

# Continuous Ambient Air Quality Monitoring Station (CAAQMS)

Presented by:

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# Introduction of CAAQMS

CAAQMS:

1. Fixed CAAQMS
2. Mobile CAAQMS
3. Portable CAAQMS



# Introduction of CAAQMS





# Ambient Air Quality

## Manual Vs. Continuous Ambient Air Quality Monitoring:



# Ambient Air Quality

## Manual Vs. Continuous Ambient Air Quality Monitoring:



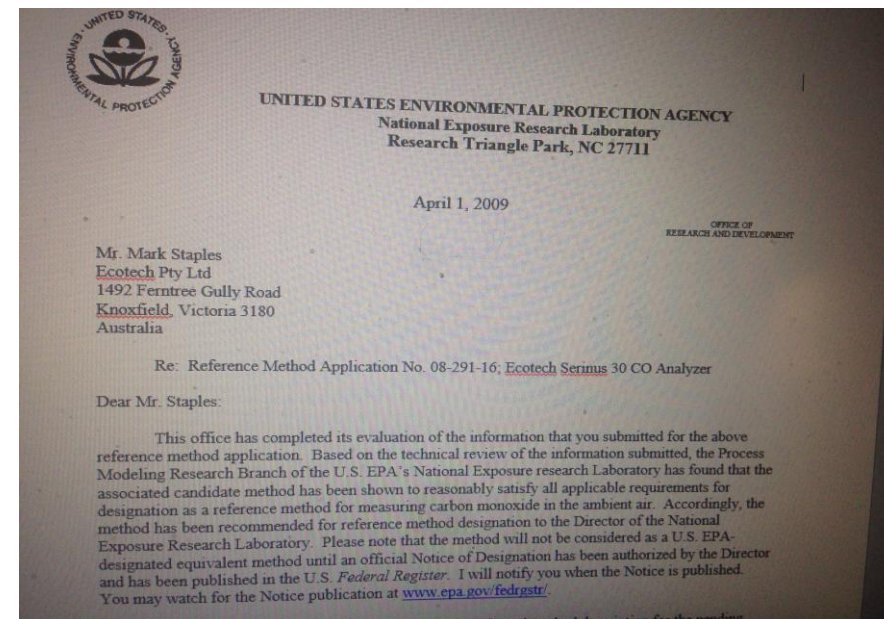
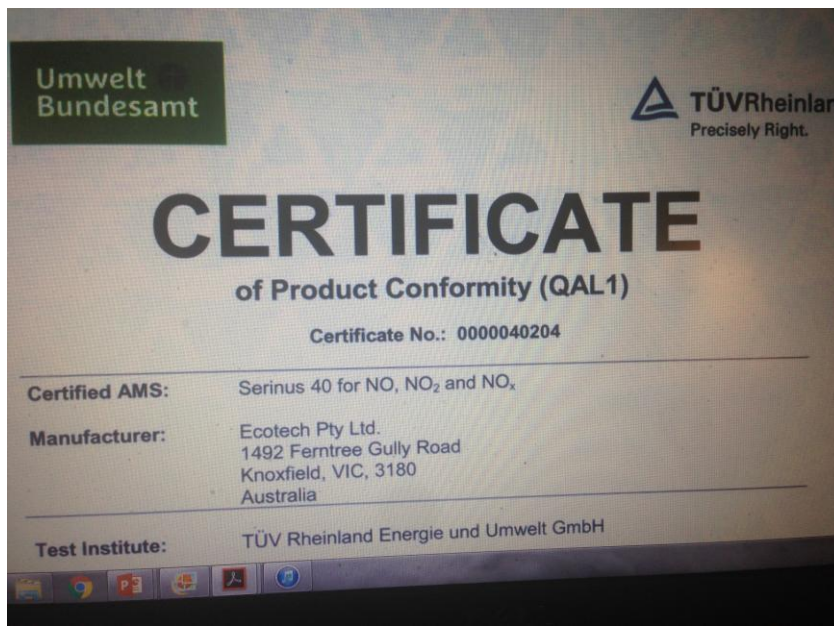
# Commonly Measured Parameters

1. Ambient air quality monitoring for: SO<sub>2</sub>, NO<sub>x</sub>, CO, O<sub>3</sub>, CO<sub>2</sub>, H<sub>2</sub>S, NH<sub>3</sub>
2. Dust monitoring: PM<sub>10</sub>, PM<sub>2.5</sub>, TSP and visibility
3. Data capture, validation and reporting
4. Pollution stream predictive modeling (dust, noise, ambient plumes)
5. Air Toxics: VOCs, M/NMHC, XAD and PUF
6. Industrial hygiene: pollens, dust, fumes, aerosols,
7. Automotive emissions: diesel, petrol and particulate (soot)
8. Meteorological (w/s, w/d, temp, RH, solar radiation, barometric pressure, rain gauge etc.)



# Certifications

1. US EPA
2. M-Cert European
3. TUV European (EN)
4. Some countries have its own standard



# ISO 9001 and ISO 14001



Ecotech has achieved ISO 9001 accreditation and ISO 14001 certification on Environmental Management System




# NATA and NIST



**NATA ISO/IEC17025 (National Association of Testing Authorities) accreditation for Ambient Air Quality Monitoring, Meteorological and Continuous Emission Systems (CEM )**

## Analyzer Details

Particulars	Measurement Techniques	Instrument Model	Instrument Make
<b>Inorganic Pollutants</b>			
Particulates (PM <sub>2.5</sub> & PM <sub>10</sub> )	Beta Ray Attenuation	BAM 1000 & 1100	Ecotech, Australia
SO <sub>2</sub>	Pulsed fluorescence	Serinus50	Ecotech, Australia
NO, NO <sub>2</sub> , NO <sub>x</sub> & NH <sub>3</sub>	Chemiluminescence	Serinus44	Ecotech, Australia
CO	Non Dispersive Infrared	Serinus30	Ecotech, Australia
O <sub>3</sub>	UV Absorption	Serinus10	Ecotech, Australia
<b>Organic Pollutants</b>			
BTX ( <i>Benzene, Toluene, Xylene</i> )	GC PID	GC 955 601	Synspec, Netherlands
<b>Meteorological Parameters</b>			
Temperature (°C)	Thermistor	Met One, USA  <b>AAQ_STANDARDS_09.pdf</b>	
Relative Humidity (%)	Capacitor		
Barometric Pressure (mm Hg)	Pressure Transducer		
Solar Radiation (Watts/m <sup>2</sup> )	Photo Cell		
Wind Direction (Degrees)	Potentiometer		
Vertical Wind Speed (m/sec)	Gill Propeller anemometer		
Wind Speed (m/sec)	Anemometer		
Rainfall (mm)	Tipping bucket		

