the health of the population and the environment is of increasing concern to industry and government. Coarse particles whilst easily seen are a lesser health risk because they settle out close to their source and if breathed in do not penetrate deeply into the lungs as fine particles.

Particles smaller than 10 microns (1 micron is a millionth part of a metre) can travel large distances before settling and those around 1 micron can stay airborne for hundreds or even thousands of kilometres. When these very fine particles are breathed in they travel deep into the lung where they become trapped, and depending on the nature of the particles can produce health effects. Fine particles also scatter light and reduce atmospheric visibility.

Fine particulates are typically produced by combustion processes, motor vehicles, industrial plants, mining operations, mineral and soil stockpiles.

It is becoming increasingly important to be able to identify the constituents of atmospheric dust to be able to assess potential effects on the population and the environment, to make possible the identification of sources and to put in place remedial and management programs.



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**GENERAL**

The Applications of Nuclear Physics Research Program at ANSTO has designed and developed a dust sampling unit which will sample the atmosphere for typically a 24 hour period, separate out and collect all dust particles smaller than 2.5 microns.

At the Lucas Heights laboratories the dust is analysed using ANSTO's ion beam accelerators. By applying advanced nuclear techniques the presence and concentration of up to 35 elements in the dust can be accurately established for concentrations as low as 1 nanogram per cubic metre of air.

Currently 30 air sampling units are operating in NSW and Queensland. They are constructed to industry standards from quality components and have proved to be highly reliable in a variety of environments and in temperatures which have varied from below -10 to 50 deg.C.

**CONTROL**

The operation of the Air Sampling Unit is automated and the control system measures and displays system vacuum, cyclone differential pressure, filter exposure elapsed time, real time and ambient minimum and maximum air temperatures.

**PARTICULATE COLLECTION**

- The analysis focuses on fine particles which:
- 1) Have greater health effects on populations than coarse particles.
  - 2) Remain airborne for long periods and are transported large distances by air currents.
  - 3) Scatter light and hence effect visibility and the public's perception of pollution.
  - 4) Settle on vegetation and buildings, corroding surfaces.

In the ANSTO Air Sampling Unit a high particle separation efficiency is achieved using a cyclone separator designed by the University of California. The separated fine particles are collected on 25mm diameter teflon membrane filters and the cyclone is supplied with up to four of these thereby permitting four samples to be exposed before collection for analysis.

Sample changeover takes approximately five minutes and can be carried out by most people with a minimal few minutes of familiarisation training.

**SAMPLE SPECTRUM**

A typical experimental spectrum shows the capabilities of the analysis system. Aluminium (Al) and silicon (Si) are from soil sources, chlorine (Cl) from sea spray, potassium (K) from smoke, heavy metals manganese (Mn), iron (Fe) and chromium (Cr) etc. from industry and lead (Pb) and bromine (Br) from vehicles. These elemental analyses which identify pollution sources are all obtained simultaneously in a few minutes of running time on the accelerators at ANSTO.

**SPECIFICATIONS**

- Fine particle cyclone 2.5 micron cutoff
  - Programmable 7 day clock system controller with 4 day battery backup
  - built-in vacuum, flow, elapsed time and temperature monitors
  - 240 V operation, 1kW switched, less than 0.25kW standby
  - oil-free vacuum pump, diaphragm type (standard) or vane type (# special) available
  - Max/min temperature measurement
  - Instrument constructed to IP56 design for use in all weather conditions
  - Interchangeable critical orifice for accurate flow calibration
  - dimensions — sampler unit box, 600mm high, 400mm wide, 250mm deep; mounted on stand, 1700mm to top of box; stack air inlet, 2500mm above ground
- #For low noise applications only.