# Site Criteria for CAAQMS

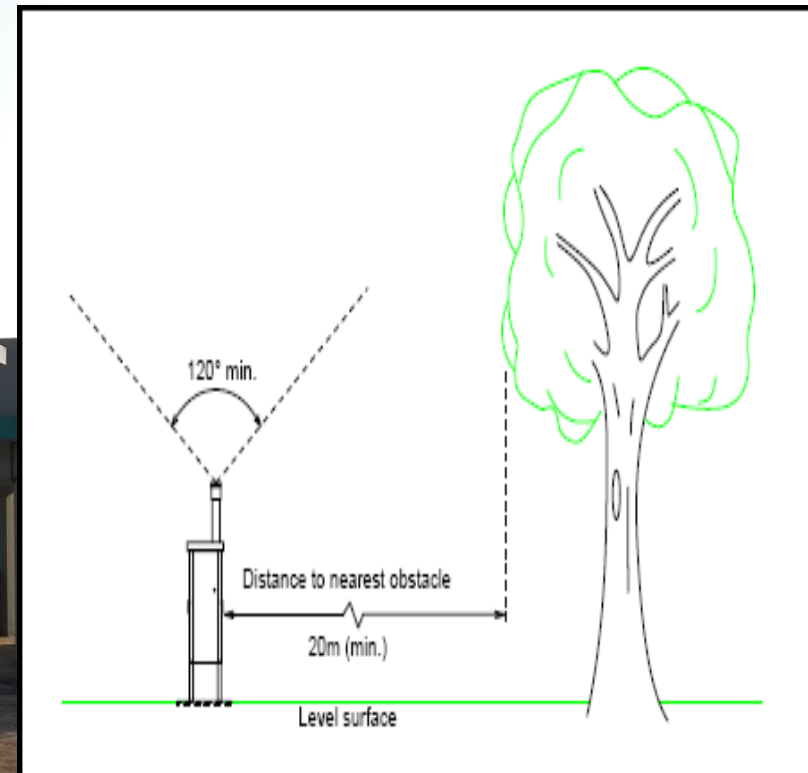
- **MODELING**
- **SOURCES AND EMISSIONS**
- **METEOROLOGY**
- **TOPOGRAPHY**
- **PROXIMITY TO PUBLIC EXPOSURE**
- **TREES & BUILDINGS**
- **SECURITY & SITE ACCESS**
- **ELECTRICITY AND PHONE**



# Location of AQMS

- Multiple factors are considered when deciding the location of air monitoring station. Sites are selected based on the pollutant or pollutants to be monitored, the population density, proximity to other monitoring stations and operational efficiency. The U.S. EPA has developed siting requirements for each of the “criteria” air pollutants. These requirements include distance from trees, buildings and roadways, distance from major point sources, and probe height. Other factors include site security and access, availability of electricity and telephone service, aesthetics and local zoning issues, and long term (+10 years) site availability. Unfortunately the ideal monitoring site is virtually impossible to acquire, especially in urban areas.
- There currently 6 criteria pollutants: sulfur dioxide, nitrogen dioxide, carbon monoxide, ozone, particulate matter less than 10 microns in diameter (PM 10), and particulate matter less than 2.5 microns in diameter (PM 2.5).

# Station Sitting



# CAAQMS includes

- Gas Analyzers, Particulate Monitors, Meteorological sensors, calibration systems, data acquisition systems, reporting and software.
- Installation & Commissioning
- Training to operators and technicians
- Operation, Maintenance & Data Reporting.





# Data Acquisition & Control System

## WinAQMS



Operating on a MS Windows latest platform, WinAQMS can collect and store up to 20 years of environmental data.

It interfaces with a wide variety of instruments digitally and provides advanced remote control functions.

# WinAQMS Agent

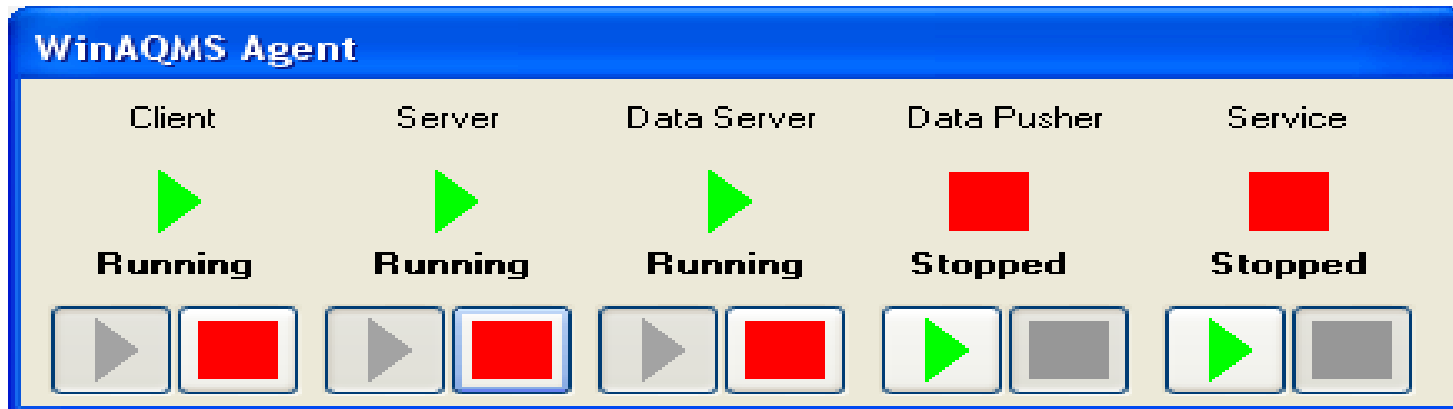
WinAQMS uses four main software components:

**Client:** Is the user interface used to view data and alter the setup of the logger components

**Server:** Collects, stores and manages data collection.

**Data server:** Responds to requests for data.

**Data pusher:** Pushes data to a FTP server.



# WinAQMS Window

**WINAQMS**  
File Edit View Manual Help

1: 20.74  
2: 15.82  
3: 0.058  
4: 293.7

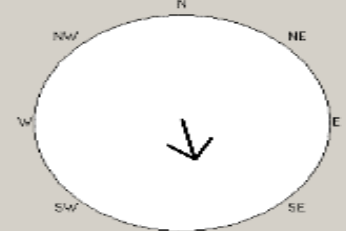
Instantaneous Data    Instantaneous Graph    Wind Rose    Historical Data    Historical Graph    Analyser Parameters    Calculated Channels

**Instantaneous Data**

Channel	Data	Units
1: Temp	15.8	°C
2: RH	102.7	%
50: SO2	NULL	ppm
5: RoomRH	49	%
13: WS	2.5	m/s
14: WD	181	°
30: CO	0.0564	ppm
41: NO2	0.016	ppm
68: Pressure	1002.0	mBar
102: Sigma	180.9	deg

Display Scheme: Default

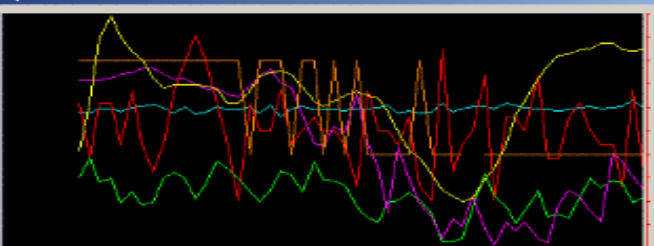
**Wind Speed and Direction**



Channel: 13: WS    Data: 2.7  
Wind Direction: 14: WD    180

Display Scheme: Default

**Instantaneous Data Graph**



10 Minutes

**Historical Data**

Start Date/Time: 2002/05/22    Period: 1 Hour    Report Name: RPT1    Find

R#	Date/Time	C1: Temp	C2: RH	C3: RTemp	C4: RoomTP	C5:	C6: Max TP	C13: WS	C14: WD	C30: CO
1	2002/05/22	15.4	103	29	22.4	47	22.4	1.6	214	0.0132
1	2002/05/22 00:05:00	15.3	103.1	29	22.4	47	22.4	1.8	207	0.0129
1	2002/05/22 00:10:00	15.4	103.1	29	22.3	47	22.4	1.9	211	0.0129
1	2002/05/22 00:15:00	15.4	103.1	29	22.3	47	22.4	1.8	203	0.0151
1	2002/05/22 00:20:00	15.4	103.2	29	22.3	47	22.4	2	209	0.0188
1	2002/05/22 00:25:00	15.4	103.2	29	22.3	47	22.3	2.6	204	0.0155
1	2002/05/22 00:30:00	15.4	103.2	29	22.3	47	22.3	2.6	200	0.0119
1	2002/05/22 00:35:00	15.4	103.2	29	22.3	47	22.3	2.9	198	0.0107
1	2002/05/22 00:40:00	15.3	103.3	28.9	22.2	47	22.3	3.2	198	0.0102
1	2002/05/22 00:45:00	15.3	103.3	28.9	22.2	47	22.3	2.4	200	0.021
1	2002/05/22 00:50:00	15.3	103.4	28.9	22.2	47	22.3	2.8	200	0.013
1	2002/05/22 00:55:00	15.4	103.4	28.9	22.2	47	22.3	2.3	203	0.0111

Data Good - all OK    Data Bad - Not Enough Samples    Data Bad - Out of Service  
Data Good - High Alarm    Data Bad - No Samples    Data Bad - Power Failure  
Data Good - Low Alarm    Data Bad - Data in Calibration    Data Bad - Instrument Fault

Display Scheme: Default

Print    Export to HTML    Export to Text

**ECOTECH**    Blackburn Client Count: 1    13:08    2002/5/24



# Powerful remote control functions

- Rebooting WinAQMS
- Changing instrument parameters and settings.
- Viewing and/or collecting data.
- Setting reporting periods.
- Setting alarms.
- Configuring and initiating calibrations.

# Additional features

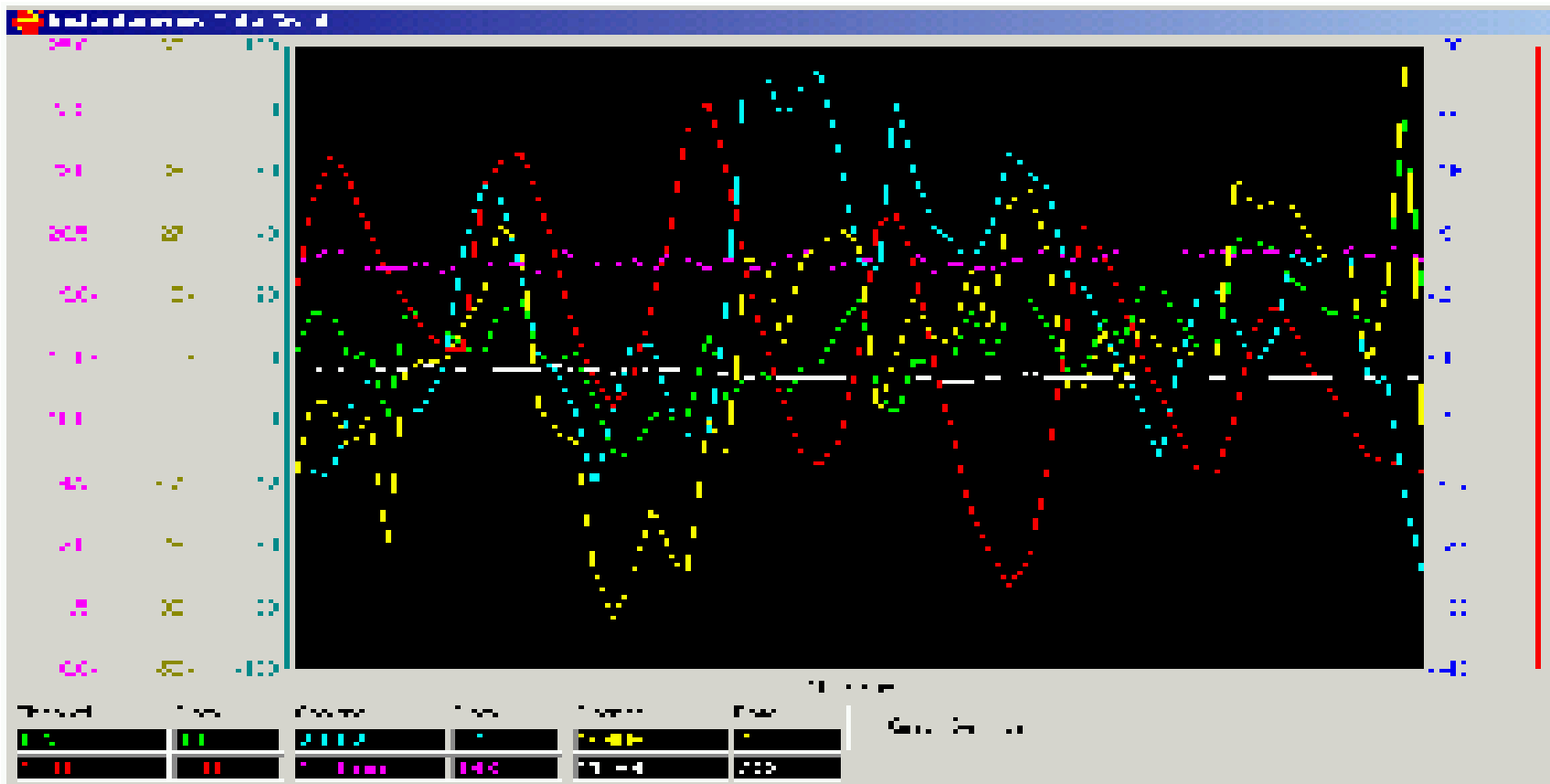
## DATA REPRESENTATION

WinAQMS presents data in a number of different formats. Data can be instantaneously generated and displayed as it's logged, or historical data logged from a user defined time period.

### Graphical representation

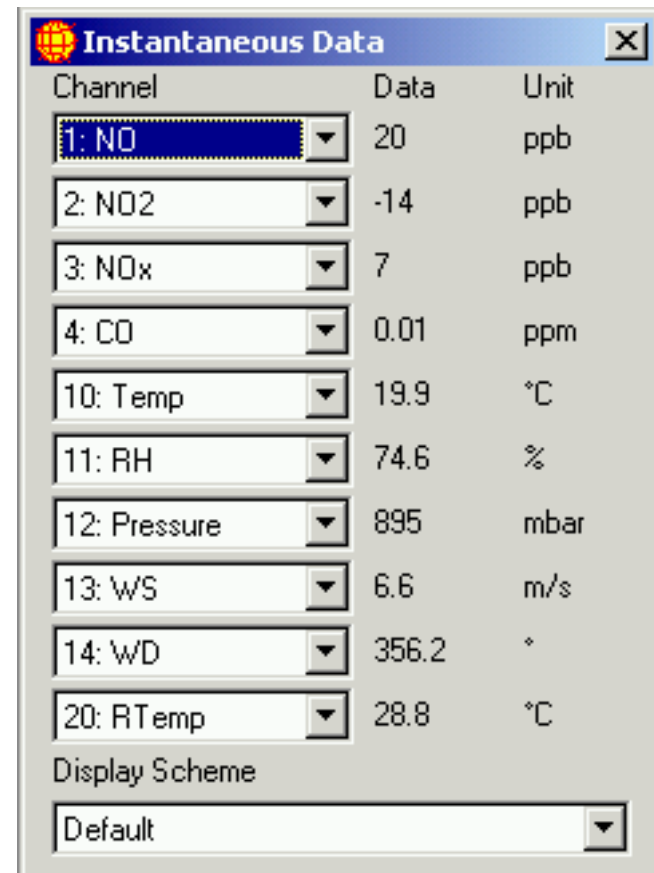
Instantaneous data or historical data can be displayed as a line graph with multiple parameters plotted in different colour lines.

# Graphical representation



# Instantaneous data table

Data can also be displayed in multiple data tables allowing up to 100 parameters to be displayed at once. The parameter displayed can be selected with drop down menus.



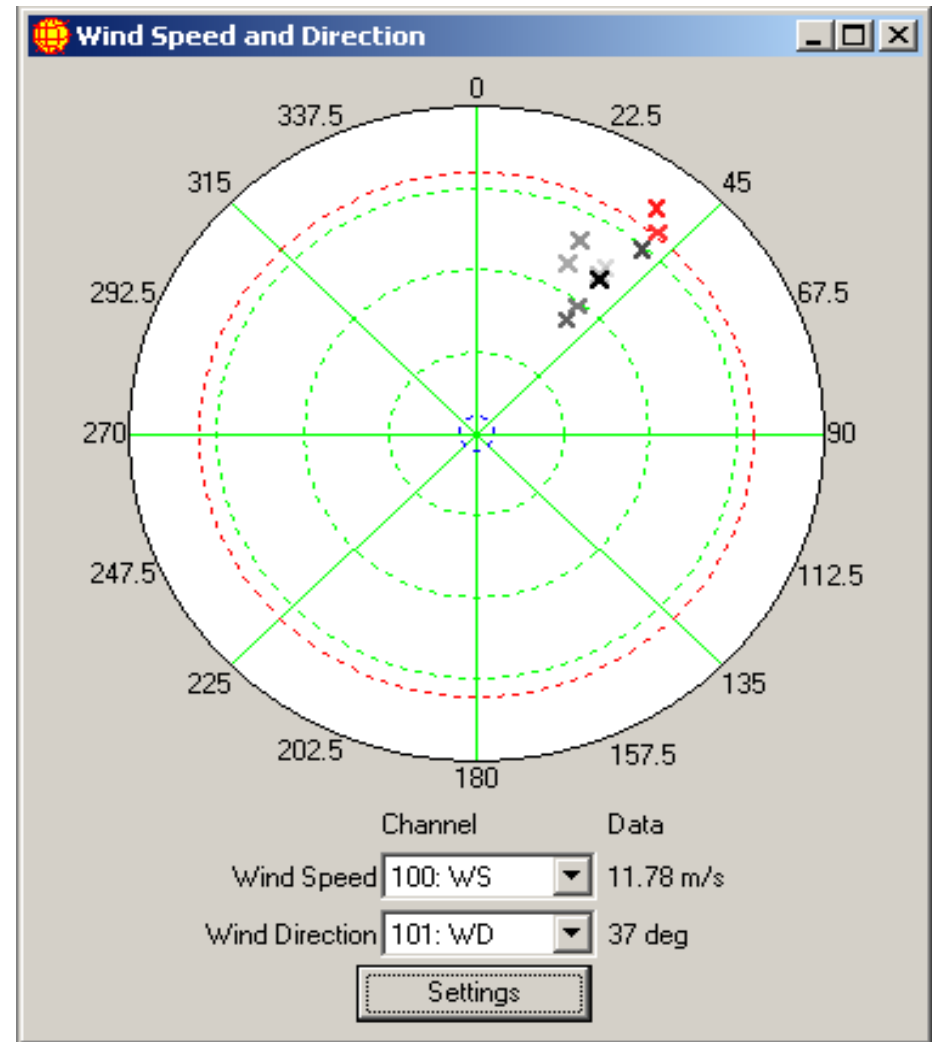
Channel	Data	Unit
1: NO	20	ppb
2: NO2	-14	ppb
3: NOx	7	ppb
4: CO	0.01	ppm
10: Temp	19.9	°C
11: RH	74.6	%
12: Pressure	895	mbar
13: WS	6.6	m/s
14: WD	356.2	°
20: RTemp	28.8	°C

Display Scheme: Default



# Wind Rose

WinAQMS displays wind speed and direction information in an easy to interpret Wind Rose graph. This information is useful when viewing data and the effects wind has on measurements

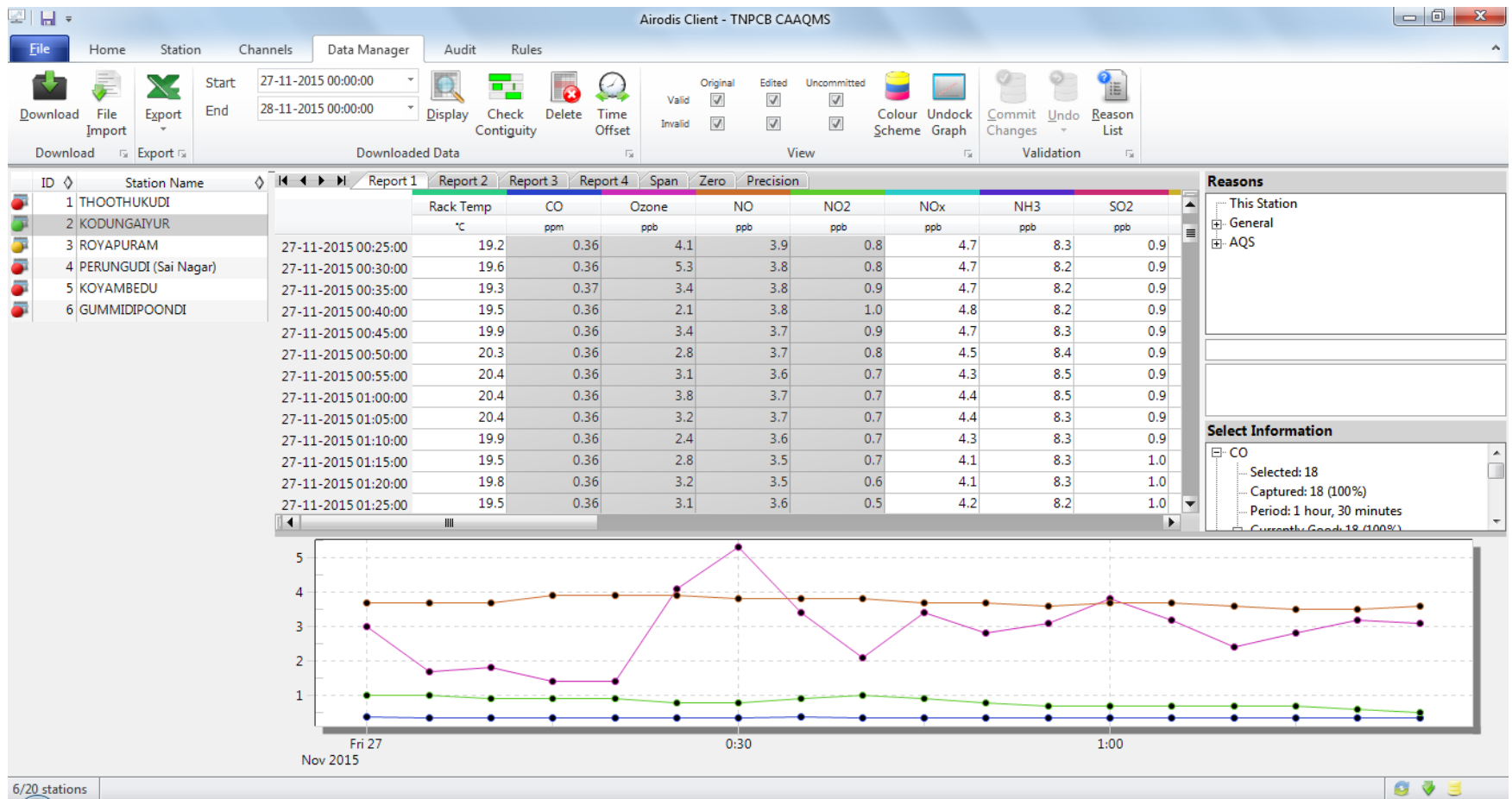


# WinAQMS SPECIFICATIONS

- Stores greater than 20 years of data
- Windows 7 Operating System  
(Windows XP optional).

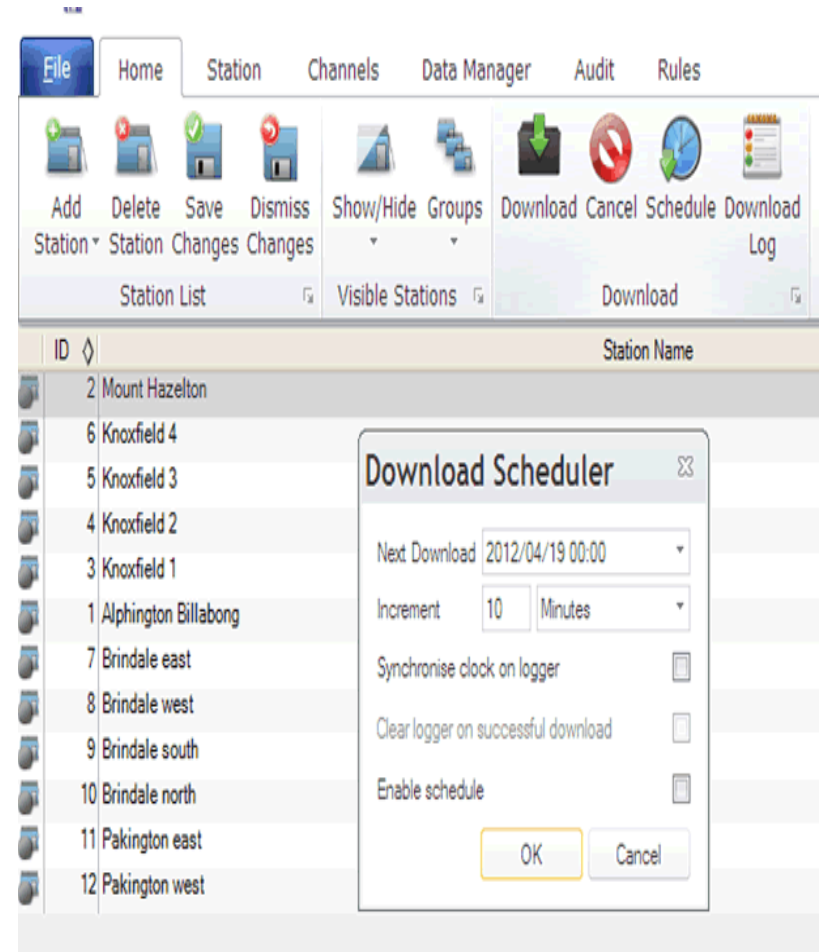
# Central Software - AIRODIS

Data collection, validation & reporting software



# Data collection

Data can be collected from a wide variety of loggers over multiple communication media. CSV file import is also supported and communication scripts for non-supported data loggers can easily be produced.





# Data management

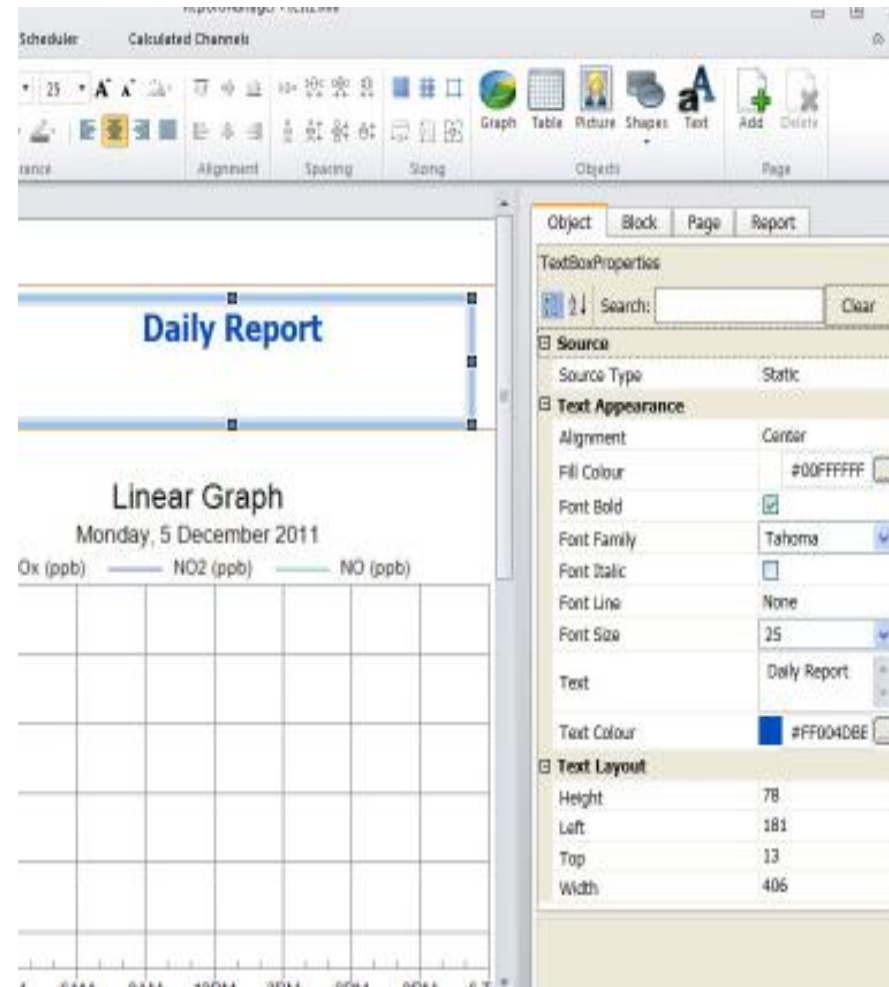
- Data can be easily validated or invalidated with the click of a button.
- Data validation graph enabling easy selection of data.
- Graphical representation of data allows quick visual inspection for outliers and data errors.
- Drag and drop functionality.
- Configurable data validation reasons.
- Data in the data table can be highlighted depending on its status. ie calibration data, validated data etc

# Data management

- Data can be imported with predefined “ranges” that data must be within or outside to be tagged as valid.
  - Fully traceable auditing of data with audit log.
  - Changes to data can be viewed in audit log.
  - Multi-lingual support including Spanish, Chinese.
- Additional languages can be configured upon request.

# Reporting

Data can be presented in reports using tables, bar graphs, distribution graphs, frequency graphs, polar plots and/or wind roses. Text and images can also be inserted.



## Calibration Procedure

- **Calibration System**

Data acquisition system (DAS) periodically controls the zero and span calibration checks for each gas analyser. Usually every 24 hours. When each analyser is set into either span or zero calibration mode, they will send a signal to the Gas Calibrator. The gas calibrator will then deliver a preset gas concentration to the instrument being calibrated.

There are four main components to the gas calibration system.



## Calibration Procedure

There are four main components to the gas calibration system.

**Zero Air Source**

**Thermal Oxidiser**

**Calibration Gas Cylinder**

**Gas Calibrator**

## Calibration Procedure

The Gas Calibrator consists of three precision Mass Flow Controllers (MFC).

One controls the flow for the Dilution (zero) air.

The other one controls the flows for the calibration gas.

The third one (optional) controls the flow of the Ozone if the Ozone generator option is installed.

## Calibration Procedure

The calibrator has two modes of operation.

### **Automatic:**

the span or zero points are remotely activated by the Data Logger, via the instruments.

### **Manual:**

can be activated from either the Data Logger, the Instrument or the Gas Calibrator.

## Calibration Procedure

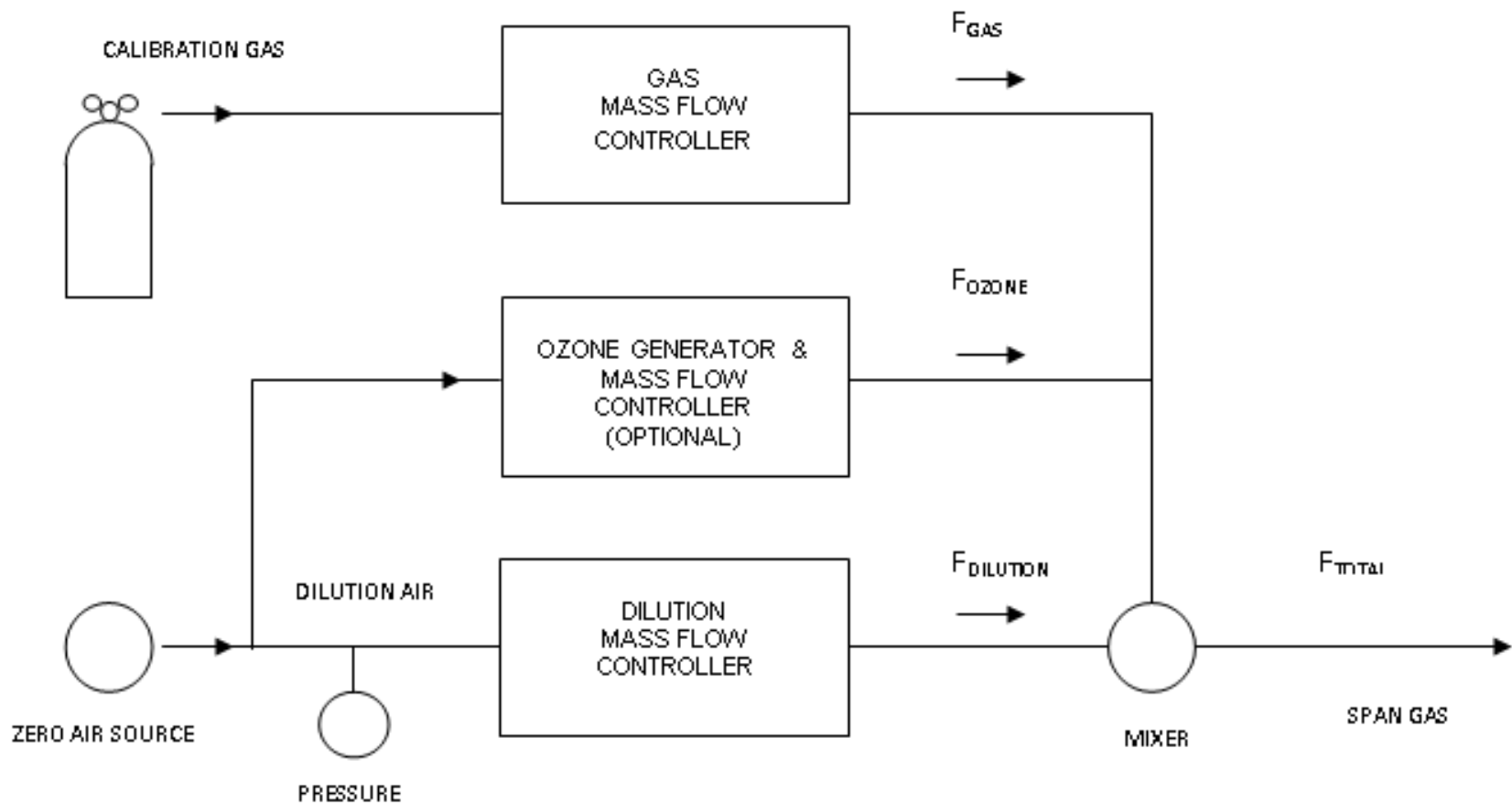
$$\text{SPAN GAS} = \frac{\text{GAS} \times F_{\text{GAS}}}{F_{\text{DILUTION}} + F_{\text{GAS}}}$$

Where: SPAN GAS = Output concentration of calibration gas from calibrator.  
GAS = Concentration of calibration gas from the cylinder.  
 $F_{\text{DILUTION}}$  = Flow rate of zero air through Dilution MFC.  
 $F_{\text{GAS}}$  = Flow rate of calibration gas through MFC.

Example: GAS = 80 ppm. (Concentration of the Cylinder).  
 $F_{\text{DILUTION}}$  = 5000 cc/min.  
 $F_{\text{GAS}}$  = 25 cc/min.



# Calibration Procedure



# ECOTECH Quality Procedure

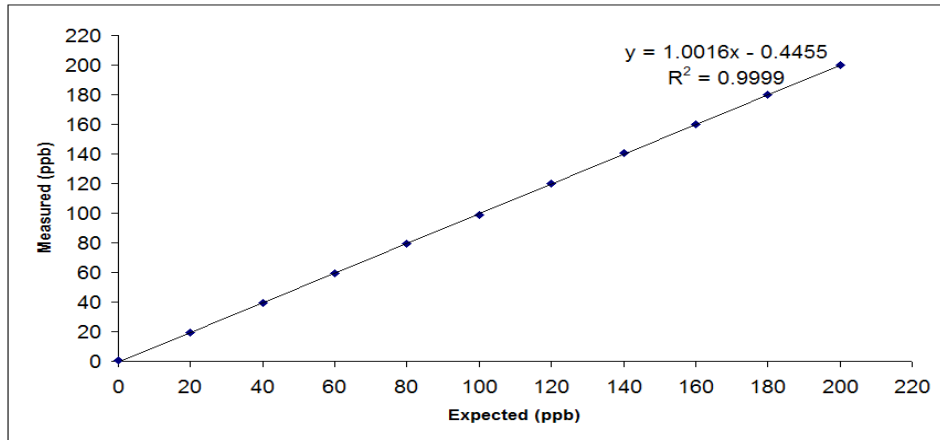
## EC9841T Multipoint

Ref: EC9841T\data.xls Revision 10  
 Date: 04/08/05 Location S:\ECOTECH\ISO\FORMS\9800\DATA\SHEETS\CURRENT

<b>ID Number</b>	<b>Date</b>	<b>Service Number</b>	<b>Engineer Initials</b>
05-0330	20-Sep-05		TFS

<b>7. Calibration Equipment</b>			
Calibrator Model	GasCal 1000	Cylinder Serial Number	CG-183
TE / Serial Number	TE-183	Cylinder Conc (ppm)	60.4
Zero Air Source	System Air	Cylinder Pressure (Bar)	90
ID / Serial Number	TE-160	Calibration Gas	NOx

<b>8. Multipoint Calibration Results</b>				
Instrument Range	200 ppb		Instrument Gain	0.766
Set Point	Zero (sccm)	Span (sccm)	Measured (ppb)	%Error
200	19934	66.16	200.0	0.00
180	19940	59.56	180.1	0.05
160	19947	52.95	159.8	-0.10
140	19954	46.34	140.4	0.20
120	19960	39.73	119.7	-0.15
100	19967	33.12	98.8	-0.60
80	19974	26.50	79.3	-0.35
60	19980	19.90	59.3	-0.35
40	19987	13.29	39.6	-0.20
20	19993	6.70	19.5	-0.25
0	20000	0.00	0.4	0.20



Gain	1.00164
R <sup>2</sup>	0.99995

Note: Linear line of best fit shall have a gain between 0.99 and 1.01 and a R2 value greater than 0.9995

Pass / Fail	PASS
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Technician's Signature	
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# QA Multipoint Calibration

## Why Measure Particulate Matter?

Scientifically-established harmful effects leading to regulations.

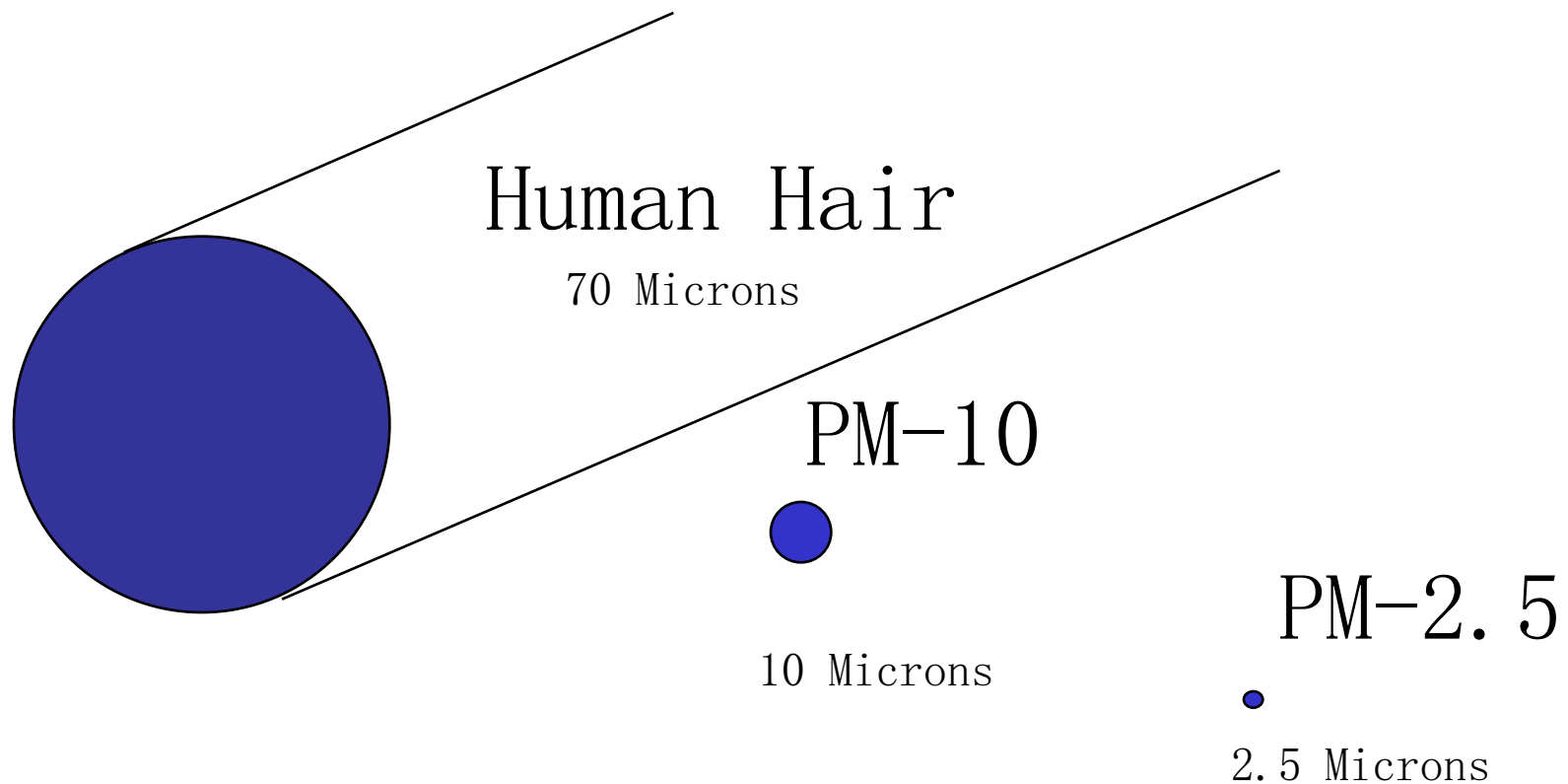
- Human health.
- Environment.

Nuisance effects.

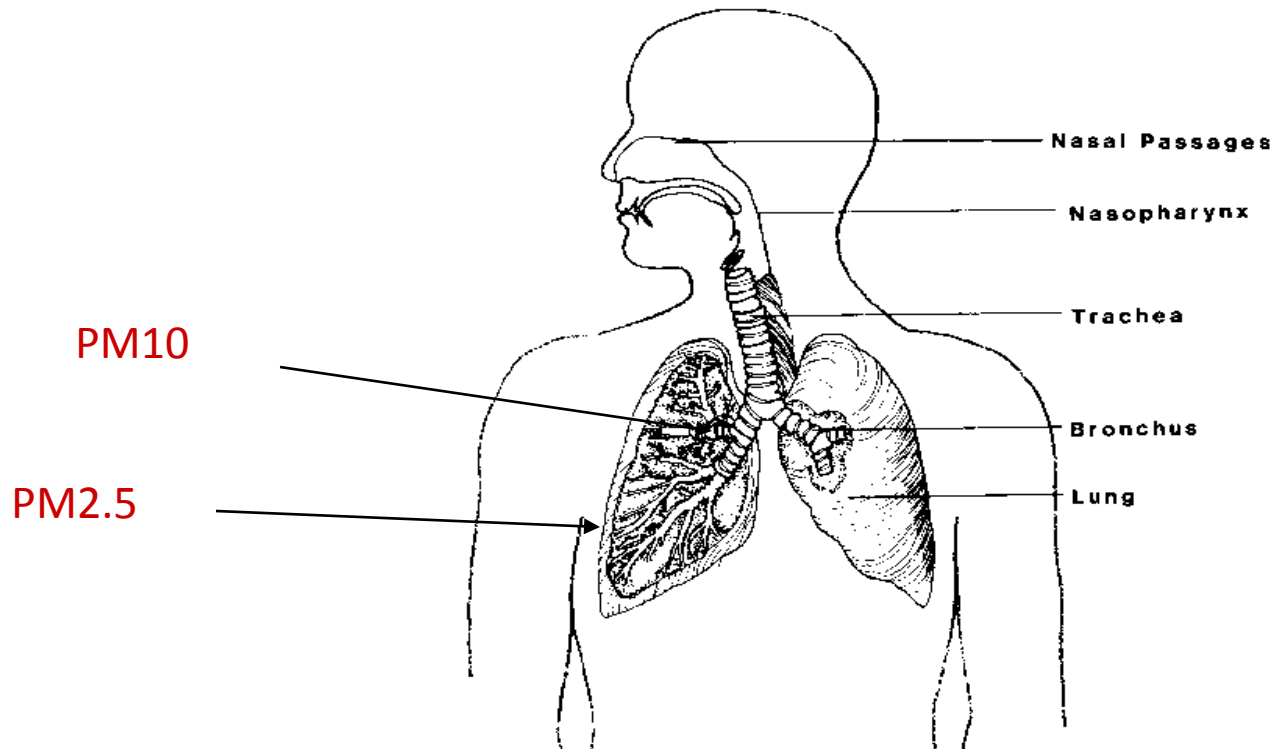
- Visibility.
- “Dirty” environment.

## Particulate Size Classifications

How small is 10 microns and 2.5 microns?



# Size Classification Based On Human Health Effects



Source: Air Quality, Godish, 1991, p. 143



# CAAQM Stations in INDIA > 80



**THE END**